No. 752,914. PATENTED FEB. 23, 1904.

E. MILES.

PLATE HANDLING MACHINE.

APPLICATION FILED NOV. 13, 1902.

NO MODEL. 7 SHEETS—SHEET 1.

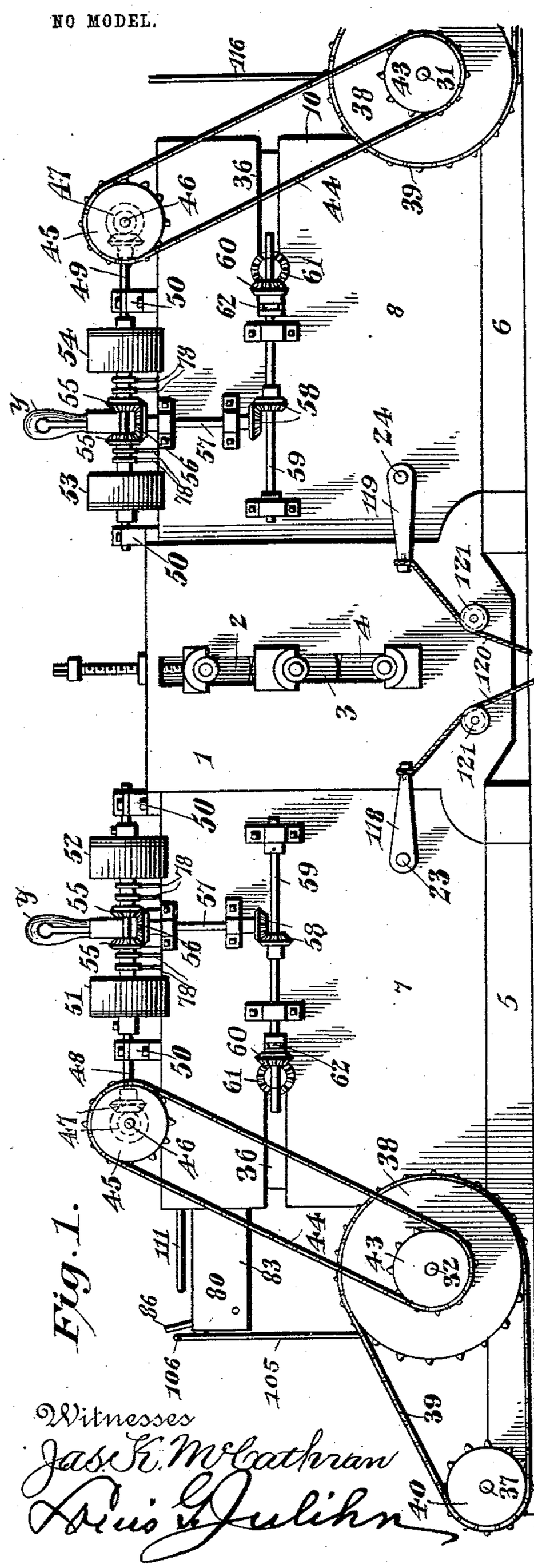

Fig. 1.

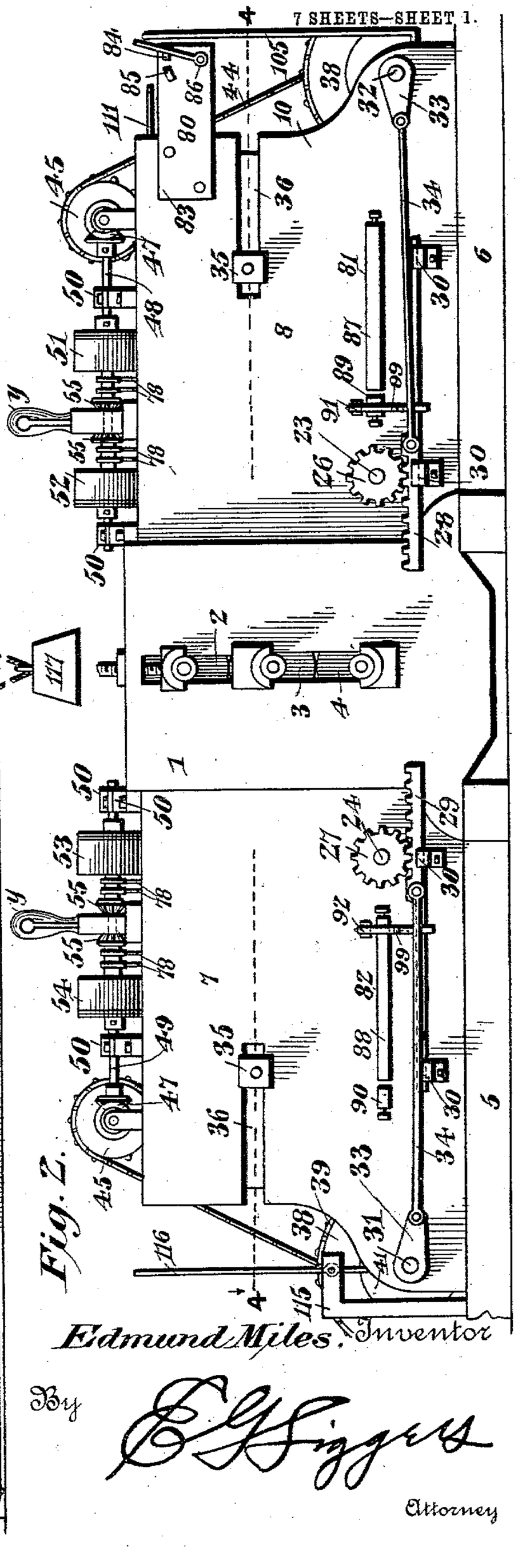

Fig. 2.

Witnesses
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Attorney

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NO MODEL. 7 SHEETS—SHEET 2.

Fig. 3.

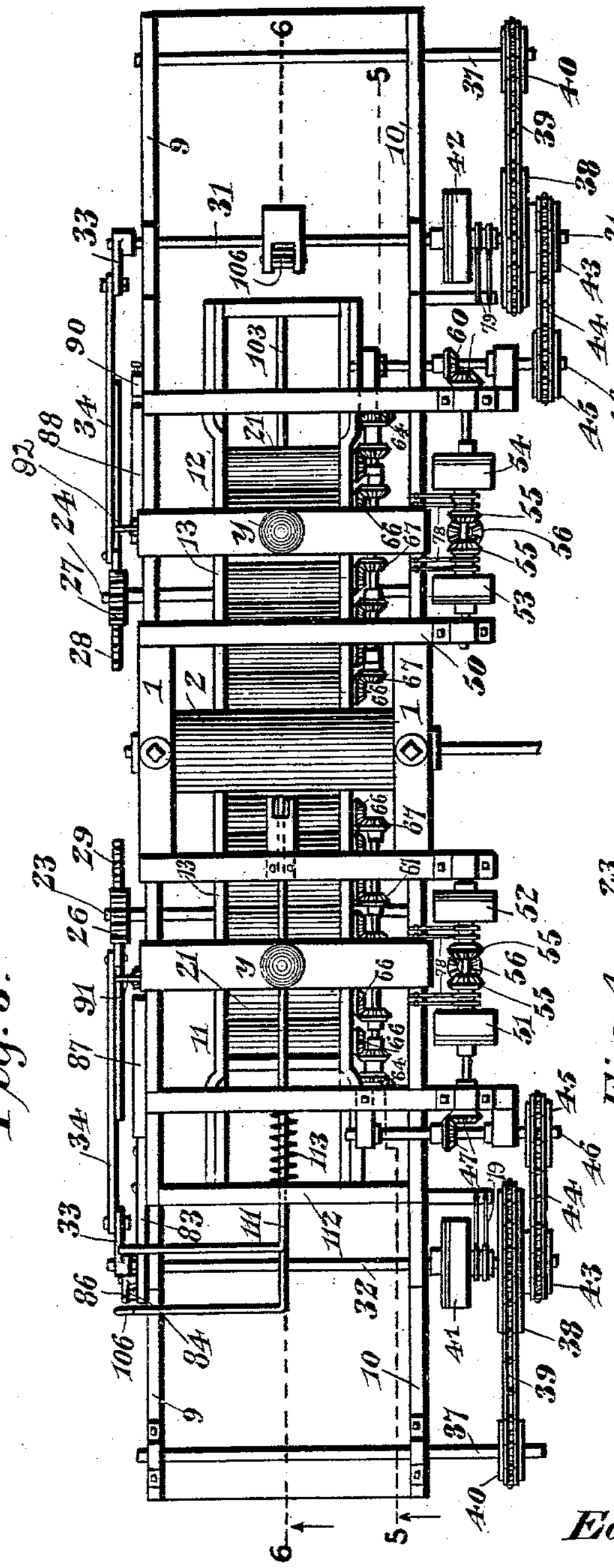
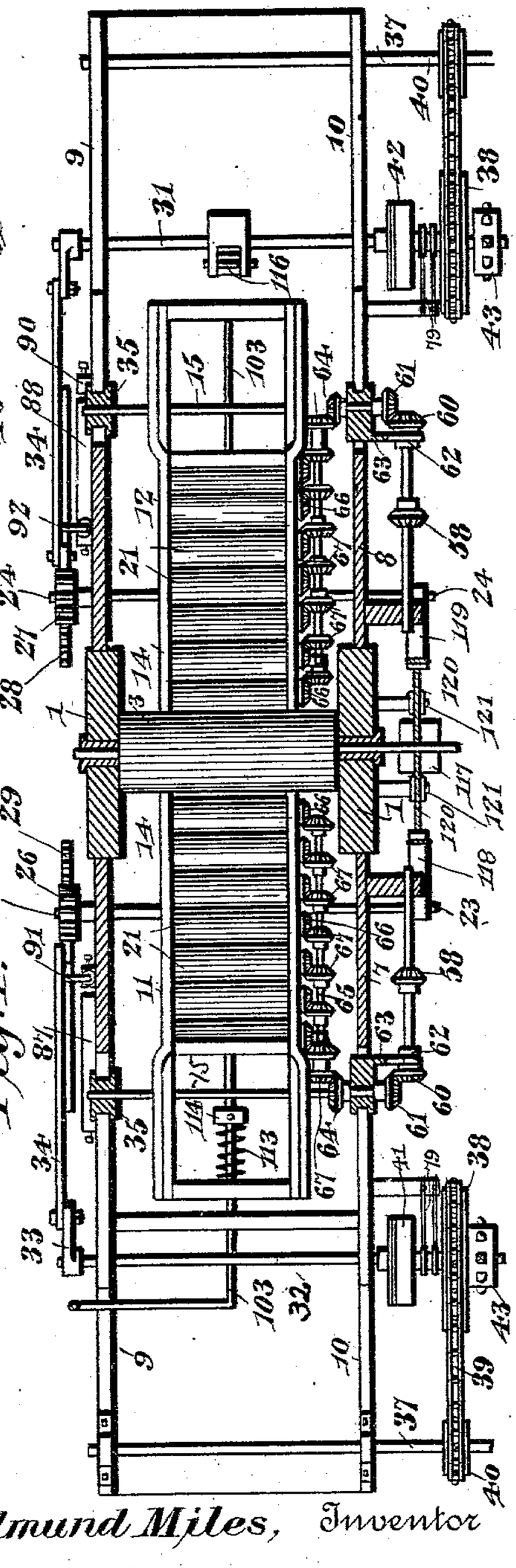


Fig. 4.



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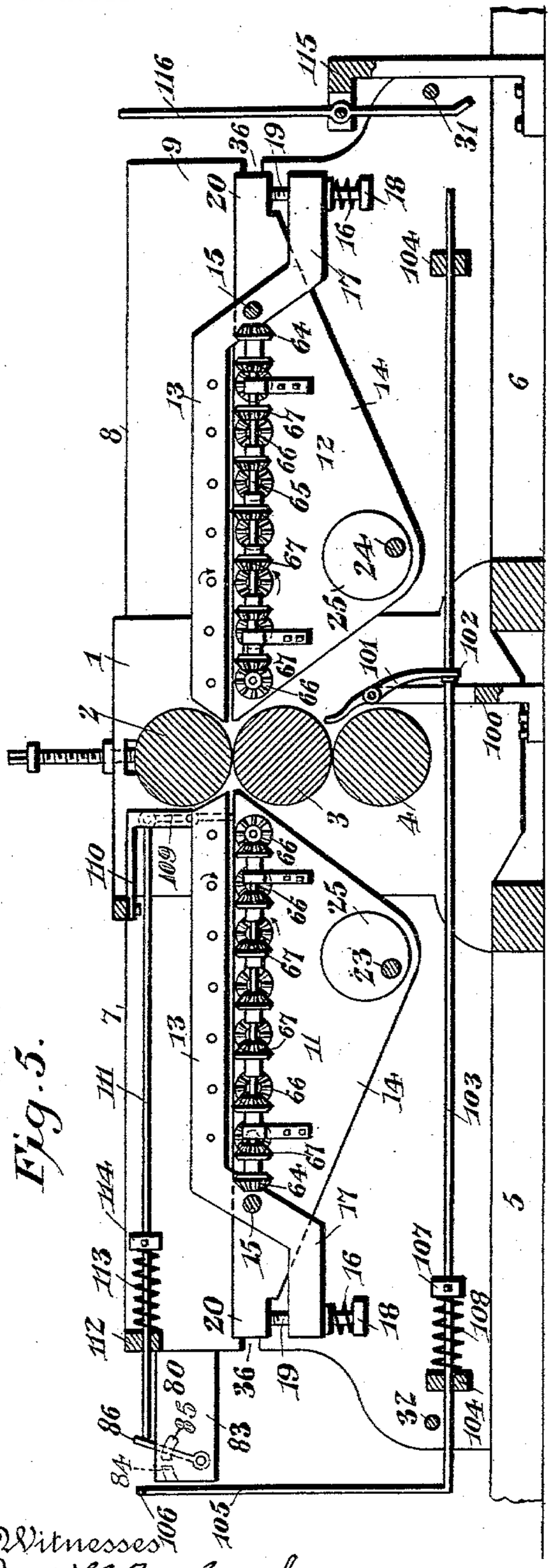
NO MODEL. 7 SHEETS—SHEET 3.

Fig. 5.



Witnesses
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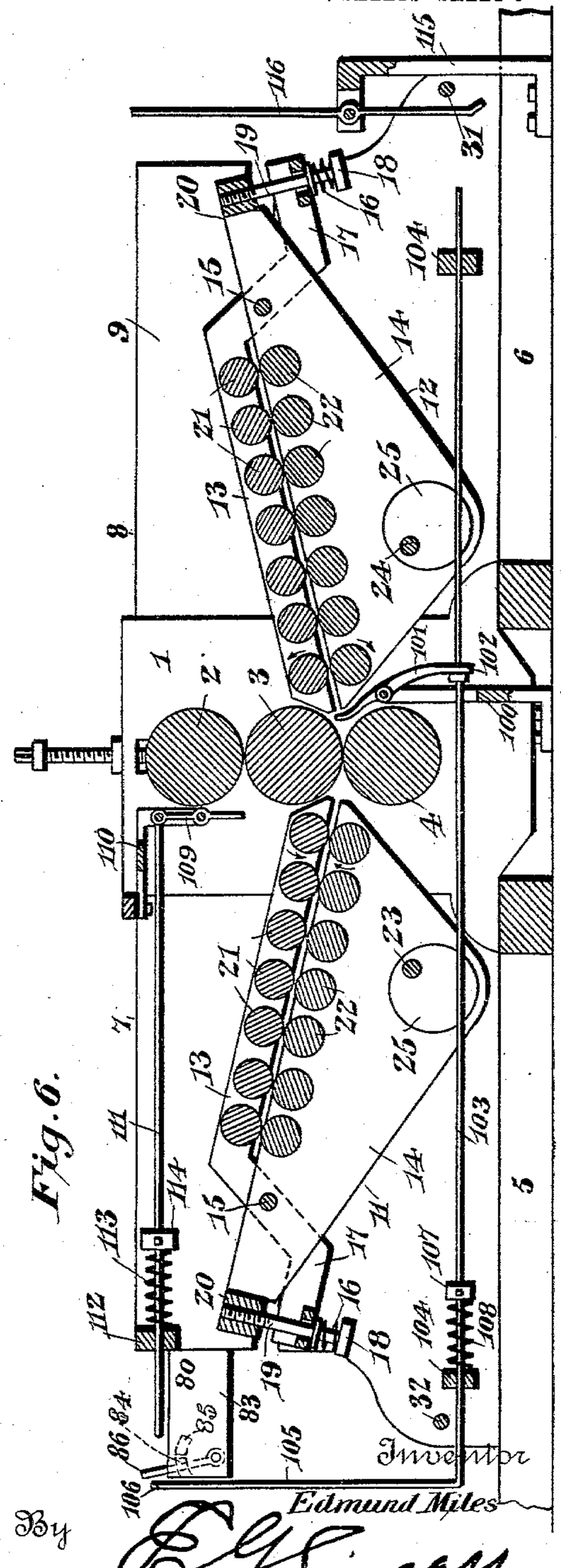
Louis D. Julihn

Fig. 6.



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NO MODEL. 7 SHEETS—SHEET 4.

Fig. 7.

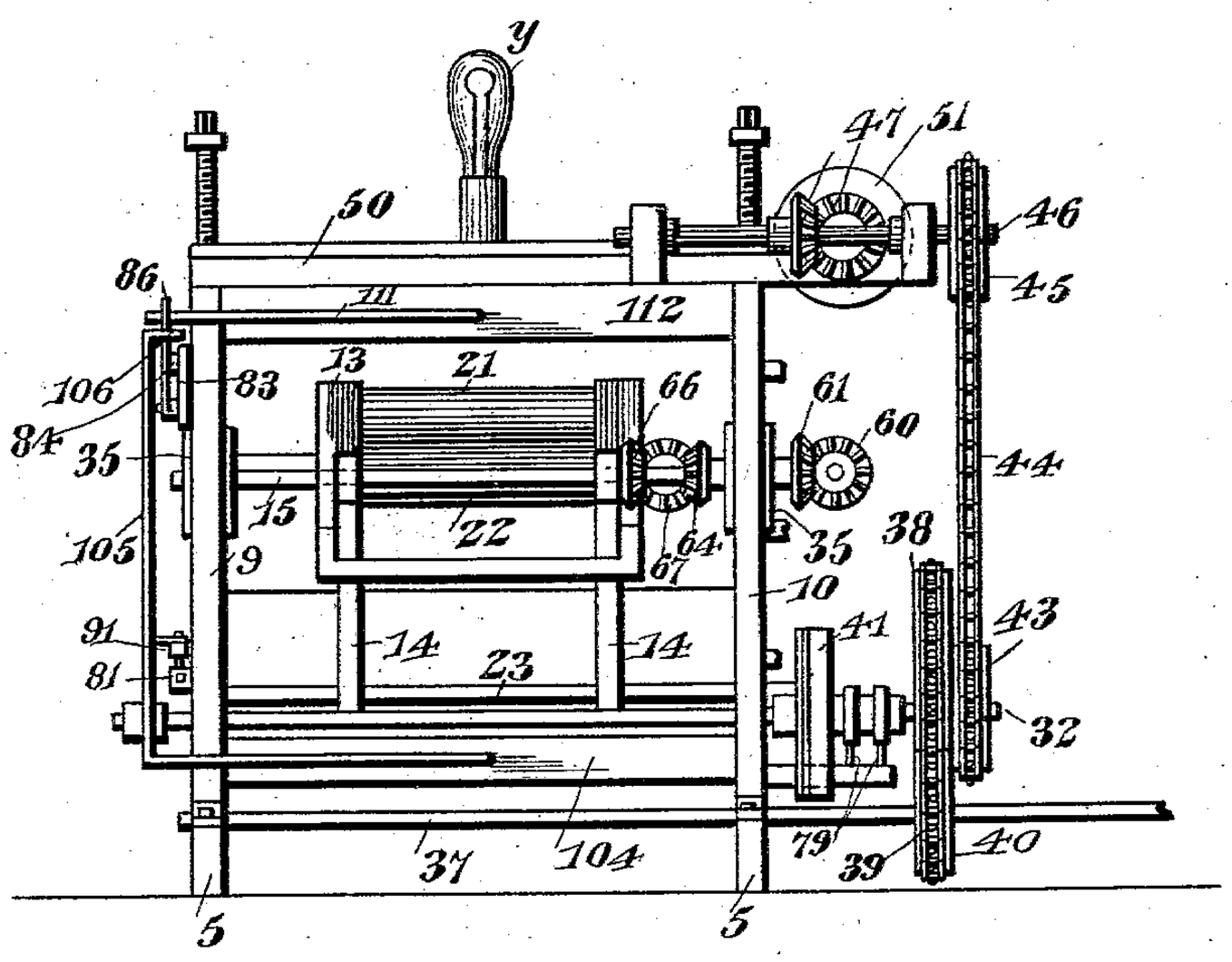


Fig. 9.

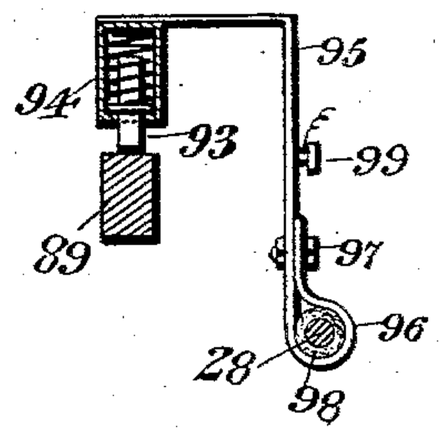


Fig. 8.

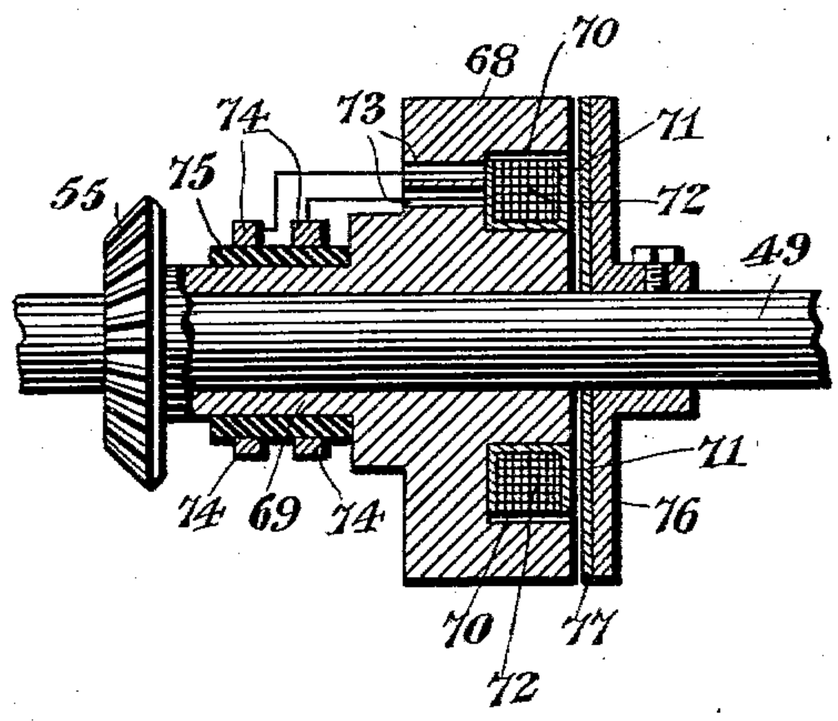
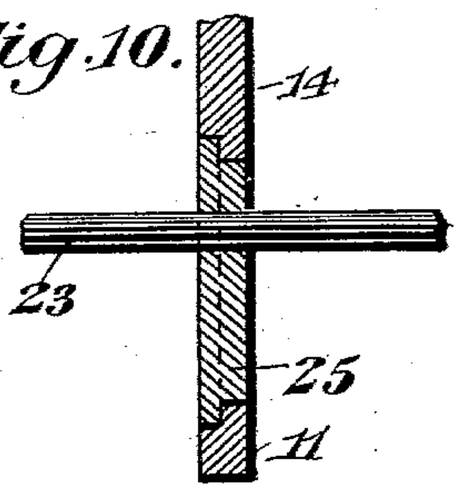


Fig. 10.



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NO MODEL. 7 SHEETS—SHEET 5.

Fig. 11.

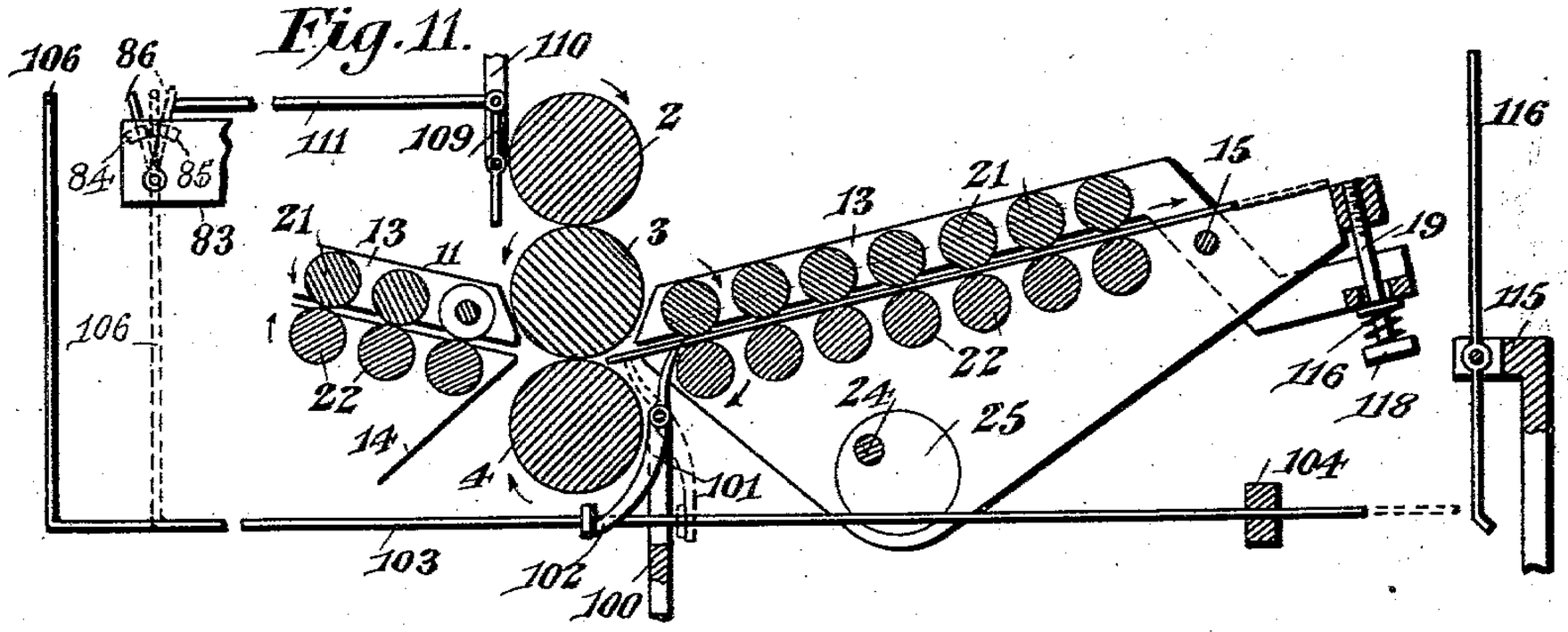


Fig. 12.

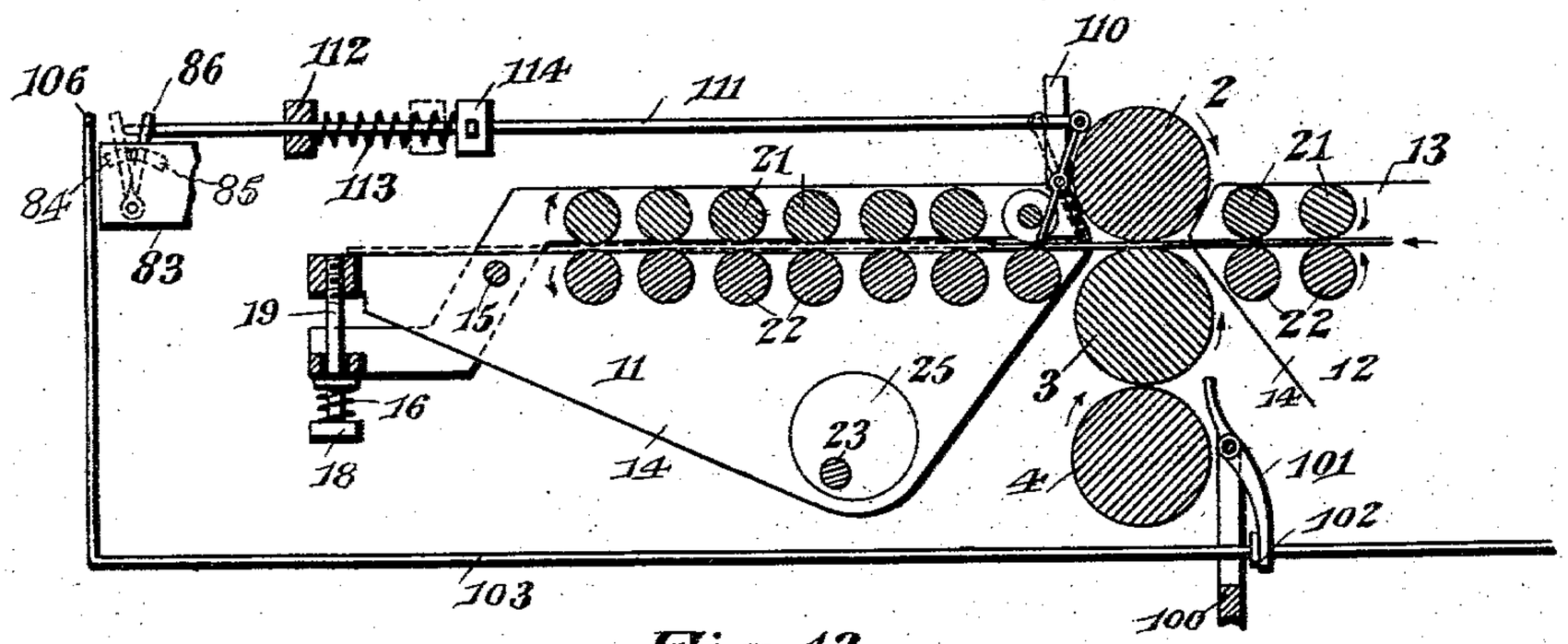
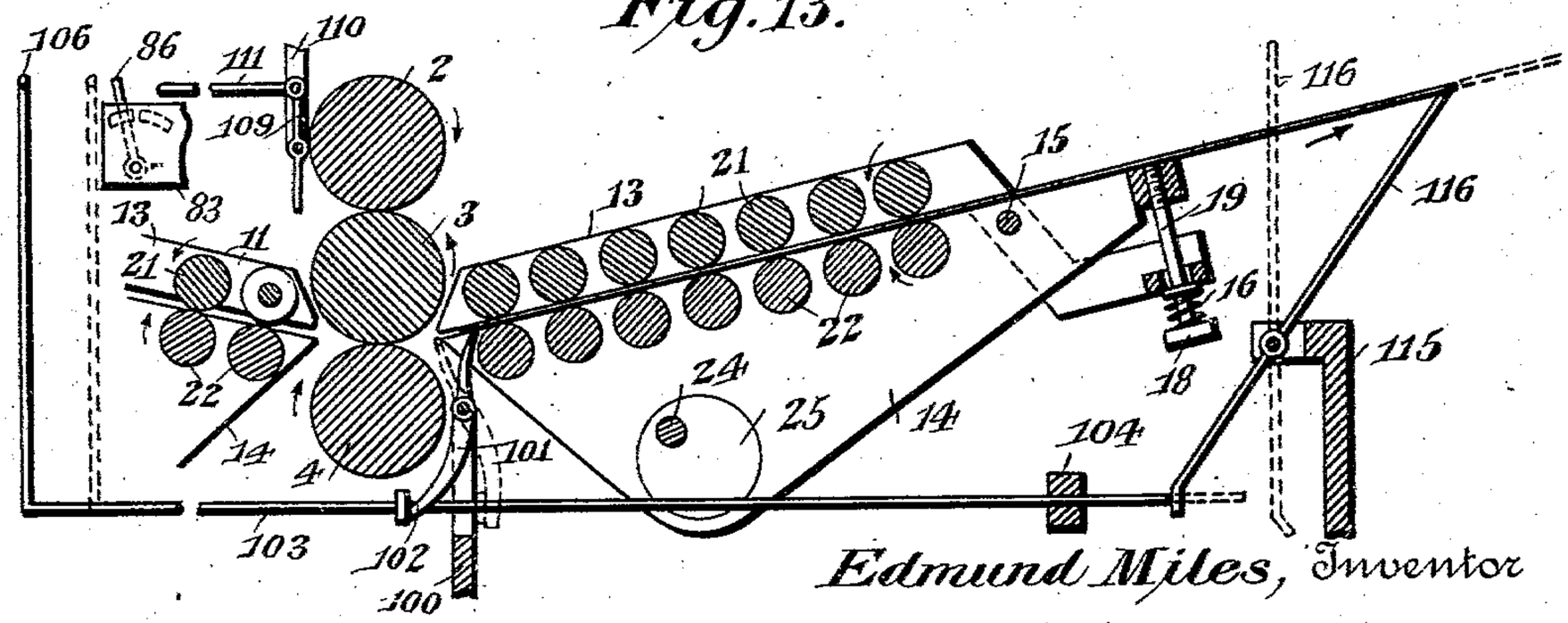


Fig. 13.



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NO MODEL. 7 SHEETS—SHEET 6.

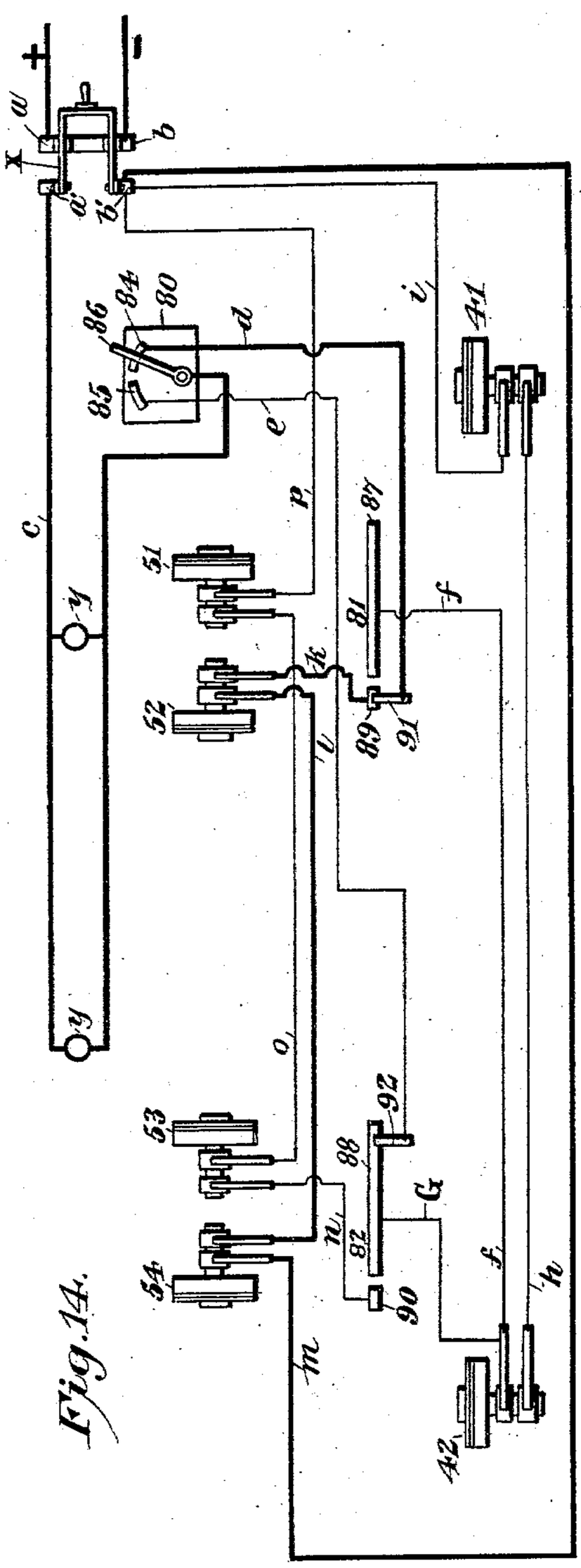

Fig. 14.

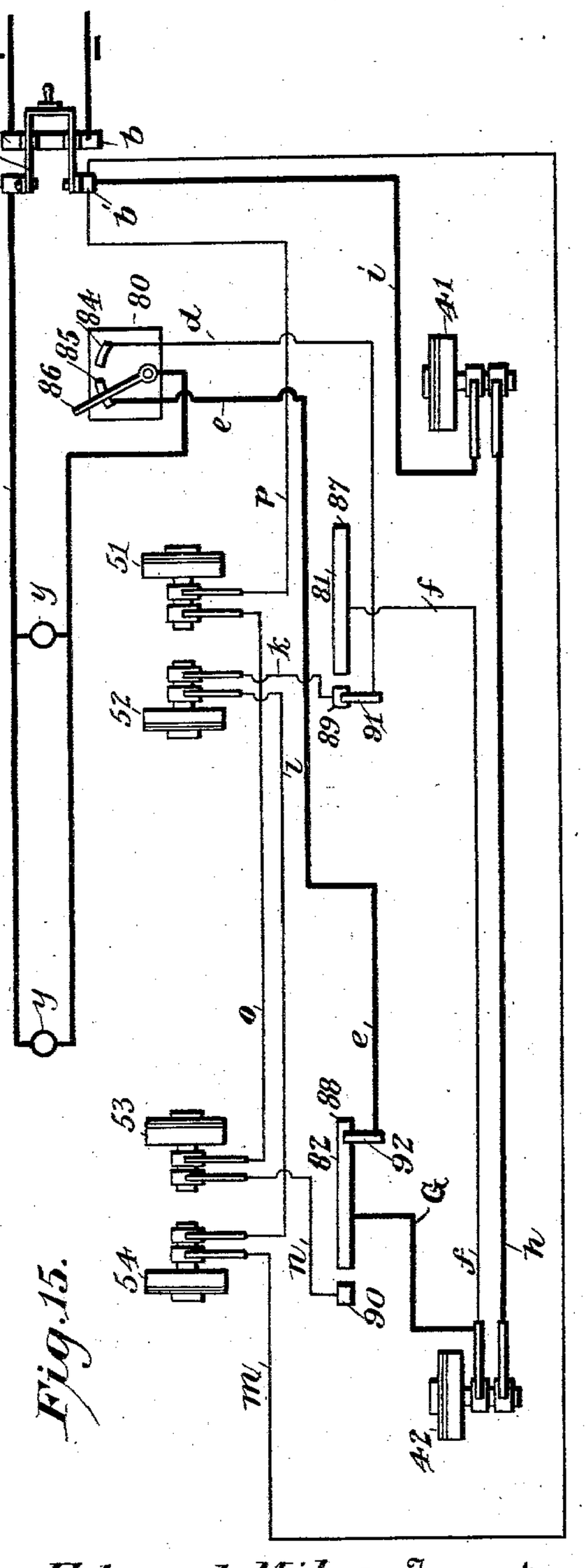

Fig. 15.

Witnesses
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NO MODEL. 7 SHEETS—SHEET 7.

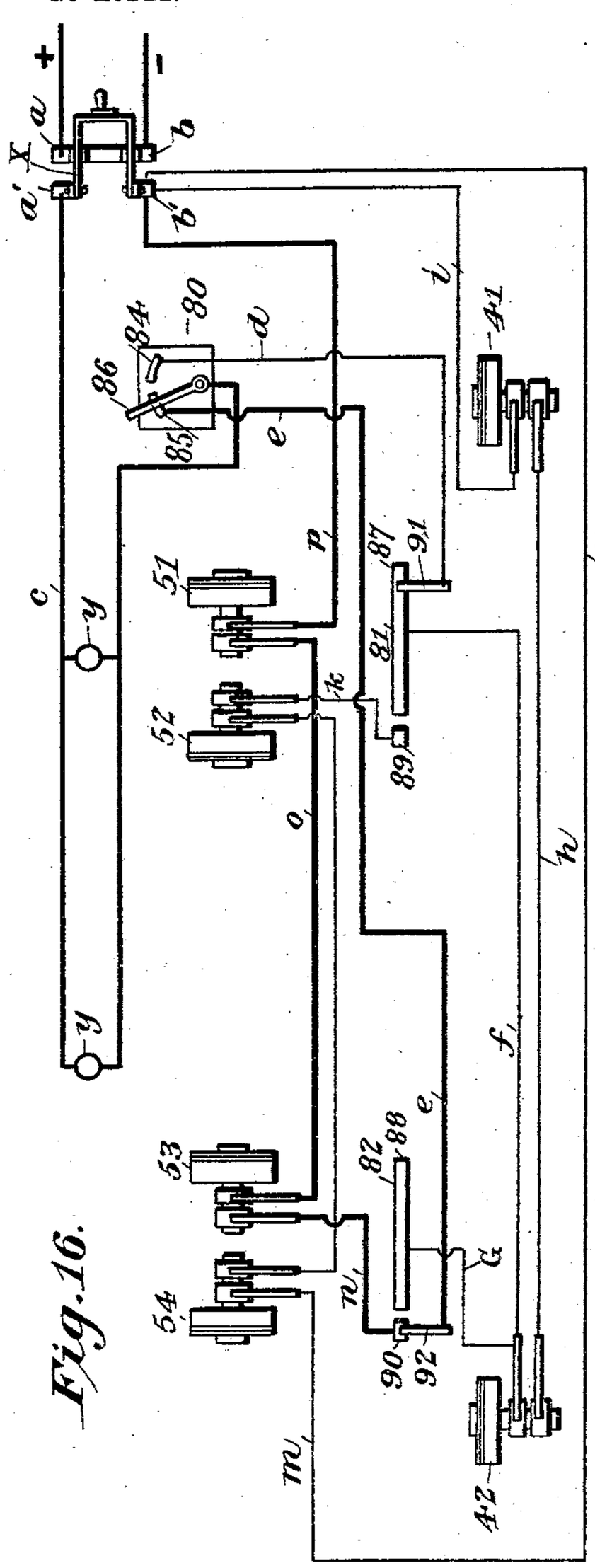

Fig. 16.

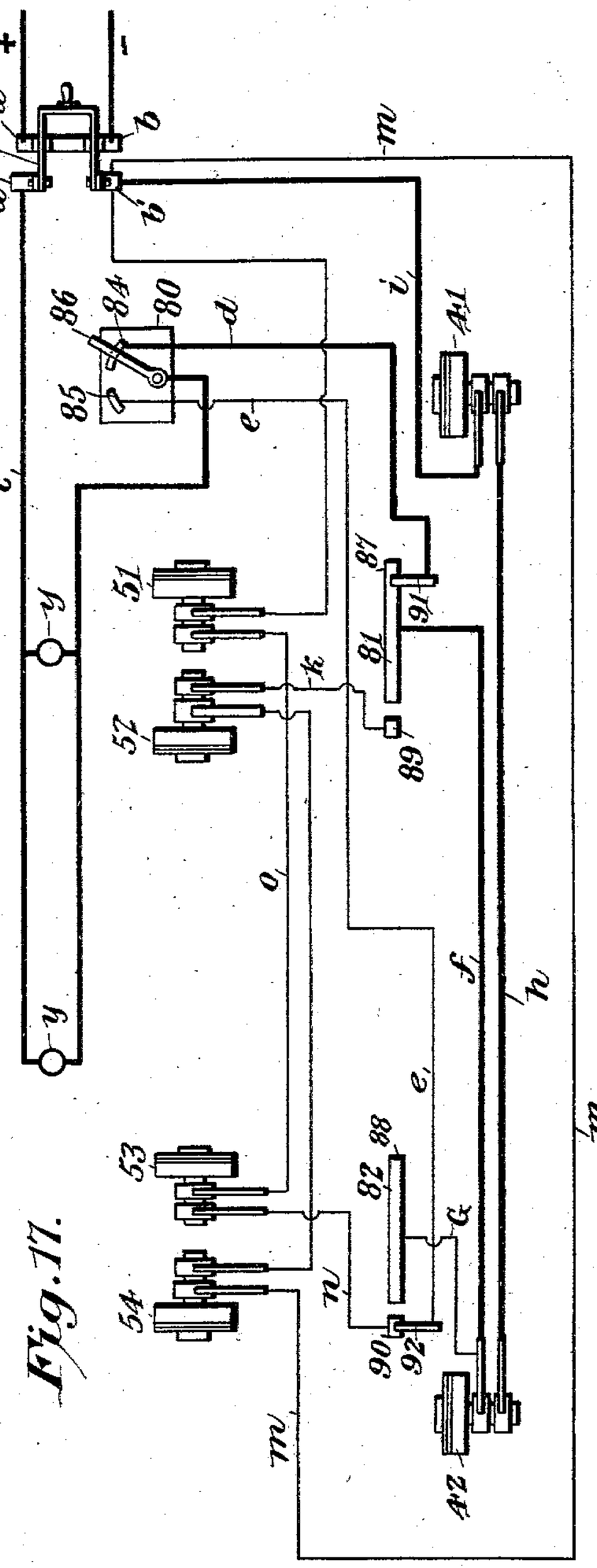

Fig. 17.

Witnesses
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Louis L. Julihn

Edmund Miles, Inventor
By E. G. Siggers
Attorney

No. 752,914. Patented February 23, 1904.

UNITED STATES PATENT OFFICE.

EDMUND MILES, OF CAMBRIDGE, OHIO, ASSIGNOR OF ONE-HALF TO S. L. SELLECK, OF CLEVELAND, OHIO.

PLATE-HANDLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 752,914, dated February 23, 1904.

Application filed November 13, 1902. Serial No. 131,221. (No model.)

To all whom it may concern:

Be it known that I, EDMUND MILES, a subject of the King of Great Britain, residing at Cambridge, in the county of Guernsey and State of Ohio, have invented a new and useful Plate-Handling Machine, of which the following is a specification.

This invention relates to a novel plate-handling machine for rolling-mills, and is a further development of the invention disclosed in my copending application, Serial No. 76,487, for Letters Patent. The machine illustrated in the application includes a plate-receiving member located at one side of a stand of rolls to receive a plate or other billet from one pass of the mill and movable to transport the plate to another pass, through which it is returned for further rolling. The positive return of the plate from the plate-receiving member to the second pass of the mill is effected by a series of positively-operated feed-rollers with which said member is equipped. The movements of the plate-receiving member and rollers at the proper times and in the proper directions are controlled by trip devices operated by the plate or billet being handled.

My present invention has for its object to provide plate-receiving members at opposite sides of the mill-stand, so that the plate or billet may be automatically passed back and forth through the mill until properly rolled, and it also has for its object to simplify and improve the mechanism whereby the automatic control of the members or tongs and the feed-rollers thereof is effected.

A further object of the invention is to provide for the automatic passing and repassing of a plate through different passes of the mill until said plate or billet is of predetermined dimensions and to then effect the automatic delivery of the plate from one side of the machine while a new billet is being fed into the other side thereof.

To the accomplishment of these ends the illustrated embodiment of the invention comprehends a pair of plate-receiving members located at opposite sides of a stand of mill-rolls, separate power mechanisms for operating the members and the feed-rollers with which the members are equipped, and electromagnetic clutches for connecting the power mechanisms with the members and rollers and included as a part of electrical controlling mechanism which properly times the movements of the members and rollers and includes one or more trip devices disposed for actuation by the plate or billet being handled.

The invention consists, further, in various features of construction and arrangement to be hereinafter described, illustrated in the accompanying drawings, and succinctly defined in the appended claims.

In said drawings, Figure 1 is a side elevation of my machine complete. Fig. 2 is a similar view of the opposite side thereof. Fig. 3 is a top plan view. Fig. 4 is a horizontal section on the line 4 4 of Fig. 2. Fig. 5 is a sectional view on the line 5 5 of Fig. 3. Fig. 6 is a similar view on the line 6 6 of Fig. 3. Fig. 7 is an end elevation of the machine. Fig. 8 is a detail sectional view, partly in elevation, showing the construction of one of the clutches. Fig. 9 is a detail sectional view of one of the secondary switches. Fig. 10 is a detail sectional view showing the manner in which the eccentrics are mounted in the side walls of the tongs. Fig. 11 is a sectional view of a portion of the machine, showing in full lines the position of the primary switch-operating mechanism when a plate is passing to the rear receiving member and in dotted lines the positions assumed by the parts when the plate has been completely received and the trigger is released. Fig. 12 is a similar view illustrating the manner in which the primary switch is operated upon the reception of a plate by the front plate-receiving member from the upper pass of the mill. Fig. 13 is still another view of like character, illustrating the operation of the mechanism for effecting the automatic delivery of a completely-rolled plate from the machine; and Figs. 14, 15, 16, and 17 are diagrammatic views illustrative of the wiring of the machine, the closed circuits being indicated in black lines.

Like characters of reference are employed to designate corresponding parts throughout the several views.

1 indicates the housing of a stand of mill-rolls 2, 3, and 4 driven continuously by power applied in any suitable manner. From this housing extend in opposite directions rails or guides 5 and 6, which support the plate-handling mechanisms located at opposite sides of the mill-stand and capable of bodily movement toward and away from the rolls to facilitate such reorganization of the apparatus as may be necessary.

The frames 7 and 8 each consist of vertical side walls 9 and 10 and suitable transverse connections and are designed for the support of plate-receiving members. These plate-receiving members, mounted in the frames 7 and 8 at opposite sides of the mill-stand, constitute the primary elements of the plate-handling apparatus and are preferably in the form of tongs 11 and 12, comprehending upper and lower members 13 and 14. The members of each tong have a common pivotal support upon a horizontal shaft 15 and are urged together—as, for instance, by a spring 16, bearing at one end against the under side of the rearwardly-extending tailpiece 17 of the upper tong member 13 and at its opposite end against the head 18 of a stem 19, projecting from the opposed tailpiece 20 of the lower tong member 14. These springs serve to urge the jaws or members of the tongs together for a purpose to be hereinafter explained. Each tong or plate-receiving member is equipped with upper and lower series of rollers 21 and 22, journaled in the opposite sides of the members 13 and 14. The plate or billet when supported by either of the members 11 or 12 is disposed between the upper or lower series of rollers thereof and is gripped with more or less pressure, so that when the lower series of rollers 22 are driven by mechanism to be described the plate will be positively fed in the proper direction according to the direction of rotation of the rollers. As premised, the plate-receiving members or tongs at opposite sides of the rolls are designed to effect the passing and repassing of the billet through the mill, and as the passes of the latter are located at different elevations it is necessary to provide means for raising and lowering the tongs. Adjacent to the inner ends of the frames 7 and 8 and somewhat near the bottom thereof are journaled eccentric-shafts 23 and 24, each of which is equipped with a pair of eccentrics 25, fitted in suitable openings in the depending sides of the plate-receiving members. Beyond one side of the machine the shafts 23 and 24 are equipped with pinions 26 and 27, meshing with the reciprocatory racks 28 and 29, mounted in suitable bearings 30, attached to the frames 7 and 8. At the outer ends of the frames 7 and 8 are journaled power-shafts 31 and 32, equipped with cranks 33, connected by pitmen 34 with the racks 28 and 29, the rotation of the power-shafts thus serving to reciprocate the racks. The relation of the strokes of the racks 28 and 29 to the dimensions of the pinions 26 and 27 is such that the eccentric-shafts 23 and 24 will make one-half of a complete revolution as the racks are moved in one direction and will be returned a like distance as the racks are retracted. It will thus be seen that a complete revolution of one of the cranks 33 will operate the adjacent eccentric-shaft to effect the elevation of a plate-receiving member by reason of the shifting of the eccentrics and to effect the return of said member by the reshifting of the eccentrics to their normal positions. It will be noted in this connection that the tongs or members 11 and 12 are moved in curvilinear paths, which will permit them to approach quite close to the opposite sides of the mill-passes and to clear the intermediate mill-roll as they move from one pass to another. This bodily curvilinear movement of the plate-receiving members will of course necessitate more or less lateral movement of the tong-shafts 15, and I therefore journal the latter in sliding journal-boxes 35, located within open-ended horizontal slots 36 in the side walls of the frames 7 and 8. (See Figs. 2 and 4.)

Each of the power-shafts 31 and 32 is driven from a separate line-shaft 37, suitably geared to a loose wheel 38, mounted on the adjacent power-shaft. While the character of this gearing is immaterial, I prefer to utilize a sprocket-chain 39, passed around the wheel 38 and around a somewhat smaller sprocket-wheel 40 on the line-shaft. Each line-shaft and wheel 38 are operated continuously, and the connection of the loose wheels with the power-shafts is effected at the proper time by means of electromagnetic clutches 41 and 42. For convenience these clutches may be termed the "machine-clutches," and their specific construction will be hereinafter more fully described. It may be stated at this point, however, that these clutches when magnetized connect the operating mechanism of the plate-receiving members with the power to cause the shifting of said members from one pass to another and when demagnetized effect the disconnection of such operating mechanism from the power to permit the plate-receiving members to remain stationary until their movement from one pass to another of the mill is again desired.

Fixed to each of the wheels 38 to rotate therewith is a comparatively small sprocket-wheel 43, geared, as by a sprocket-chain 44, with a similar sprocket-wheel 45, fixed to the outer end of a short horizontal shaft 46, mounted in suitable bearings above one side of the adjacent machine-frame. These short horizontal shafts 46 are geared—as, for instance, by beveled gears 47—to the roller-op-

erating shafts 48 and 49, journaled in suitable bearings 50, supported by the adjacent side walls of the frames 7 and 8. These shafts 48 and 49 are rotated continuously and are each provided with a pair of electromagnetic roller-clutches, (the several clutches being indicated by 51, 52, 53, and 54,) by means of which said shafts are operatively connected at the proper times with the feed-rollers of the plate-receiving members to drive said rollers in the desired direction. Associated with each of the roller-clutches is a small beveled gear-wheel 55, the wheels associated with the clutches of each pair being oppositely disposed and in mesh with similar gears 56, fixed to the upper ends of short vertical shafts 57, geared, as by beveled gears 58, to horizontal shafts 59, mounted in suitable bearings fixed to the side walls of the frames 7 and 8. Each of the shafts 59 is provided adjacent to its outer end with a small beveled gear 60, meshing with a similar gear 61 on the adjacent tong-shaft 15.

It has been heretofore explained that the tong-shafts move laterally as the tongs or plate-receiving members are raised and lowered, and to prevent this movement of the shafts from throwing them out of gear with the shafts 59 the gear-wheels 60 on the latter are mounted to slide longitudinally of the shafts and are each provided with a grooved hub 62, engaged by a finger 63, projecting from the adjacent journal-box 35. As the boxes 35 slide back and forth with the tong-shafts the fingers 63 will shift the gears 60 upon the shafts 59 and will thus insure an operative connection between the shafts 59 and 15 at all times. Geared to each tong-shaft 15, as by beveled gears 64, is a counter-shaft 65, movable with the adjacent plate-receiving member and journaled in suitable bearings at one side thereof. The counter-shafts 65 are in turn geared to the lower series of feed-rollers, the trunnions of which latter are equipped with beveled gear-wheels 66, meshing with similar gear-wheels 67, mounted on the shafts 65. (See Fig. 4.)

It will now be seen that the vertical counter-shafts 57 are geared constantly to the feed-rollers of the plate-receiving members at opposite sides of the mill-rolls and are also geared to a pair of oppositely-disposed beveled gear-wheels 55, loosely mounted upon a continuously-rotating roller-operating shaft 48 or 49. It therefore follows that by connecting one or the other of the wheels 55 with the roller-operating shaft the counter-shaft 57 will be rotated in one direction or the other to rotate the feed-rollers of the adjacent plate-receiving member to feed the plate either toward or away from the mill-rolls, as the case may be. We have now seen that by throwing in the machine-clutches 41 and 42 the operating mechanism of the tongs will effect the elevation or depression of said tongs or plate-receiving members and also how the feed-rollers may be rotated in either direction by throwing in the proper roller-clutch of each pair of clutches to connect the appropriate wheels 55 with the roller-operating shaft. It is now in order to describe the means controlling the operation of these clutches to properly time the movements of the plate-receiving members and the feed-rollers thereof as the plate is passed back and forth through the mill-rolls by the handling apparatus without attention on the part of an operator. The controlling mechanism is largely electrical, and as the several electromagnetic clutches are thrown in by the closing of a circuit the specific construction of one of them may be first explained. As shown in Fig. 8, each of the magnetic clutches comprises a metal disk 68, from one side of which extends a hub 69, terminating in the case of the roller-clutches in a beveled gear-wheel 55. In the flat side face of the disk 68 opposite the hub 69 is formed an annular recess 70 for the reception of a reel 71, upon which is wound a coil 72, of wire. The terminals of the coil 72 are passed through openings 73 in the disk 68 and are electrically connected to a pair of brass rings 74, encircling the hub 68 and insulated therefrom—as, for instance, by an insulating-ring 75 of any suitable character. Upon the shaft supporting the clutch member just described is fixed a circular armature 76, opposed to that side of the disk 68 in which the coil is seated. The electromagnetic attraction of the magnet and armature when the former is energized by the passage of an electric current therethrough connects the loosely-mounted clutch member to the armature and causes it, together with the gear-wheel associated therewith, to rotate with the shaft. As soon, however, as the circuit through the magnet is broken the clutch will be thrown out and the operating-shaft will rotate independently of it. It has been found in practice that the magnetism of the armature is sometimes sufficient to hold the clutch in engagement for a short period after the circuit therethrough has been broken. To overcome this difficulty, I interpose between each disk 68 and the adjacent armature 76 a thin disk 77, of copper, which will insure the prompt release of the clutch. The machine-clutches 41 and 42 are constructed precisely as above described, but instead of being provided with beveled gears at the ends of their hubs are equipped with the sprocket-wheels 38, to which are fixed the somewhat smaller sprocket-wheels 43, as shown in Fig. 4. It will be noted that slight lateral movement of the gear-wheels connected to the clutches when said clutches are thrown in is contemplated; but such movement is not sufficient to be of consequence. It should be understood, however, that while this particular form of clutch is preferable it is by no means essential, since the control of the machine might be effected by means of

other devices capable of being operated substantially in the manner herein described.

The metallic rings 74 constitute the annular terminals of the clutch-magnets, and the electrical contact between the circuit-wires and these terminals is effected by metallic contact plates or brushes 78 and 79, 78 being applied to the brushes of the roller-clutches and 79 to the brushes of the machine-clutches. The brushes 78 are preferably mounted on the side walls of the frames 7 and 8 adjacent to the clutches, as shown in Figs. 1 and 3, being insulated from said walls in any suitable manner.

In connection with the various clutches I employ electrical controlling mechanism including a primary controlling-switch 80, two secondary switches 81 and 82, and suitable wiring, the primary switch being designed to close the circuit through either of the secondary switches, each of which latter controls the movement of the plate-receiving members in one direction and also one direction of movement of the feed-rollers. The primary switch is located at any convenient point, but preferably at one end of the apparatus. In Figs. 1 and 2 the switchboard 83 of the primary switch is shown attached to one side of the frame 7 at the front end of the apparatus and equipped with a pair of switch-contacts 84 and 85, over which is disposed to operate a swinging switch-arm 86, pivoted to the switchboard 83 and disposed vertically, with its upper end projected somewhat above the board. Each of the secondary switches 81 and 82 includes a long contact-plate 87 or 88 and a short contact-plate 89 or 90. These plates are mounted on the outer sides of the frames 7 and 8 and are insulated therefrom and from each other. Over the contact-plates of each secondary switch is disposed to travel a switch-arm 91 or 92, secured to the racks 28 and 29 and movable therewith. Each of these switch-arms is constructed as illustrated in detail in Fig. 9, in which a spring-pressed plug 93 is shown mounted in a cylindrical socket 94, depending from the upper end of an arm 95, formed at its lower end with a split collar 96, encircling the reduced portion of a rack-bar and retained by a bolt 97, an insulating-sleeve 98 being interposed between the collar and the bar for obvious reasons. Each of the arms 91 and 92 is equipped with a binding-post 99 for the attachment of the circuit-wires. The arms of the secondary switches, being connected to the machine-operating racks for reciprocation therewith, will obviously be moved with the plate-receiving members or tongs, and, furthermore, since the racks are moved in opposite directions and since the long and short contact-plates of the secondary switches are disposed in the same relation it follows that when the tongs are in their completely-depressed positions the arm 91 of the secondary switch 81 will be in contact with the short plate 89 thereof, while the arm 92 of the switch 82 will be in contact with the inner end of the long plate 88. Thus when the racks are drawn back for the purpose of effecting the elevation of the tongs the arm 91 will immediately leave the short plate 89 and pass to the long plate 87 of the switch 81, while the arm 92 will traverse the long plate 88 of the switch 82 and will not pass to the short contact-plate 90 until the racks have been completely retracted and the tongs raised to a position opposite the upper pass of the mill. Upon the inward movement of the racks to depress the tongs the reverse of the described operation will take place—that is to say, the arm 92 will pass from a short contact-plate to a long plate as soon as the advance of the racks begins, while the arm 91 will traverse a long plate and will not contact with a short plate until the end of the stroke of the rack, or, in other words, until the tongs are completely depressed to positions opposite the lower pass of the mill.

Having described the manner in which the secondary switches are operated, so far as the mechanical manipulation of the secondary switch-arms is concerned, I shall now describe the manner in which the arm 86 of the primary switch is shifted from one contact to the other for the purpose of closing the circuit through either of the secondary switches in a manner to be hereinafter explained.

Mounted upon a suitable supporting bracket or standard 100 is a pivoted trip device or trigger 101, having its upper end disposed immediately in rear of the lower pass of the mill. (See Figs. 5 and 6.) The tailpiece 102 of the trigger is connected to a switch-operating device in the form of a reciprocatory rod 103, disposed longitudinally of the machine in a plane below the mill-rolls and guided in suitable bearings 104. At its front end the rod 103 is provided with an upwardly-extending angular arm 105, the horizontal upper extremity 106 of which is disposed slightly in advance of and in operative proximity to the upper end of the primary-switch arm 86. Between one of the bearings 104 and a set-collar 107, mounted on the rod 103, is interposed a compression-spring 108. When a plate is fed from the front plate-receiving member 11 to the rear member or catcher 12, its front edge after passing through the mill will strike the upper end of the trigger 101, swinging it to the position indicated in full lines in Fig. 11 and retaining it in this position during the passage of the plate to the rear receiving member. When the trigger is swung in the manner indicated, the rod 103 will be reciprocated against the resistance opposed to such movement by the spring 108, the upper end 106 of the arm 105 being thus moved to a greater distance in front of the switch-arm 86. When the plate has been completely received by the member 12, its rear edge passing beyond the

trigger will permit the latter to fly back to its initial position under the impulse of the spring 108, the elasticity of which will effect a reciprocation of the rod 103 sufficiently violent to cause the end 106 of the arm 105 to strike a sharp blow upon the switch-arm 86, thereby shifting said arm from the contact 84 to the contact 85 of the primary switch, the effect of which is to change the circuit for the purpose of effecting the automatic elevation of the plate-receiving members or tongs, as will presently appear. It should be noted, however, that the retractile movement of the switch-throwing device under the impulse of the spring 108 carries the arm 105 beyond its normal position. (See dotted position in Fig. 11.) It is this excess of movement which is utilized in the throwing of the switch-arm, the recovery of the spring 108 after its violent expansion serving to restore the arm 105 to its normal or initial position. (Shown in Fig. 6.) The shifting of the switch-arm 86 in the opposite direction—that is to say, from the contact 85 to the contact 84—is effected by means of a similar device, which, however, instead of being disposed for actuation by a plate passing through the lower pass of the mill, is disposed to be operated by a plate being passed back through the upper pass of the mill from the rear plate-receiving member 12 to the front member 11. This second device includes a pivoted trip or trigger 109, mounted in a suitable bearing-bracket 110 and having its lower end disposed immediately in front of the upper pass of the mill. (See Fig. 5.) To the upper end of the trip 109 is connected the rear end of a reciprocatory switch-throwing rod 111, guided in suitable bearings 112 and having its front end bent at an angle and extended into operative relation with the switch-arm 86, as shown in Fig. 3. The rod 111, like the rod 103, is provided with a retracting-spring 113, interposed between a bearing 112 and a set-collar 114 on the rod. A plate passing through the upper pass of the mill will strike the lower end of the trip 109, swinging the latter against the resistance of the spring 113. The trip will be held in this position (see Fig. 12) until the plate has been completely received by the plate-receiving member 11, at which time the rear end of the plate having passed the trip the latter will be released, and the spring 113 will effect the violent retraction of the rod 111 to throw the switch-arm 86 from the contact 85 to the contact 84. (See dotted position in Fig. 12.)

We have now seen that the primary switch is operated by plate-controlled means and that the secondary switches are operated by moving elements of the machine, and it may be emphasized at this point that it is immaterial what machine element or elements are utilized to effect the movement of the switch-arms 91 and 92, since the transfer of these arms to the several contact-plates of the secondary switches when the tongs have reached predetermined positions might be effected in a variety of ways.

I shall now proceed to describe the electrical connections by means of which the roller and tongs operating mechanisms are called into action at the proper times to move the tongs and rollers in the proper directions by the throwing in or out of the proper clutches. In Figs. 14, 15, 16, and 17 the wiring has been illustrated in diagram and is substantially as follows: Line-wires *a* and *b* are connected to the wiring of the machine by means of a line-switch *x*, whose binding-posts are indicated by *a'* and *b'*. From the binding-post *a'* of the switch *x* is led a wire *c*, which after being paralled to feed one or more lamps *y*, preferably mounted on the machine, is led to the switch-arm 86 of the primary switch 80. From the contact 84 of the switch 80 a wire *d* is led to the switch-arm 91 of the secondary switch 81, and from the contact 85 of the primary switch a wire *e* is led to the arm 92 of the secondary switch 82. From the long contact-plate 87 of the switch 81 a wire *f* is led to one brush of the machine-clutch 42, and a wire *g* is led to the same brush from the long contact-plate 88 of the switch 82. From the other brush of the machine-clutch 42 a wire *h* is led to a brush of the machine-clutch 41, from the other brush of which a wire *i* is led to the binding-post *b'* of the line-switch.

It has been heretofore noted that by reason of the peculiar gearing employed between the roller-operating shafts and the rollers the rotation of said rollers in one direction is effected by throwing in the clutches 52 and 54 and in the other direction by throwing in the clutches 51 and 53. These clutches are therefore necessarily paired in wiring as follows: From the short contact-plate 89 of the secondary switch 81 a wire *k* is led to one brush of the clutch 52, from the other brush of which a wire *l* is led to one brush of the clutch 54, the other brush being connected, by means of a wire *m*, with the binding-post *b'* of the line-switch. The other pair of clutches—to wit, 51 and 53—are connected with the short contact-plate 90 of the switch 82, a wire *n* being led from the plate to one brush of the clutch 53 and a wire *o* being led from the other brush to a brush of the clutch 51, whose second brush is in turn connected with the binding-post *b'* of the line-switch by a wire *p*.

The operation of the machine as thus far described is as follows: Assuming the parts to be in the positions indicated in Figs. 2 and 6 of the drawings, the circuit (see Fig. 14) is as follows: from the line-wire *a* to to the wire *c*, primary switch-arm 86, and the contact 84, opposite which the arm is located, from the contact 84 through the wire *d* to the secondary switch-arm 91, thence through the short contact-plate 89, with which the arm 91 is in contact, thence through the wire *k*, clutch 52,

wire *l*, clutch 54, wire *m* to binding-post *b'*, and line-wire *b*. This circuit will effect the magnetization of the clutches 52 and 54 to cause their rotation with the roller-operating shafts 48 and 49 in the proper direction to rotate the feed-rollers of the two plate-receiving members in the direction of the arrows in Fig. 6. If now a plate or other billet is presented to the front plate-receiving member 11, it will be fed toward the mill by the rotation of the feed-rollers, and as its front end emerges from the lower pass it will swing the trigger 101 and will then be engaged by the rollers of the rear plate-receiving member or catcher 12 and will be drawn into the latter. (See Fig. 11.) As soon as the rear end of the plate passing to the member 11 moves beyond the trigger 101 the latter will fly back under the impulse of the spring 108, and the reciprocation of the rod 103 will cause the upper end of the arm 105 to throw the switch-arm 86 from the contact 84 of the primary switch to the contact 85 thereof. (See dotted position in Fig. 11.) The circuit (see Fig. 15) will then be as follows: line-wire *a* and wire *c* to switch-arm 86, thence through wire *e* to the arm 92 of the switch 82, thence to the long contact-plate 88 of said switch, and through the wire *g*, machine-clutch 42, wire *h*, machine-clutch 41, and wire *i* to the binding-post *b'* and line-wire *b*. It will now be noted that the automatic shifting of the primary switch upon the complete reception of the plate by the plate-receiving member 12 has opened a circuit through the secondary switch 81, the arm 91 of which is in contact with the short plate 89 and has closed the circuit through the arm 92 of the switch 82, which arm is in contact with the long plate 88 of the switch. It will also be noted that the roller-clutches will be cut out and that the machine-clutches have been energized or thrown in. Thus upon the complete reception of the plate by the member 12 the feed-rollers will be stopped and the plate-ceiving members will begin to ascend in consequence of the connection of their operating mechanisms with the source of power through the medium of the machine-clutches. The elevation of the plate-receiving members will finally present them in positions at opposite sides of the upper pass of the mill, at which time the switch-arm 92 will have reached the end of the long contact-plate 88, opening the circuit through the machine-clutches to stop the tongs and making contact with the short contact-plate 90 to close the circuit through the roller-clutches 51 and 53 for the purpose of operating the rolls in the reverse direction (indicated by the arrows in Fig. 5) to feed the plate through the upper pass of the mill from the rear member 12 to the member 11 as the machine-clutches are automatically released. When the arm 92 shifts from the plate 88 to the plate 90 of the switch 82, the reciprocation of the machine-operating racks will cease, and as a consequence the arm 92 will remain in contact with the plate 90 to maintain the circuit through the roller-clutches 51 and 53 during the passage of the plate through the upper pass of the mill. This third position of the connections will present the following circuit, (see Fig. 16:) line-wire *a*, wire *c* to switch-arm 86 and contact 85, thence through wire *e*, contact-arm 92, short contact-plate 90, wire *n*, roller-clutch 53, wire *o*, roller-clutch 51, and wire *p* to binding-post *b'* and line-wire *b*. As the advancing end of the plate emerges from the upper pass of the mill it strikes the lower end of the trip device or trigger 109, swinging the latter (see Fig. 12) and moving the rod 111 longitudinally against the resistance of the spring 113. When the rear end of the plate passes from under the trigger 109, the latter will fly back, (see dotted lines in Fig. 12,) and the retraction of the rod 111 will cause the angular end thereof to strike a sharp blow upon the primary-switch arm 86, shifting the latter from the contact 85 back to the contact 84. This will cut out the arm 92 of the secondary switch 82, thus opening the circuit through the roller-clutches and stopping the rollers. At the same time the circuit will be closed through the switch-arm 91 of the switch 81, which arm will have moved to the outer end of the long contact-plate 87 during the elevation of the tongs. The throwing of the primary switch-arm, as just described, will cut out the roller-clutches to stop the rollers, as stated, and will close a circuit through the machine-clutches, which in an obvious manner will cause the retraction of the racks 28 and 29 to lower the plate-receiving members to their initial positions. The circuit with the parts in this (the fourth) position is as follows, (see Fig. 17:) line-wire *a*, wire *c*, switch-arm 86, contact 84, wire *d*, contact-arm 91, plate 87, wire *f*, machine-clutch 42, wire *h*, machine-clutch 41, wire *i* to binding-post, and line-wire *b*. When the tongs reach their completely-depressed positions, the arm 91 will pass out of contact with the plate 87, thus opening the circuit through the machine-clutches, and will pass into contact with the plate 89, thus closing the circuit, as traced in describing the first position of the parts, through the roller-clutches 52 and 54 to start the rollers for the purpose of again passing the plate through the lower pass of the mill from the member 11 to the member 12 in the manner heretofore described. By a continuation of the described operation the plate or billet is passed and repassed through the mill until it has attained a standard length, at which time it is automatically fed out of the machine, while another plate is being fed into the machine from the opposite side thereof. The means for causing the automatic delivery of the plate from the machine when it has been sufficiently rolled is exceedingly simple and consists merely in providing a device operated

by the plate to prevent the shifting of the primary switch after the plate has been completely received by the member 12. At the rear end of the machine is located a standard 115, in which is mounted a lever 116, the pivotal connection of which with the standard 115 is of such nature that more or less friction will be opposed to the shifting of the lever on its fulcrum. The upper end of the lever is so disposed that a plate which has been rolled to standard length will strike its upper end and swing it to the position shown in Fig. 13 before the rear end of the plate has passed from over and thus released the trigger 101. Therefore when the rolled plate or billet fed to the member 12 is of proper length it will shift the lever 116 to an obstructing position with respect to the rod 103 prior to the release of the trigger. Consequently when the trigger is released the lever 116 (held in position by the plate) will prevent the rod 103 from flying back, and will thus prevent the throwing of the switch-arm of the primary switch. The feed-rollers will continue to rotate in the direction of the arrows in Fig. 13, and the completely-rolled plate will be delivered from the rear end of the machine. When the delivery of the plate is complete, its release of the trigger 116 will permit the latter to be swung back to its initial position by the rod 103 under the impulse of the spring 108; but as considerable frictional resistance is opposed to this movement of the lever the rod 103 instead of being violently retracted will gradually return to its normal position (shown in dotted lines in Fig. 13) and the primary switch will not be shifted. As a consequence the tongs or plate-receiving members will remain in their depressed positions and the rollers will continue to rotate in the direction of the arrows in Fig. 6. A plate may therefore be fed into the front tongs or member 11 while a finished plate is being delivered from the member 12, and as the plate so fed will not be of sufficient length to operate the lever 116. the release of the trigger 101 will stop the rollers and start the tongs to effect the passing and repassing of such plate through the mill until it has attained the desired length, when it will in turn effect the operation of the lever 116 and will be delivered from the machine.

A subordinate feature of the invention resides in the provision of means for counterbalancing the tongs or plate-receiving members, such means being preferably common to both tongs and comprising a counterbalancing-weight 117, connected to a pair of crank-arms 118 and 119 on the eccentric-shafts 23 and 24 by one or more cables 121, passed over guide-pulleys 121, mounted on the frame of the mill-stand.

It is believed that from the foregoing the construction and operation of my plate-handling machine will be clearly apparent; but while the illustrated embodiment of the invention is thought at this time to be preferable I wish to be distinctly understood as reserving to myself the right to effect such changes, modifications, and variations of the illustrated structure as may be fairly embraced within the scope of the protection prayed.

What I claim is—

1. In a plate-handling machine, the combination with a movable plate-receiving member, and feed-rollers, of electrical controlling mechanism for the feed-rollers, and plate-operated means for effecting the actuation of said mechanism.

2. In a plate-handling machine, the combination with a movable plate-receiving member, and feed-rollers, of electrical controlling mechanism for effecting alternate movements of the member and rollers, and means for automatically actuating the controlling mechanism.

3. In a plate-handling machine, the combination with a movable plate-receiving member, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism for effecting alternate movements of the member and rollers, and plate-operated means for automatically actuating the controlling mechanism.

4. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill and provided with feed-rollers, of means for operating the member and rollers, and means for automatically stopping the member and starting the rollers when the plate arrives opposite one pass, and for stopping the member and starting the rollers in the reverse direction when said member arrives opposite another pass of the mill.

5. In a plate-handling machine, the combination with a movable plate-receiving member, and feed-rollers, of operating mechanism for the member and rollers, electrical controlling mechanism for stopping the member and starting the rollers before one pass of a mill, and for stopping the member and starting the rollers in the reverse direction before another pass thereof, and plate-controlled means for actuating the controlling mechanism.

6. In a plate-handling machine, the combination with a movable plate-receiving member, and feed-rollers, of means for operating the rollers to facilitate the reception of a plate by the member, means for moving the member, means for stopping the rollers and starting the member to transport the plate to a different pass of the mill, and means for preventing the stoppage of the rollers and the starting of the member when the plate received by said member exceeds a predetermined length.

7. In a plate-handling machine, the combi-

nation with a movable plate-receiving member, feed-rollers, means for operating said rollers to facilitate the reception of a plate by the member, and means for moving the member, of automatically-operated controlling mechanism for stopping the rollers and starting the member upon the complete reception of a plate, and plate-controlled means for preventing the stoppage of the rollers and the starting of the member when the plate received by said member exceeds a predetermined length.

8. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and means for operating the member and rollers, of electrical controlling mechanism for the rollers including a switch and plate-controlled means for throwing the switch.

9. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and means for operating the member and rollers, of electrical controlling mechanism for the rollers including a switch and separate plate-controlled devices for operating the switch to control the movement of the rollers when the member is disposed opposite different mill-passes.

10. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism common to the member and rollers and including a switch and automatically-operated means for throwing the switch.

11. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism common to the member and rollers and including a switch and plate-controlled means for operating the switch.

12. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism common to the member and rollers and including a switch and separate plate-controlled devices for throwing the switch to effect the movement in opposite directions of the member and rollers, respectively.

13. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic clutch controlling the connection between the rollers and their operating mechanism, a circuit including the clutch, a switch for said circuit, and plate-controlled means for operating the switch.

14. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic clutch controlling the connection between the rollers and their operating mechanism, a circuit including the clutch, a switch for said circuit, and separate plate-controlled devices disposed to be operated to throw the switch when the member is located opposite different passes of the mill.

15. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the rollers and the operating mechanism, an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a switch, electrical connections between the switch and each of the clutches, and means for operating said switch to close a circuit through either of the clutches.

16. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the rollers and the operating mechanism, an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a switch, electrical connections between the switch and each of the clutches, and automatically-operated means for operating said switch to close a circuit through either of the clutches.

17. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the rollers and the operating mechanism, an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a switch, electrical connections between the switch and each of the clutches, and plate-controlled means for operating said switch to close a circuit through either clutch.

18. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the rollers and the operating mechanism, an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a switch, electrical connections between the switch and each of the clutches, and separate plate-controlled devices for operating the switch when the member is located opposite different passes of the mill.

19. In a plate-handling machine, the combi-

nation with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of a pair of electromagnetic roller-clutches controlling the connection between the rollers and their operating mechanism and arranged when thrown in to operate the rollers in different directions, separate electric circuits each including one of the clutches, a switch constituting a circuit-closing device common to said circuits, and automatically-operated means for throwing the switch, whereby the rollers may be rotated in either direction.

20. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of a pair of electromagnetic roller-clutches controlling the connection between the rollers and their operating mechanisms and arranged when thrown in to operate the rollers in different directions, separate electric circuits each including one of the clutches, a switch constituting a circuit-closing device common to said circuits, and plate-controlled means for throwing the switch, whereby the rollers may be rotated in either direction.

21. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of a pair of electromagnetic roller-clutches controlling the connection between the rollers and their operating mechanism and arranged when thrown in to operate the rollers in different directions, separate electric circuits each including one of the clutches, a switch constituting a circuit-closing device common to said circuits, and separate plate-controlled devices for throwing the switch when the member is located opposite different passes of the mill.

22. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism controlling the connection between the operating mechanism and the member and rollers, respectively, and including a switch operative to effect the alternate connection of the member and rollers with the operating mechanism.

23. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism controlling the connection between the operating mechanism and the member and rollers, respectively, and including a switch operative to effect the alternate connection of the member and rollers with the operating mechanism, and automatic operating means for said switch.

24. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism controlling the connection between the operating mechanism and the member and rollers, respectively, and including a switch operative to effect the alternate connection of the member and rollers with the operating mechanism, and means for operating said switch from a moving part of the machine.

25. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, an electromagnetic roller-clutch controlling the connection between the operating mechanism and the rollers, and electrical controlling mechanism common to said clutches and including a switch operative to open and close the circuits through said clutches.

26. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, an electromagnetic roller-clutch controlling the connection between the operating mechanism and the rollers, and electrical controlling mechanism common to said clutches and including a switch operative to open and close the circuits through said clutches and means operated by a movable machine element to throw the switch.

27. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism including a primary switch, separate circuits for which the primary switch constitutes a common circuit-closing device and a secondary switch designed to close said circuits alternately to effect the alternate connection of the member and rollers with the operating mechanism.

28. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of electrical controlling mechanism including a primary switch, separate circuits for which the primary switch constitutes a common circuit-closing device, a secondary switch designed to close said circuits alternately to effect the alternate connection of the member and rollers with the operating mechanism and automatic operating means for said switches.

29. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and

operating mechanism for the member and rollers, of electrical controlling mechanism including a primary switch, separate circuits for which the primary switch constitutes a common circuit-closing device, a secondary switch designed to close said circuits alternately to effect the alternate connection of the member and rollers with the operating mechanism, plate-controlled means for operating the primary switch and means operated from a moving machine element to actuate the secondary switch.

30. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the rollers and the operating mechanism, an electromagnetic machine-clutch controlling the connection between the member and the operating mechanism, separate circuits each including one of the clutches, a primary switch constituting a circuit-closing device common to both circuits, and a secondary switch for closing the circuits alternately to alternately energize the machine and roller clutches.

31. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the rollers and the operating mechanism, an electromagnetic machine-clutch controlling the connection between the member and the operating mechanism, separate circuits each including one of the clutches, a primary switch constituting a circuit-closing device common to both circuits, a secondary switch for closing the circuits alternately to alternately energize the machine and roller clutches, and means for automatically operating one of said switches.

32. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the rollers and the operating mechanism, an electromagnetic machine-clutch controlling the connection between the member and the operating mechanism, separate circuits each including one of the clutches, a primary switch constituting a circuit-closing device common to both circuits, a secondary switch for closing the circuits alternately to alternately energize the machine and roller clutches, means for automatically operating the primary switch, and means for operating the secondary switch from a moving machine element.

33. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the rollers and the operating mechanism, an electromagnetic machine-clutch controlling the connection between the member and the operating mechanism, separate circuits each including one of the clutches, a primary switch constituting a circuit-closing device common to both circuits, a secondary switch for closing the circuits alternately to alternately energize the machine and roller clutches, plate-controlled means for operating the primary switch, and means for operating the secondary switch from a moving machine element.

34. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a pair of electromagnetic roller-clutches controlling the connection of the rollers with the operating mechanism and arranged to effect the rotation of said rollers in opposite directions, separate electric circuits each including one of the roller-clutches, separate circuits each including the machine-clutch, and separate switches each controlling a roller-clutch circuit and a machine-clutch circuit.

35. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a pair of electromagnetic roller-clutches controlling the connection of the rollers with the operating mechanism and arranged to effect the rotation of said rollers in opposite directions, separate electric circuits each including one of the roller-clutches, separate circuits each including the machine-clutch, separate switches each controlling a roller-clutch circuit and a machine-clutch circuit, and automatically-operated mechanism for operating the switches.

36. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a pair of electromagnetic roller-clutches controlling the connection of the rollers with the operating mechanism and arranged to effect the rotation of said rollers in opposite directions, separate electric circuits each including one of the roller-clutches, separate circuits each including the machine-clutch, separate switches each controlling a roller-clutch circuit and a ma-

chine-clutch circuit, and means for simultaneously operating said switches from moving parts of the machine.

37. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a pair of electromagnetic roller-clutches controlling the connection of the rollers with the operating mechanism and arranged to effect the rotation of said rollers in opposite directions, separate electric circuits each including one of the roller-clutches, separate circuits each including the machine-clutch, secondary switches each controlling a roller-clutch circuit and a machine-clutch circuit, and a primary switch for throwing either of the secondary switches out of circuit.

38. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a pair of electromagnetic roller-clutches controlling the connection of the rollers with the operating mechanism and arranged to effect the rotation of said rollers in opposite directions, separate electric circuits each including the machine-clutch, secondary switches each controlling a roller-clutch circuit and a machine-clutch circuit, a primary switch for throwing either of the secondary switches out of circuit, and means for effecting the simultaneous automatic operation of the secondary switches.

39. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a pair of electromagnetic roller-clutches controlling the connection of the rollers with the operating mechanism and arranged to effect the rotation of said rollers in opposite directions, separate electric circuits each including one of the roller-clutches, separate circuits each including the machine-clutch, secondary switches each controlling a roller-clutch circuit and a machine-clutch circuit, a primary switch for throwing either of the secondary switches out of circuit, and automatically-actuated operating means for the primary and secondary switches.

40. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic machine-clutch controlling the connection between the member and its operating mechanism, a pair of electromagnetic roller-clutches controlling the connection of the rollers with the operating mechanism and arranged to effect the rotation of said rollers in opposite directions, separate electric circuits each including one of the roller-clutches, separate circuits each including the machine-clutch, secondary switches each controlling a roller-clutch circuit and a machine-clutch circuit, a primary switch for throwing either of the secondary switches out of circuit, means for automatically operating the secondary switches, and plate-controlled means for operating the primary switch.

41. In a plate-handling machine, the combination with a plate-receiving member movable between the passes of a mill, feed-rollers, and operating mechanism for the member and rollers, of an electromagnetic roller-clutch controlling the connection between the member and its operating mechanism, a pair of electromagnetic roller-clutches controlling the connection of the rollers with the operating mechanism and arranged to effect the rotation of said rollers in opposite directions, separate electric circuits each including one of the roller-clutches, separate circuits each including the machine-clutch, secondary switches each controlling a roller-clutch circuit and a machine-clutch circuit, a primary switch for throwing either of the secondary switches out of circuit, means for effecting the simultaneous actuation of the secondary switches from moving elements of the machine, and plate-controlled means for operating the primary switch.

42. In a plate-handling machine, the combination with a pair of plate-receiving members arranged for disposal at opposite sides of a stand of mill-rolls and movable between the passes of the mill, of means for moving the receiving members and electrical controlling mechanism common to said members, said mechanism including a switch and automatic operating means therefor.

43. In a plate-handling machine, the combination with a pair of plate-receiving members arranged for disposal at opposite sides of a stand of mill-rolls and movable between the passes of the mill, of electrical controlling mechanism common to said members and including a switch and means for automatically operating said switch in different positions of the members.

44. In a plate-handling machine, the combination with a pair of plate-receiving members arranged for disposal at opposite sides of a stand of mill-rolls and movable between the passes of the mill, of means for moving the members and electrical controlling mechanism common to both members and including a switch, and plate-controlled switch-operating mechanism.

45. In a plate-handling machine, the combination with a pair of plate-receiving members

arranged for disposal at opposite sides of a stand of mill-rolls and movable between the passes of the mill, of means for moving the members, electrical controlling mechanism common to said members and including a switch, and separate switch-operating devices disposed for actuation by a plate as it passes through the different passes of the mill.

46. In a plate-handling machine, the combination with a pair of plate-receiving members arranged for disposal at opposite sides of a stand of mill-rolls and movable between the passes of the mill, of a series of feed-rollers carried by each plate-receiving member, and plate-operated controlling mechanism common to both series of feed-rollers.

47. In a plate-handling machine, the combination with a pair of plate-receiving members arranged for disposal at opposite sides of a stand of mill-rolls and movable between the passes of the mill, and a series of feed-rollers carried by each plate-receiving member, of electrical controlling mechanism common to both series of rollers and including a switch and means for automatically operating the switch to effect the stopping and starting of the rollers.

48. In a plate-handling machine, the combination with a pair of plate-receiving members arranged for disposal at opposite sides of a stand of mill-rolls and movable between the passes of the mill, and a series of feed-rollers carried by each plate-receiving member, of electrical controlling mechanism common to both series of rollers and including a switch and plate-controlled means for operating the switch to effect the stopping and starting of the rollers.

49. In a plate-handling machine, the combination with a pair of plate-receiving members arranged for disposal at opposite sides of a stand of mill-rolls and movable between the passes of the mill, and a series of feed-rollers carried by each plate-receiving member, of electrical controlling mechanism common to both series of rollers and including a switch and separate plate-controlled switch-operating devices disposed for actuation in different positions of the plate-receiving members.

50. In a plate-handling machine, the combination with a pair of plate-receiving members each of which is equipped with a series of feed-rollers, and operating means for the members and rollers, of automatically-operated means for stopping both members and starting both series of feed-rollers when the members arrive opposite one pass of a mill, and for automatically stopping the members and starting both series of rollers in the reverse direction when the members arrive opposite another pass of the mill.

51. In a plate-handling machine, the combination with a pair of plate-receiving members each of which is equipped with a series of feed-rollers, and operating means for the members and rollers, of plate-controlled means for stopping both members and starting both series of feed-rollers when the members arrive opposite one pass of a mill, and for stopping the members and starting both series of rollers in the reverse direction when the members arrive opposite another pass of the mill.

52. In a plate-handling machine, the combination with a pair of plate-receiving members, and operating mechanism therefor, of electrical controlling mechanism including electromagnetic machine-clutches controlling the operative connection between the members and the operating mechanism, a switch also included as a part of the electrical controlling mechanism, and automatically-operated means for operating the switch.

53. In a plate-handling machine, the combination with a pair of plate-receiving members, and operating mechanism therefor, of electrical controlling mechanism including electromagnetic machine-clutches controlling the operative connection between the members and the operating mechanism, a switch also included as a part of the electrical controlling mechanism, and plate-controlled means for operating the switch.

54. In a plate-handling machine, the combination with a pair of plate-receiving members, and operating mechanism therefor, of electrical controlling mechanism including electromagnetic machine-clutches controlling the operative connection between the members and the operating mechanism, a switch also included as a part of the electrical controlling mechanism, and separate plate-controlled devices for operating the switch in different positions of the members.

55. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, and a series of feed-rollers carried by each member, of operating mechanism for the members and rollers, separate electromagnetic roller-clutches controlling the connection of the operating mechanism and rollers to effect the rotation of said rollers in opposite directions, and plate-controlled means for closing a circuit through the proper clutch to effect the rotation of the rollers in either direction.

56. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the rollers and members, of electrical controlling mechanism common to both members and to both series of rollers, said mechanism including electromagnetic roller-clutches controlling the operation of the rollers, electromagnetic machine-clutches controlling the operation of the members, a switch and electrical connections between the switch and the several clutches.

57. In a plate-handling machine, the combination with a pair of plate-receiving members

movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the rollers and members, of electrical controlling mechanism common to both members and to both series of rollers, said mechanism including electromagnetic roller-clutches controlling the operation of the rollers, electromagnetic machine-clutches controlling the operation of the members, a switch, electrical connections between the switch and the several clutches and means for automatically operating the switch.

58. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the rollers and members, of electrical controlling mechanism common to both members and to both series of rollers, said mechanism including electromagnetic roller-clutches controlling the operation of the rollers, electromagnetic machine-clutches controlling the operation of the members, a switch, electrical connections between the switch and the several clutches and plate-controlled means for operating the switch.

59. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the rollers and members, of electrical controlling mechanism common to both members and to both series of rollers, said mechanism including electromagnetic roller-clutches controlling the operation of the rollers, electromagnetic machine-clutches controlling the operation of the members, a switch, electrical connections between the switch and the several clutches and separate plate-controlled switch-operating devices disposed for actuation in different positions of the members.

60. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism for said members including a pair of secondary switches controlling the movement of the members in opposite directions and a primary switch for closing a circuit through either of the secondary switches.

61. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism for said members including a pair of secondary switches controlling the movement of the members in opposite directions, a primary switch for closing a circuit through either of the secondary switches and automatically-operated means for throwing the primary switch.

62. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism for said members including a pair of secondary switches controlling the movement of the members in opposite directions, a primary switch for closing a circuit through either of the secondary switches and plate-controlled means for operating the primary switch.

63. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism for said members including a pair of secondary switches controlling the movement of the members in opposite directions, a primary switch for closing a circuit through either of the secondary switches and separate plate-controlled devices operative in different positions of the members to throw the primary switch.

64. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to the rollers of both members and including separate electromagnetic roller-clutches for effecting the simultaneous operation of all of the rollers in each direction, secondary switches each of which controls the clutch for rotating the rollers in one direction and a primary switch arranged to close a circuit through either of the secondary switches.

65. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to the rollers of both members and including separate electromagnetic roller-clutches for effecting the simultaneous operation of all of the rollers in each direction, secondary switches each of which controls the clutch for rotating the rollers in one direction, a primary switch arranged to close a circuit through either of the secondary switches and automatically-operated actuating mechanism for the primary switch.

66. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to the rollers of both members and including separate electromagnetic roller-clutches for effecting the simultaneous operation of all of the rollers in each direction, sec-

ondary switches each of which controls the clutch for rotating the rollers in one direction, a primary switch arranged to close a circuit through either of the secondary switches and plate-controlled mechanism for operating the primary switch.

67. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to the rollers of both members and including separate electromagnetic roller-clutches for effecting the simultaneous operation of all of the rollers in each direction, secondary switches each of which controls the clutch for rotating the rollers in one direction, a primary switch arranged to close a circuit through either of the secondary switches and separate plate-controlled devices for operating the primary switch in different positions of the members.

68. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to both members and both series of rollers, said mechanism including machine-clutches for connecting the operating mechanism with the members, separate sets of roller-clutches for connecting the operating mechanism with the rollers to drive the latter in opposite directions, secondary switches each controlling a circuit through the machine-clutches and through one set of roller-clutches and a primary switch for cutting either of the secondary switches out of circuit.

69. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to both members and both series of rollers, said mechanism including machine-clutches for connecting the operating mechanism with the members, separate sets of roller-clutches for connecting the operating mechanism with the rollers to drive the latter in opposite directions, secondary switches each controlling a circuit through the machine-clutches and through one set of roller-clutches, a primary switch for cutting either of the secondary switches out of circuit and means for effecting the simultaneous operation of the secondary switches.

70. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to both members and both series of rollers, said mechanism including machine-clutches for connecting the operating mechanism with the members, separate sets of roller-clutches for connecting the operating mechanism with the rollers to drive the latter in opposite directions, secondary switches each controlling a circuit through the machine-clutches and through one set of roller-clutches, a primary switch for cutting either of the secondary switches out of circuit and means for automatically operating the primary and secondary switches.

71. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to both members and both series of rollers, said mechanism including machine-clutches for connecting the operating mechanism with the members, separate sets of roller-clutches for connecting the operating mechanism with the rollers to drive the latter in opposite directions, secondary switches each controlling a circuit through the machine-clutches and through one set of roller-clutches, a primary switch for cutting either of the secondary switches out of circuit, means for operating the secondary switches during the movement of the members and means for operating the primary switch while the members are at rest.

72. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to both members and both series of rollers, said mechanism including machine-clutches for connecting the operating mechanism with the members, separate sets of roller-clutches for connecting the operating mechanism with the rollers to drive the latter in opposite directions, secondary switches each controlling a circuit through the machine-clutches and through one set of roller-clutches, a primary switch for cutting either of the secondary switches out of circuit, means for operating the secondary switches from moving elements of the machine and plate-controlled means for operating the primary switch.

73. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and operating mechanism for the members and rollers, of electrical controlling mechanism common to both members and both series of rollers, said mechanism including machine-clutches for connecting the operating mech-

anism with the members, separate sets of roller-clutches for connecting the operating mechanism with the rollers to drive the latter in opposite directions, secondary switches each controlling a circuit through the machine-clutches and through one set of roller-clutches, a primary switch for cutting either of the secondary switches out of circuit, means for operating the secondary switches during the movement of the members and separate plate-controlled devices for operating the primary switch in different positions of the members.

74. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and means for operating the members and rollers, of means for stopping the rollers and starting the members upon the complete transfer of a plate from one member to the other, and automatically-operated means for preventing the stopping of the rollers and the starting of the members when the plate so transferred exceeds a predetermined length.

75. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and means for operating the members and rollers, of means for stopping the rollers and starting the members upon the complete transfer of a plate from one member to the other, and plate-operated means for preventing the stopping of the rollers and the starting of the members when the plate so transferred exceeds a predetermined length.

76. In a plate-handling machine, the combination with a pair of plate-receiving members movable between the passes of a mill, a series of feed-rollers carried by each member, and means for operating the members and rollers, of means for stopping the rollers and starting the members upon the complete transfer of a plate from one member to the other, and a lever arranged for actuation by the transferred plate when said plate exceeds a predetermined length, said lever being operatively related to the means for stopping the rollers and starting the members and disposed when operated by the plate to prevent the effective operation of such means.

77. In a plate-handling machine, the combination with a pair of movable plate-receiving members, and operating means therefor, including a pair of eccentrics, of a counterbalancing device common to said members, and having operative connection with the eccentrics.

78. In a plate-handling machine, the combination with a stand of mill-rolls, of a pair of plate-receiving members, means for simultaneously moving said members in curvilinear paths, whereby the inner ends of said members are caused to approach close to the passes of the mill and to clear the sides of the roll disposed between the passes, and plate-controlled devices for starting the members from positions opposite different passes of the mill.

79. In a plate-handling machine, the combination with a movable plate-receiving member, feed-rollers and operating mechanism for the member and rollers, of plate-operated electrical controlling mechanism for effecting alternate movement of the member and rollers.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

EDMUND MILES.

Witnesses:
IRA H. WATSON,
B. R. MITCHELL.