W. FORSSTROM.

MANIPULATOR.

APPLICATION FILED OCT. 4, 1918.

1,360,106.

Patented Nov. 23, 1920.

4 SHEETS—SHEET 1.

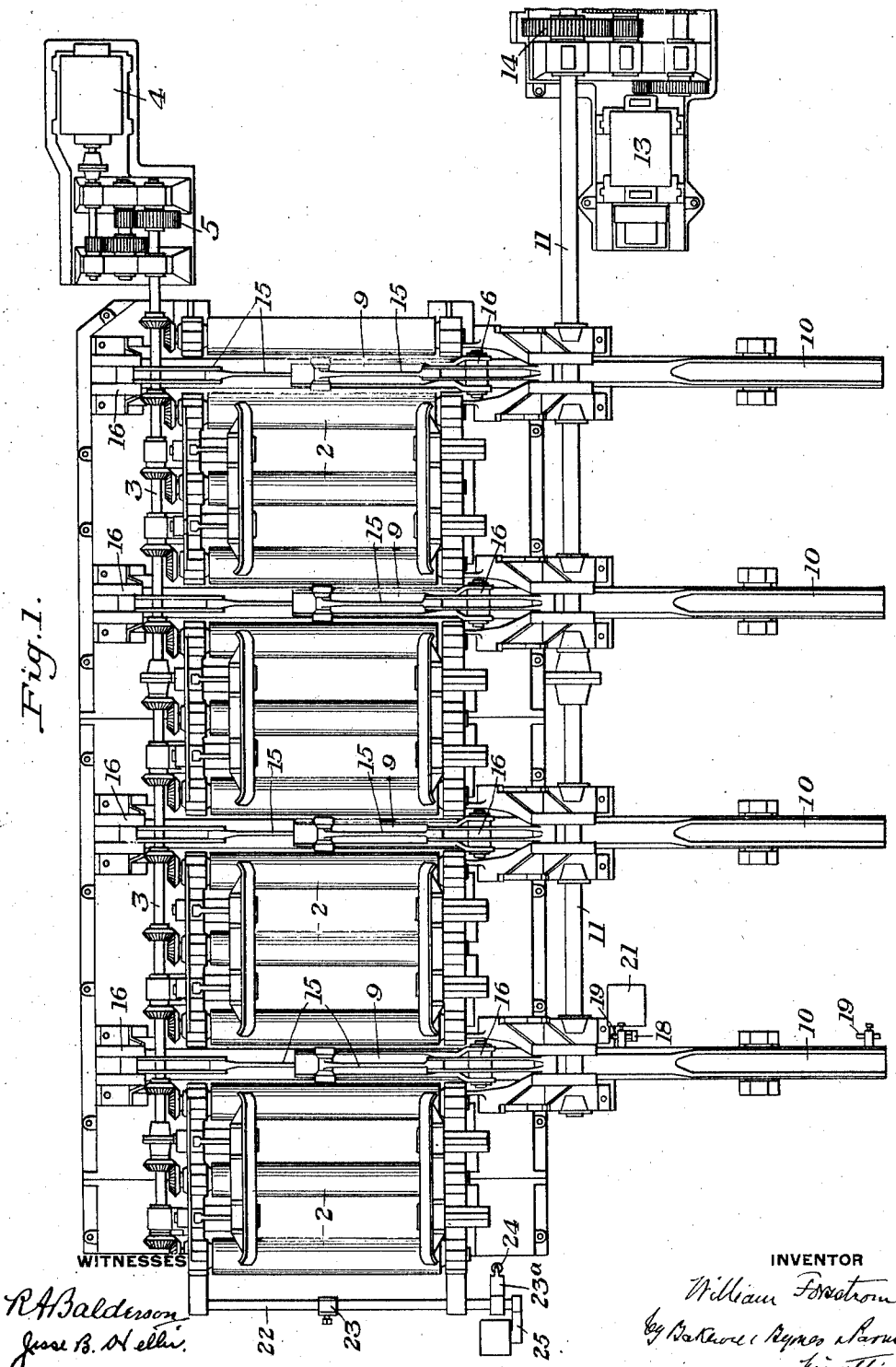

Fig. 1.

WITNESSES

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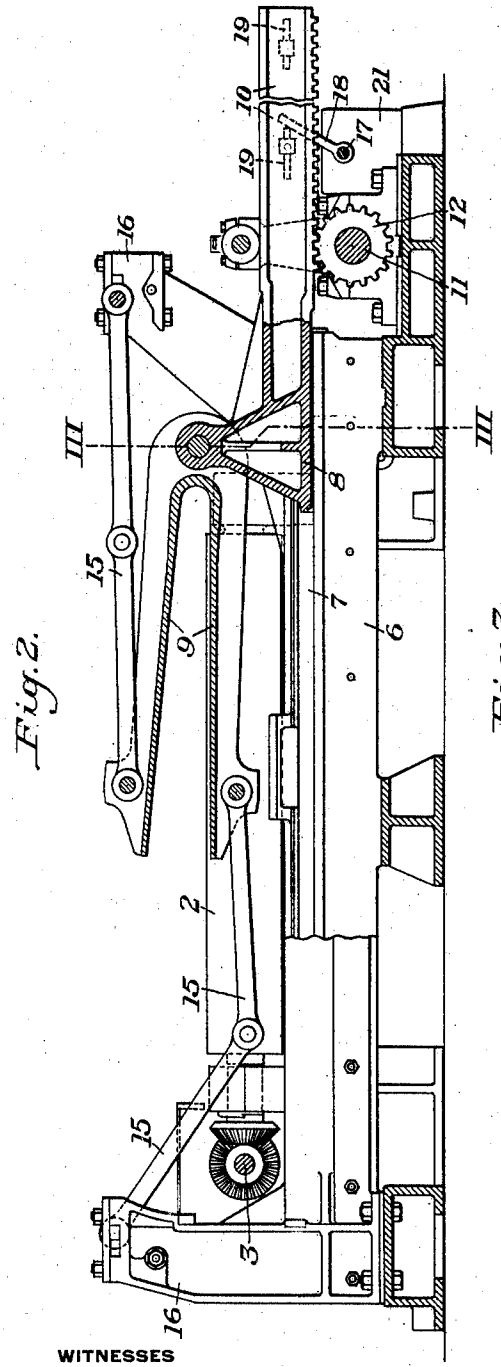

Fig. 2.

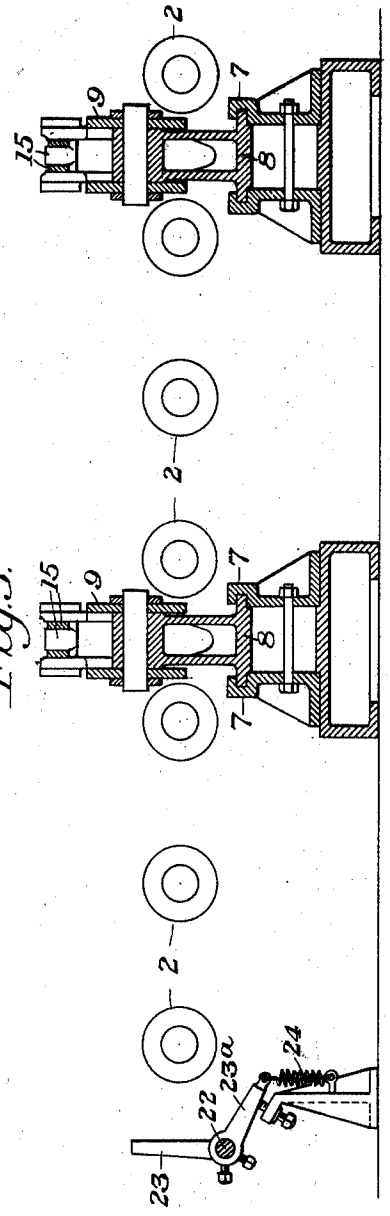

Fig. 3.

WITNESSES

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4 SHEETS—SHEET 3.

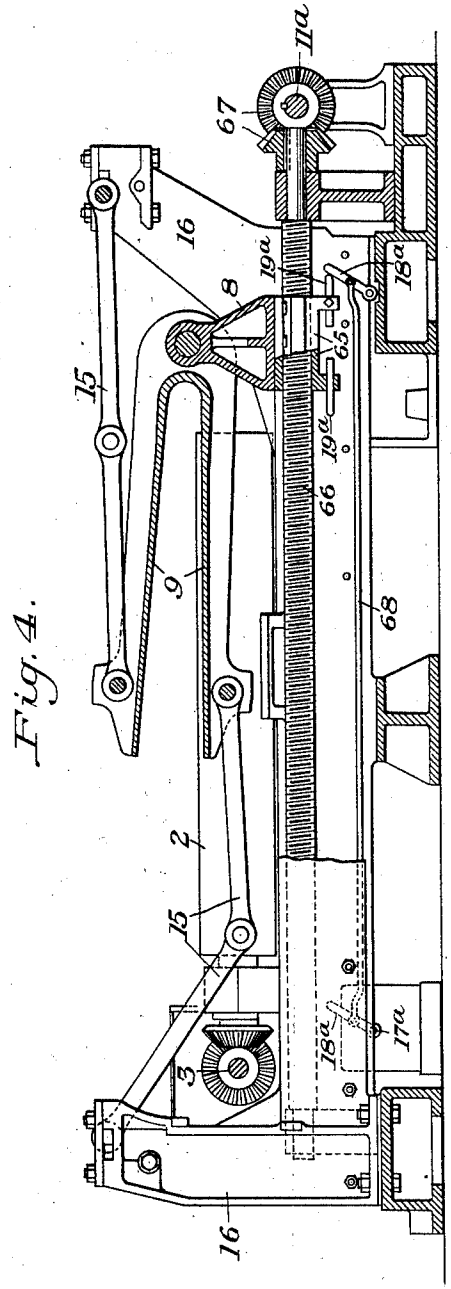

Fig. 4.

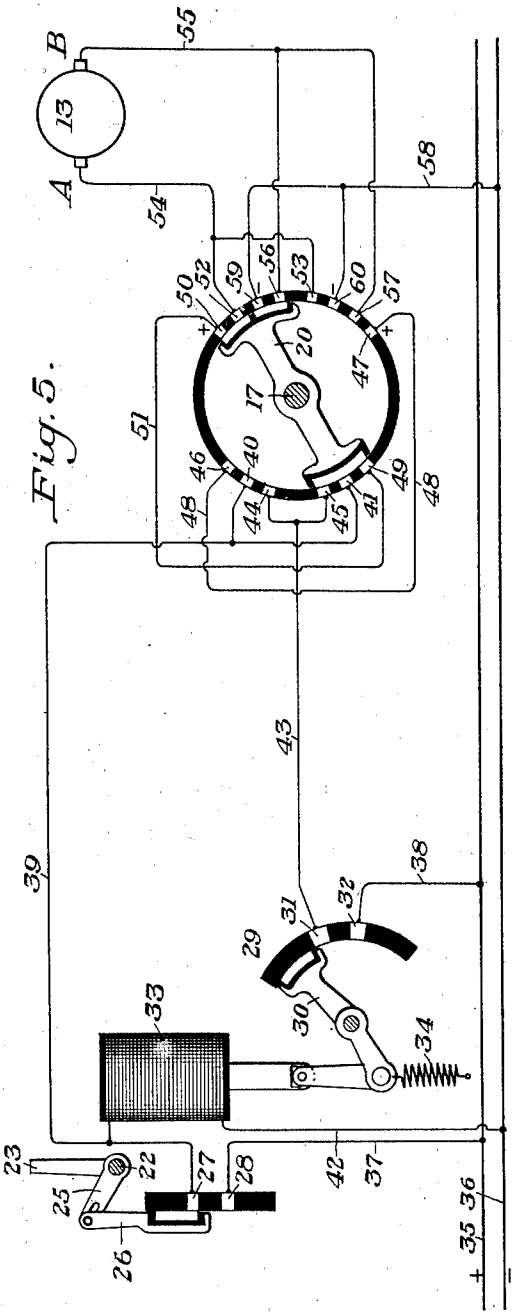

Fig. 5.

WITNESSES

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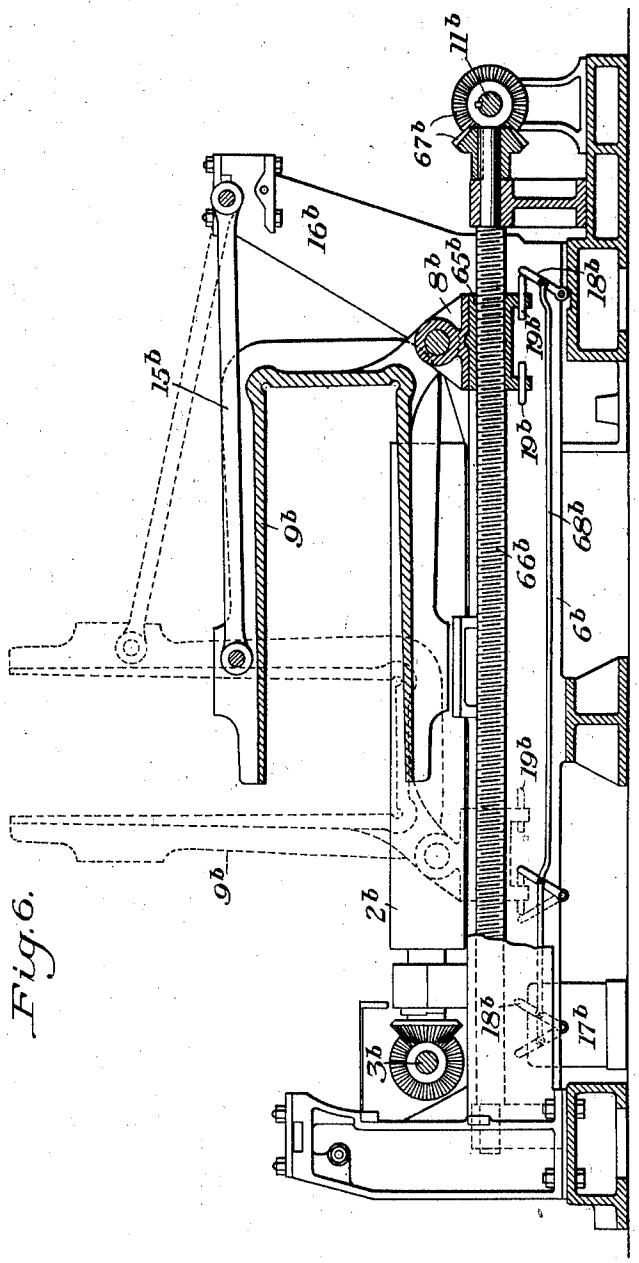

Fig. 6.

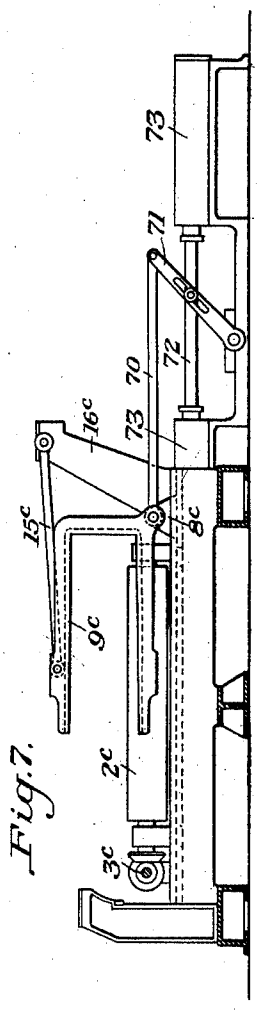

Fig. 7.

WITNESSES

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UNITED STATES PATENT OFFICE.

WILLIAM FORSSTROM, OF YOUNGSTOWN, OHIO.

MANIPULATOR.

1,360,106. Specification of Letters Patent. Patented Nov. 23, 1920.

Application filed October 4, 1918. Serial No. 256,885.

To all whom it may concern:

Be it known that I, WILLIAM FORSSTROM, a citizen of the United States, residing at Youngstown, in the county of Mahoning and State of Ohio, have invented a new and useful Improvement in Manipulators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan view of an apparatus in which I have embodied one form of my invention.

Fig. 2 is a transverse sectional view on an irregular line.

Fig. 3 is a vertical sectional view on the line III—III of Fig. 2 with some of the parts omitted for clearness.

Fig. 4 is a view similar to Fig. 2, showing a modified form of the device.

Fig. 5 is a diagram illustrating the electrical connections for the automatic control of the device.

Fig. 6 is a view similar to Fig. 2, showing still another modified form, and

Fig. 7 is an end view illustrating another modified form.

This invention relates to an improvement in manipulators, and is designed to provide a simple and efficient manipulator and operating mechanism therefor, whereby a work-piece can readily be turned on a feed table. The device is more particularly adapted for use in connection with rolling mills, where it is desired to turn the workpiece, or to turn the piece completely over to permit the scale to fall therefrom; or to place the workpiece on its edges in order to inspect the various sides thereof.

Another object of my invention is to provide controlling mechanism for the manipulator which may be hand controlled, or which may be arranged to automatically set the mechanism into motion when the workpiece has reached a predetermined point on the table, so that the workpiece will be turned and the automatic mechanism thrown out of operation after it has been turned, and leave the parts in such a position that they will be automatically thrown into operation when the next workpiece reaches a predetermined point on the table.

The precise nature of my invention will be best understood by reference to the accompanying drawings, which will now be described, it being premised, however, that various changes can be made in the details of construction of the apparatus, as well as the controlling mechanism, without departing from the spirit and scope of my invention, as defined in the appended claims.

In the drawings, the reference character 2 designates the rolls of a well-known rolling mill table, which are arranged to be actuated by a shaft 3, which is in turn actuated by a motor 4 through the medium of interposed reducing gearing 5. The various rolls and the shaft 3 are suitably journaled in bearings mounted on the frame 6 of the table, and slidably mounted in guides 7 on this table are a plurality of supporting members 8. Pivotally connected to each of the supporting members 8 is a jaw member 9 of the manipulator, there being four of such jaws shown, although it will readily be understood that the number thereof will vary in accordance with the size of the table. In the construction shown in Figs. 1 to 3, the supporting members 8 are arranged to be reciprocated by means of racks 10 secured to supporting members 8, there being one of these racks connected to each of the supporting members 8. 11 is a longitudinal shaft supported in bearings mounted on the table, and connected to this shaft 11 are pinions 12, each of which is in mesh with one of the racks 10. The shaft 11 is rotated first in one direction and then in the reverse direction, by means of a motor 13 which is geared thereto by means of reduction gearing 14, and which motor is set into operation by the controlling mechanism, as hereinafter described.

Connected to the upper end of each jaw member 9 and at each side thereof is a flexible link 15. The other end of each of these links is connected to a standard 16 formed integrally with or secured to the table 6.

The controlling mechanism in the construction shown in Figs. 1 to 3 comprises a longitudinal shaft 17, to which is connected an operating lever 18 which is arranged to be oscillated by means of adjustable stops 19 on the rack member 10. Connected to the shaft 17 is a motor controlling switch member 20 which is located within the switch box 21, the switch being more clearly shown in Fig. 5, and is arranged to control the flow of current through the motor 13, as hereinafter described.

Extending transversely of the device at any desired point, is a shaft 22, to which is

connected a lever 23 in line of movement of the workpiece rolls 2, and 23ª is a second crank connected to the shaft 22 to which is connected a spring 24 for retaining the crank 23 in its elevated position, as shown in Fig. 3. 25 is a third lever connected to the shaft 22 to which is connected a switch member 26 arranged to close the circuit between contact members 27 and 28, for closing the circuit through the motor 13 to operate the manipulator when the lever 23 is struck by the work piece. The switch, composed of the member 26 together with the contacts 27 and 28, might be termed the "pilot switch," which is arranged to control the circuit through the main switch 29. The main switch comprises a switch lever 30 which is arranged to close the circuit through contacts 31 and 32, and which switch lever 30 is actuated in one direction by a solenoid 33 and is returned to its open position by means of a spring 34, as clearly shown in Fig. 5.

35 and 36 are wires leading from any suitable source of electrical energy. The wire 35 which is the positive wire from the source of supply is connected by means of a wire 37 with the contact 28, and is also connected by means of a wire 38 with the contact 32 of the switch 29. 39 is a wire which extends from the contact 22 to one side of the winding of the solenoid 33, and also to contacts 40 and 41 of the motor controlling switch. 42 is a wire extending from the other side of the winding of the solenoid 33 to the return wire 36 leading to the source of electrical energy. 43 is a wire connected to the contact 31 of the switch 29 as well as contacts 44 and 45 of the controlling switch for the motor 13. Contacts 46 and 47 of the motor control switch are connected to each other by means of a wire 48, while contacts 49 and 50 of the motor control switch are connected to each other by means of a wire 51. One side of the motor 13 is connected to contacts 52 and 53 of the motor control switch by means of a wire 54. The wire 55, extending from the other side of the motor, is connected to contacts 56 and 57 of the motor control switch. 58 is a wire connected to the contacts 59 and 60 of the motor control switch which is also connected to the return wire 36.

The operation of the device is as follows: The workpiece is moved over the rolls 2 from any desired point and as soon as the end thereof moves the lever 23 a sufficient distance to close the circuit through contacts 27 and 28 by means of a switch lever 26, the circuit will be completed through the wires 39, 51 and 54 to the motor 13, the return current from the motor 13 passing through wires 55 and 58 to the line. The motor control switch is so arranged that at one time the current will pass through the motor from A to B or from wire 54 to wire 55, and when the switch is shifted the current will pass from point B to A, or from wire 55 to wire 54 for the purpose hereinafter described. As soon as the circuit is closed through the motor 13 the supporting member 8, as shown in Fig. 2, will be moved from left to right, which will cause the jaw member 9 to be first elevated and lowered on the other side of the member 8 to turn the workpiece 180°. As soon as the jaw member starts to turn upon its pivotal connection, the workpiece will be raised from the rolls 2, and as soon as the workpiece is raised the switch member 26 will be returned to the position shown in Fig. 5 of the drawings, by means of the actuating spring 24. The closing of the circuit through the wire 39 by means of the switch member 26 will also cause a current to pass through the winding of the solenoid 33 back to the line by means of wire 42, which will shift the lever 30 from the position shown in Fig. 5 to a position to close the circuit through contacts 31 and 32, so that the circuit through the windings of the solenoid will be maintained by the switch 29 and the motor control switch through contacts 41 and 45 so that the circuit will be maintained through the motor after the switch member 26 is moved to its open position, and will be maintained until the shaft 11 has been rotated a sufficient distance to turn the jaws 9 180°. Just before the jaws have been turned 180° the right hand adjustable stop member 19, as shown in Fig. 2, will engage the lever 18 on the shaft 17 to shift the shaft 17 and throw the switch member 20 of the motor control-switch approximately 60° to close the circuits between the other contacts. The movement of the switch member 20 from the position shown in the drawings will break the circuit through the wire 39 to the winding of the solenoid 33, and as soon as this circuit is broken the spring 34 will move the arm 30 to break the circuit through the main switch 29, so that the parts will remain at rest until the next workpiece engages the lever 23. The connections through the motor control switch are such that the motor 13 will be actuated in the reverse direction to return the jaw members 9 to the position shown in the drawings when the circuit is again closed by means of the switch member 29.

In Fig. 4 of the drawings I have shown a modified form, in which the supporting member 8 is provided with a nut 65 which has a threaded engagement with a screw 66. The screw 66 is arranged to be actuated in either direction by means of bevel gear connections 67 with a shaft 11ª, which is operated by means of the motor. In this construction, the adjustable stops 19ª are connected to the nut, and are arranged to actuate levers 18ª connected to each other by a

link 68. One of these levers 18^a is connected to a switch shaft 17^a which is similar to the shaft 17 of the device shown in Figs. 1 to 3.

In Fig. 6 I have shown another modified form of device in which the work-piece is only turned 90° for edging the workpiece or for inspection, instead of 180° as in the former described structures. In this figure I have applied the same reference characters to the various parts with the letter "b" affixed. As the jaw member 9^b is merely raised to a vertical position and then again returned to its horizontal position, it is only necessary to use a single link such as 15^b, which need not have a joint as in the other structures.

In Fig. 7 I have shown still another modified form which is similar to Fig. 6, and in which I have applied the same reference characters to similar parts with the letter "c" affixed. In this construction the support 8^c is actuated by means of a link 70, which is in turn shifted by the lever 71 connected to a piston rod 72. This piston rod 72 is reciprocated by means of pistons within the cylinders 73, the valves of which may be controlled in any desired manner.

It will readily be appreciated by those familiar with the art that the controlling devices for the manipulator may be actuated by other mechanism and in other ways than that shown in the drawings and described in the specification.

The advantages of my invention result from the provision of a manipulator for turning articles for inspection or changing the positions thereof between operations, in which the mechanism for actuating the manipulator is caused to move in one direction at one time and then move in the reverse direction the next time, together with means for automatically controlling the manipulator actuating mechanism so that the actuating mechanism will be set into operation when the article to be turned is moved to a predetermined point. Further, from the provision of mechanism which is arranged to automatically throw the controlling mechanism out of operation when the piece has been turned.

I claim:

1. A manipulator comprising an oscillating jaw for the reception of the work-piece, a movable support for the jaw, means to move the support, means to turn the jaw when the support is moved, and automatic mechanism for setting the means to reciprocate the support into operation controlled by the piece to be turned after it has been deposited in the jaw, substantially as described.

2. A manipulator having an oscillating jaw to receive the piece to be turned, a reciprocating support for the jaw, means to turn the jaw when the support is moved, actuating mechanism for the support, and automatic mechanism for setting the actuating mechanism into operation after the work-piece to be turned has been deposited in the jaw and for throwing it out of operation when the piece has been turned, substantially as described.

3. A manipulator having a receiving table, oscillating jaw members for receiving the piece to be turned, a reciprocating support for each jaw member, means to turn the jaws when the support is moved, actuating mechanism for the support, and automatic mechanism for setting the actuating mechanism into operation controlled by the piece to be turned after it has been deposited in the jaw, substantially as described.

4. A manipulator, comprising an oscillating jaw, a traveling support to which said jaw is pivoted, a rotary shaft, reversible means for rotating the shaft in either direction, actuating connections between the shaft and the support to reciprocate the support, actuating connections for turning the jaw during the movement of the support and reversing connections controlled by the movement of the support, substantially as described.

5. A manipulator, comprising a plurality of oscillating jaws, a traveling support for each of said jaws, a shaft, means for rotating the shaft in either direction, a rack connected to each support, and pinions on said shaft arranged to engage with said racks for moving the supports, substantially as described.

6. The combination with a plate receiving table, of a member having arms between which plates deposited on said table are received, rack and gearing means to shift said member bodily whereby the body is shifted transversely across the table, and means interposed between the arms of said member and opposite sides of the table, whereby said member is caused to rotate on its shifting means to a reversed position with each shifting movement thereof, substantially as described.

In testimony whereof I have hereunto set my hand.

WM. FORSSTROM.