Aug. 29, 1961 E. J. GUINN 2,997,815

BUFFING MACHINE

Filed Sept. 9, 1958 6 Sheets-Sheet 1

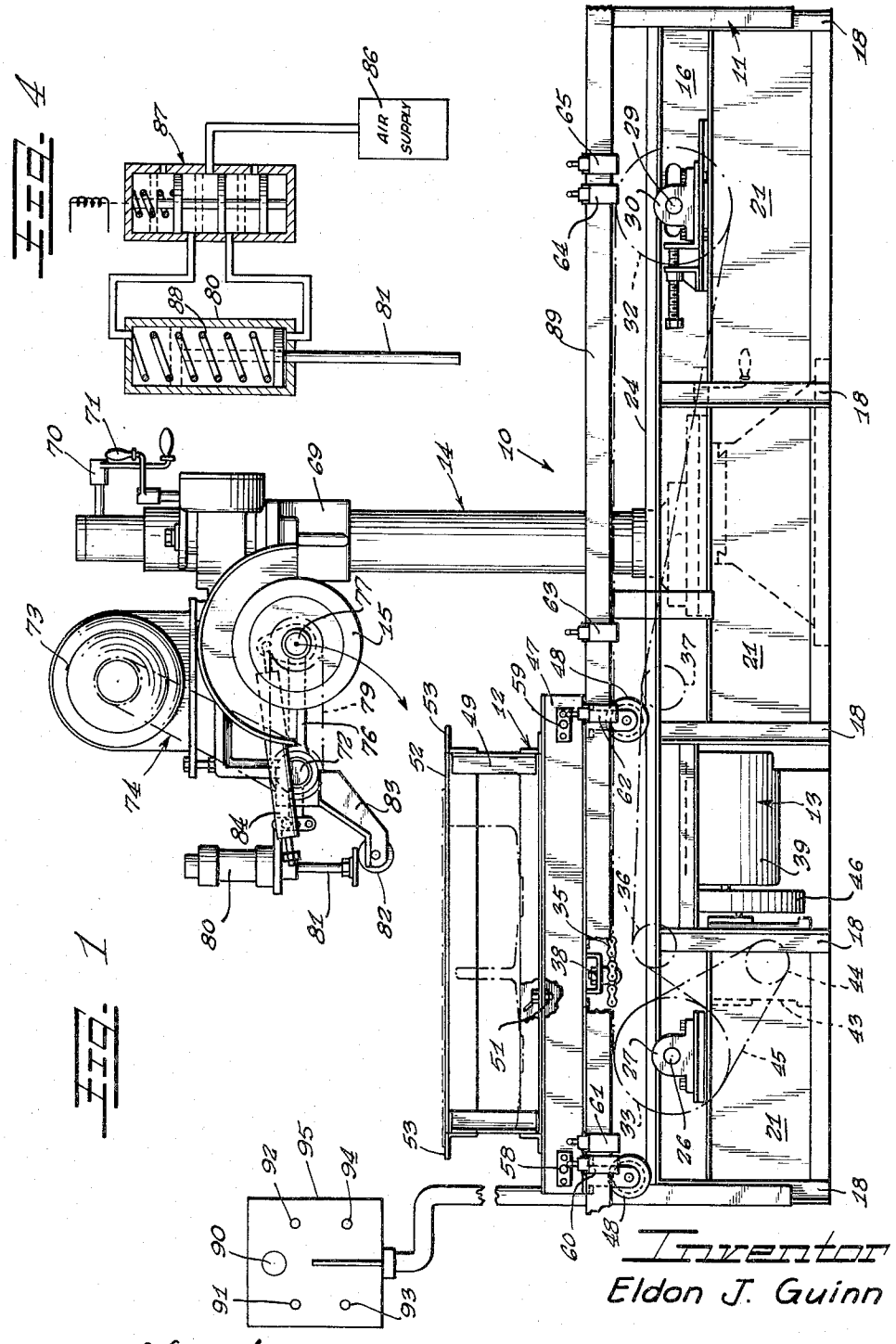



FIG. 1

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BUFFING MACHINE

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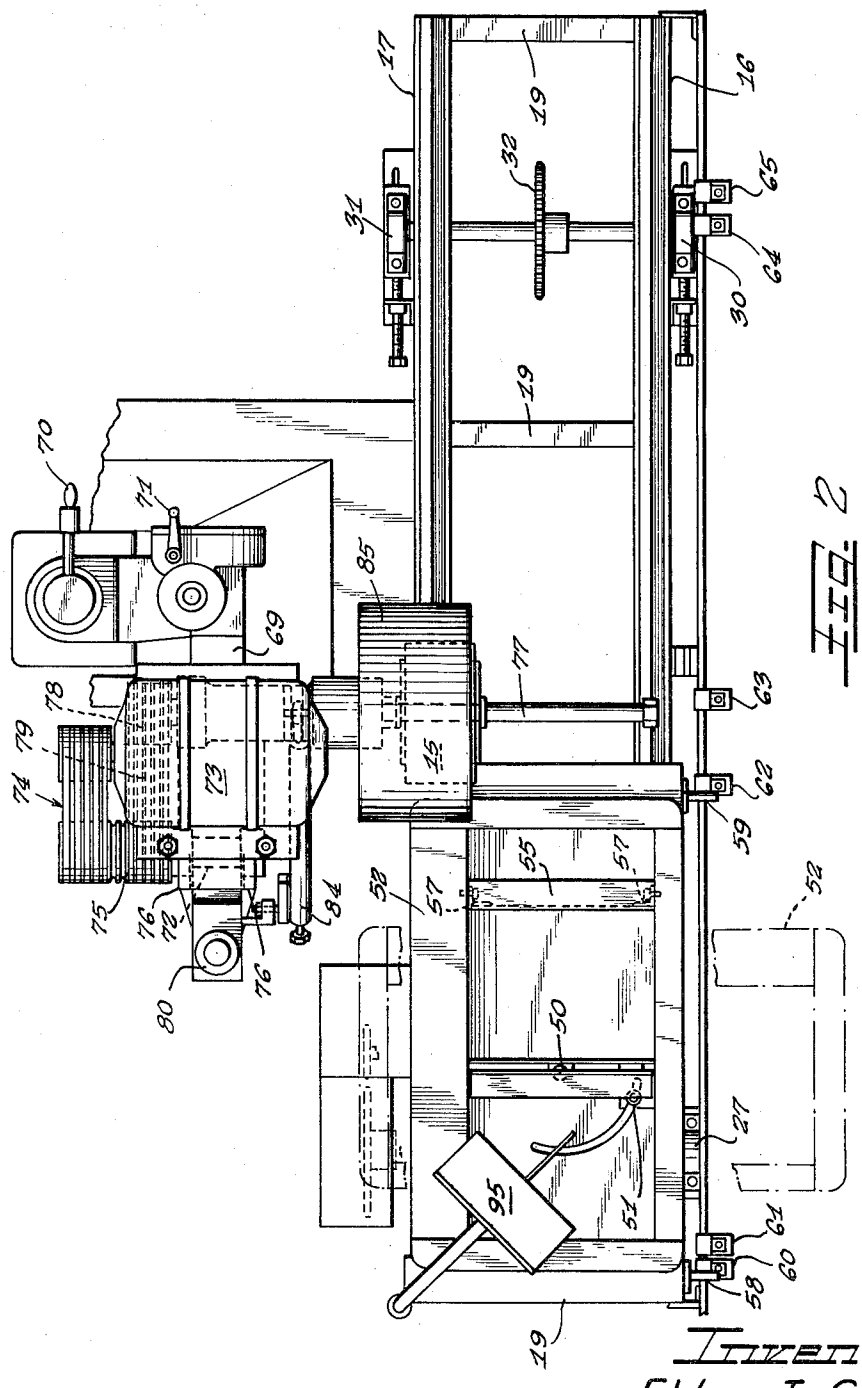


FIG. 2

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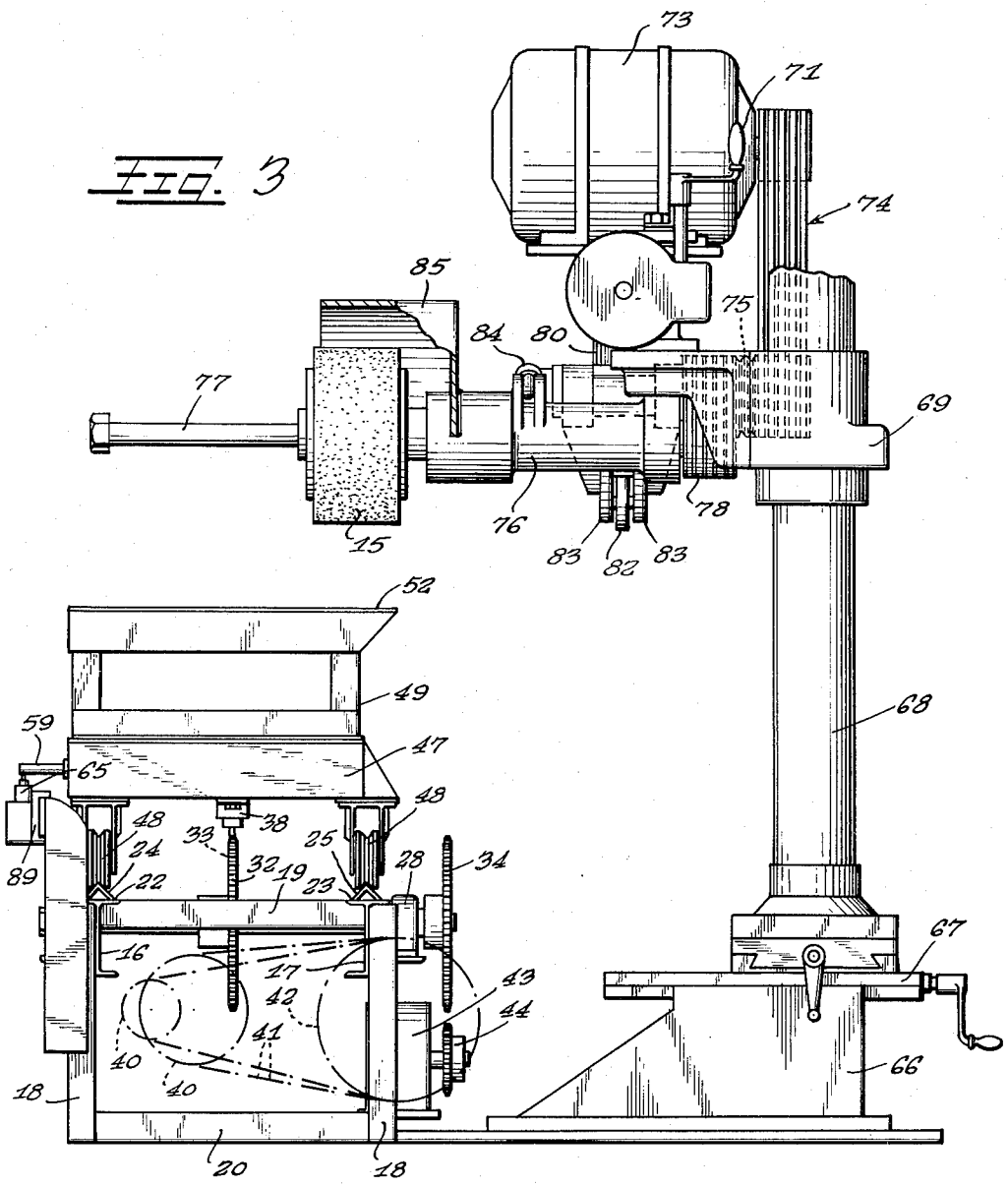
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BUFFING MACHINE

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Fig. 3




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BUFFING MACHINE

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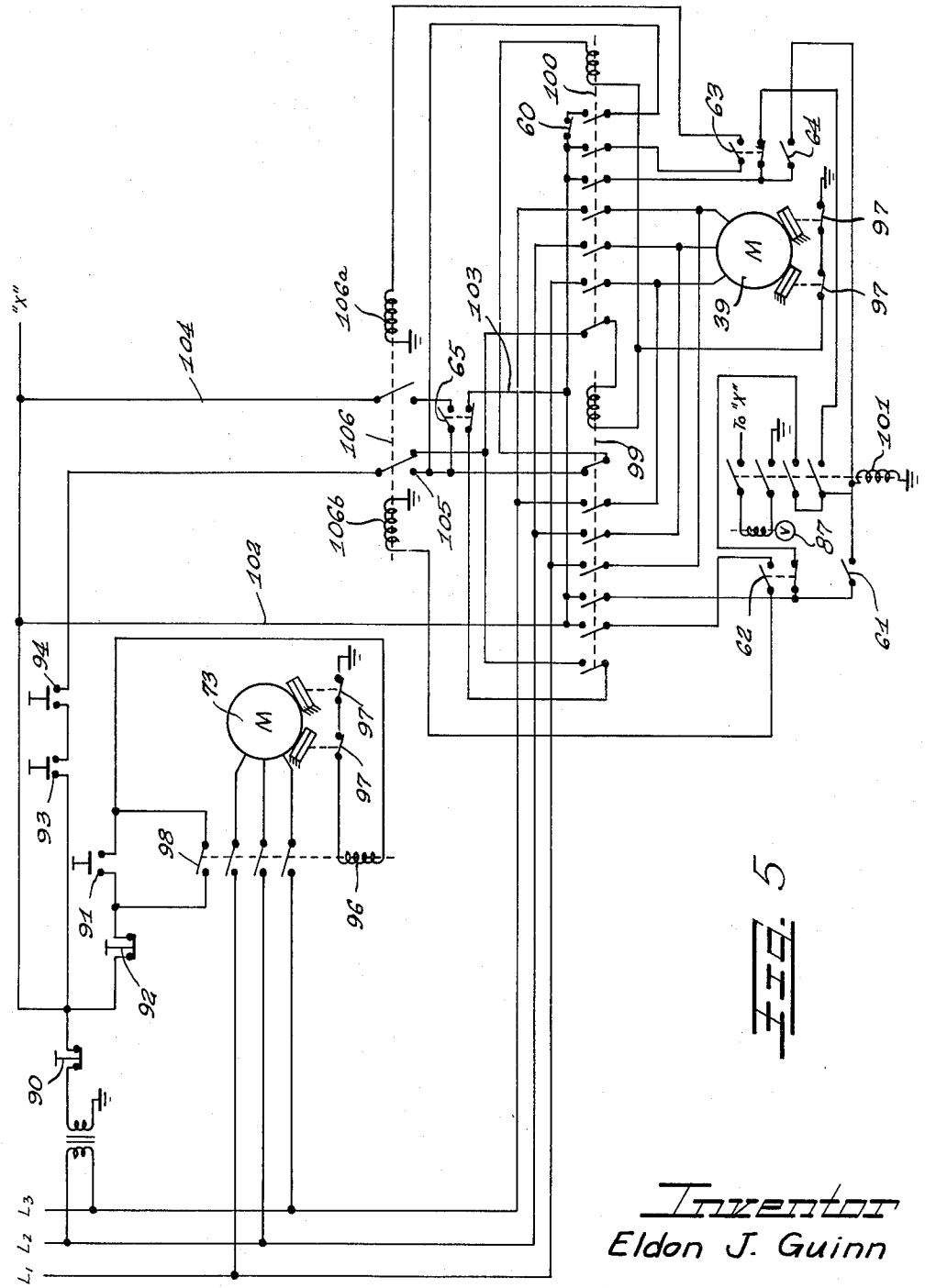



FIG. 5

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BUFFING MACHINE

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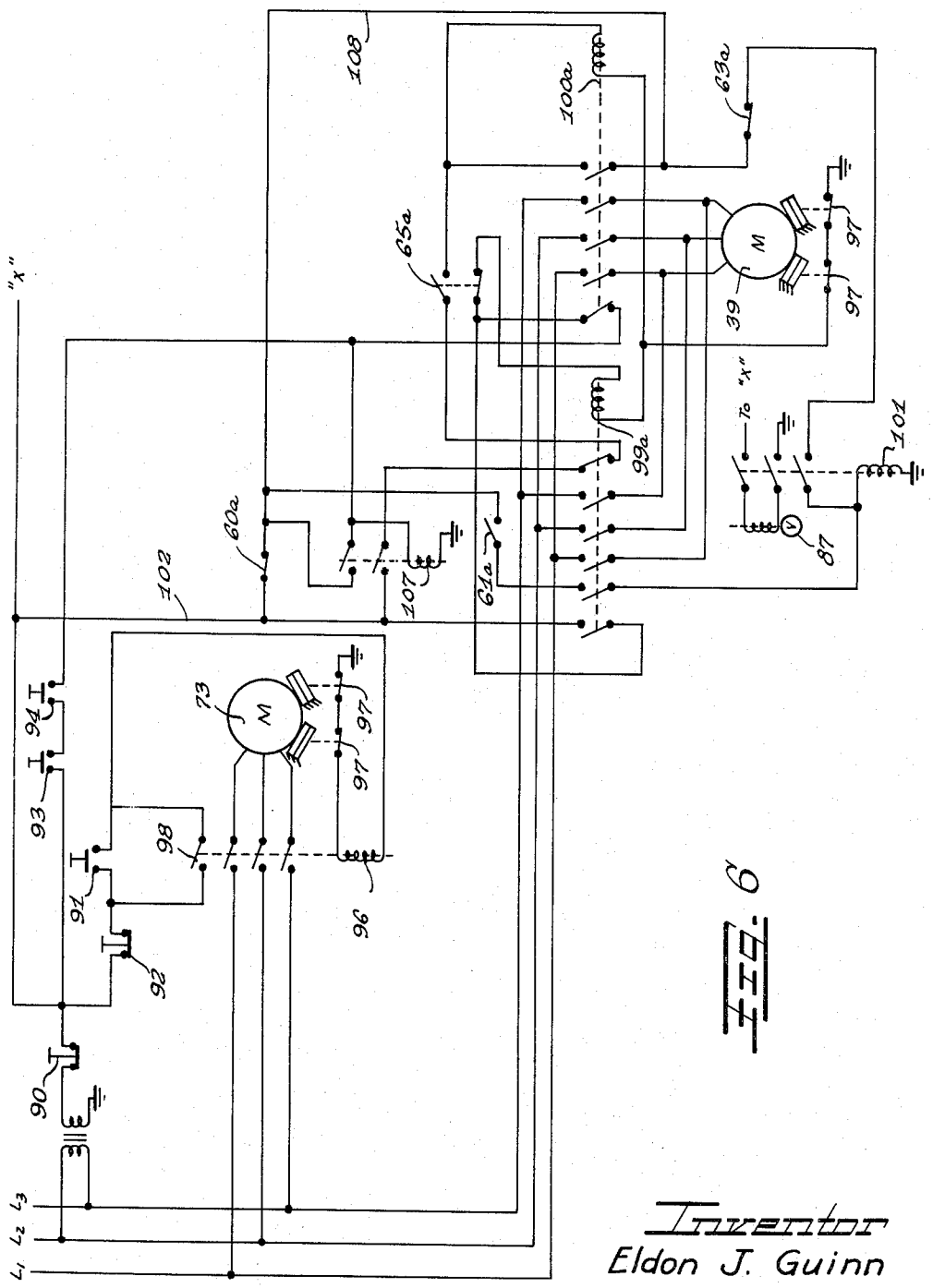



FIG. 9

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Aug. 29, 1961 E. J. GUINN 2,997,815

BUFFING MACHINE

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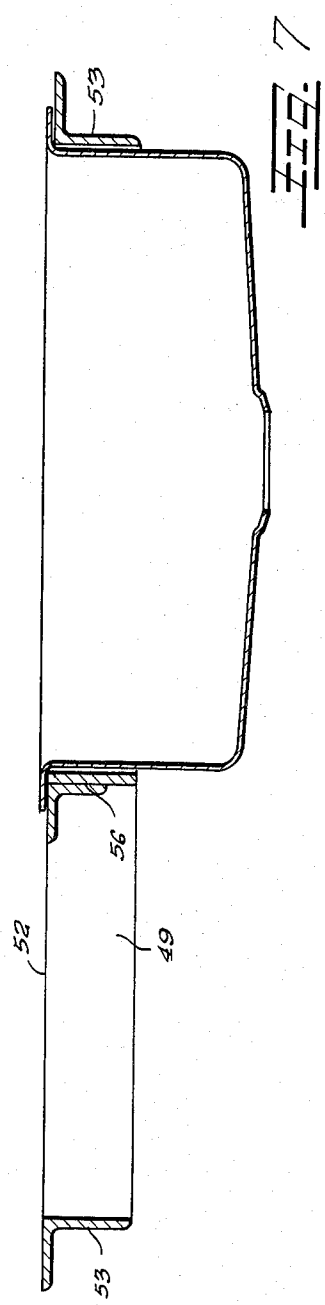



Fig. 7

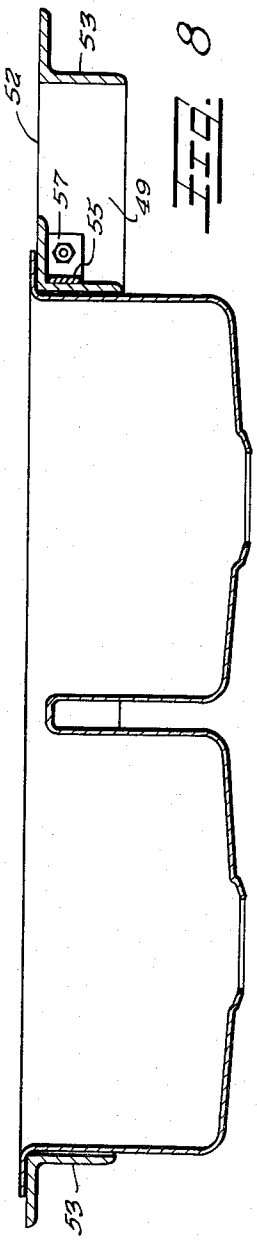



Fig. 8

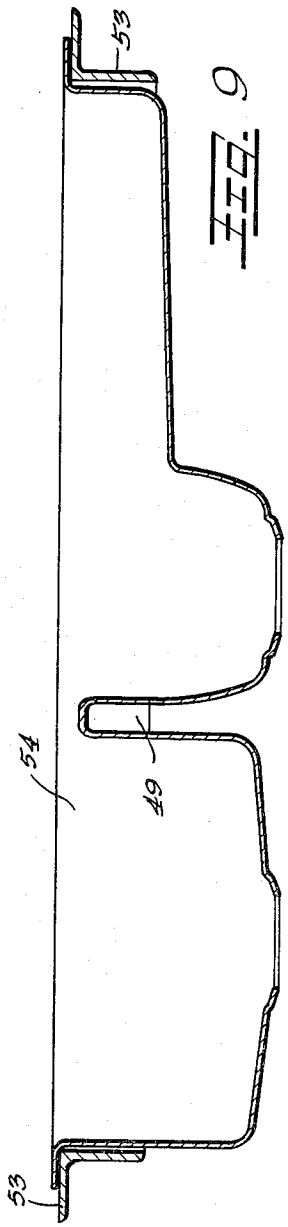



Fig. 9

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United States Patent Office 2,997,815 Patented Aug. 29, 1961



# 2,997,815
# BUFFING MACHINE

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Filed Sept. 9, 1958, Ser. No. 760,010
14 Claims. (Cl. 51—92)

This invention relates generally to buffing machines and more specifically to an improved buffing machine which is particularly well adapted to polish the back ledge of sinks.

Although the principles of the present invention may be included in various buffing machines a particularly useful application is made in buffing or polishing machines of the type that are employed to polish an upwardly directed surface, such as the back ledge, of a stainless steel sink. In particular, when stainless steel sinks are manufactured, certain tooling marks are produced on the sink, the presence of which on a completed product is unsightly. In order to remove these marks, it is necessary to first polish, and then to buff the surfaces having such marks. The instant invention may be provided with either a polishing head or a buffing head, and for this reason, these terms, insofar as they apply to the instant invention, are interchangeable, it being contemplated that either operation may be performed by this machine.

When either buffing or polishing is to be accomplished, it is desired to obtain a result wherein the polish marks remaining on the product are extremely fine and uniformly aligned with the direction in which the particular part of the workpiece extends. Thus to polish the back ledge of a sink, it is necessary that the relative movement between the buffing or polishing element and the ledge of the sink is in the same direction as that in which the ledge extends.

The present invention contemplates the utilization of a workpiece supporting table or chuck on which a sink is supported. The table, in turn, is movably driven beneath and past a rotating finishing element. The table is movable reciprocably in a horizontal direction while the finishing element may be vertically retracted. Controls are provided for the automatic control and synchronization of the table and the finishing element.

Accordingly, it is an object of the present invention to provide an improved polishing and buffing machine.

Another object of the present invention is to provide a polishing and buffing machine which is particularly well adapted to polish the back ledge of a sink.

Yet another object of the present invention is to provide a finishing machine wherein the workpiece is movably and automatically positioned with respect to the finishing element.

A further object of the present invention is to provide a novel support means for a workpiece.

A still further object of the present invention is to provide a control system for a finishing machine.

Many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

FIGURE 1 is a front view of a finishing machine provided in accordance with the principles of the present invention;

FIGURE 2 is a top view of the finishing machine shown in FIGURE 1;

FIGURE 3 is an enlarged end view of the machine shown in FIGURE 1;



FIGURE 4 is a schematic diagram of the pneumatic system of the embodiment of FIGURE 1;

FIGURE 5 is a schematic diagram of the electrical control system of the machine shown in FIGURE 1;

FIGURE 6 is a schematic electrical diagram of a slightly modified form of circuit which may be employed to control the embodiment shown in FIGURE 1;

FIGURE 7 is an enlarged schematic diagram, shown in cross-section, of a single-bowl sink as it is supported by the polishing machine of this invention;

FIGURE 8 is generally similar to FIGURE 7, but shows a double-bowl sink being supported by the machine; and

FIGURE 9 is generally similar to FIGURE 8, except that a somewhat longer sink is supported by the machine.

As shown on the drawings:

The principles of this invention are particularly useful when embodied in a finishing machine such as illustrated in FIGURE 1, generally indicated by the numeral **10**. The finishing machine **10** generally includes a base or base assembly **11** having a workpiece supporting table **12** supported thereon and provided with means for driving the table **12** along the base **11**, generally indicated by the numeral **13**, together with means responsive to table movement for controlling the driving means **13**, best seen in FIGURE 5. The finishing machine **10** also includes a support **14** on which there is rotatably mounted a finishing element **15** which is vertically positionable with respect to the base **11**. The means responsive to table movement for controlling the driving means **13** also includes means for controlling the vertical position of the finishing element **15**.

As best seen in FIGURES 1–3, the base **11** includes principally a pair of beams **16**, **17** which are laterally spaced from each other and which extend in a horizontal direction. To this end, there is provided a series of vertically extending legs **18** rigidly secured to each of the beams **16**, **17**, and a series of horizontally extending braces **19**, extending transversely of the beams **16**, **17** and also rigidly secured thereto. Other braces **20**, extend horizontally between the lower ends of the legs **18** and are securely attached thereto. If desired, a series of cover plates **21** may be provided to enclose the base **11**, being secured to such members as the beams **16**, **17**, the legs **18**, or the braces **19** and **20**.

The beams **16**, **17** are each provided with an upwardly directed surface **22**, **23** on which there is disposed a pair of elongated tracks **24**, **25** of V-shaped section wherein the vertex extends upwardly.

As best seen in FIGURE 1, the base **11** is provided with a head shaft **26** extending transversely of the tracks **24**, **25**, and supported by a pair of journals **27**, **28** for rotation.

At a longitudinally spaced position from the shaft **26**, the base **11** is also provided with a tail shaft **29** rotatably carried by a pair of adjustable position journals **30**, **31** for longitudinal movement at the opposite or tail end of the base **11**. The shaft **29** is provided with a sprocket wheel **32** disposed intermediate the journals **30** and **31**, while the shaft **26** is provided with two sprocket wheels, one wheel **33** being disposed intermediate the journals **27** and **28**, and the other sprocket wheel **34** being disposed adjacent to the journal **28**.

An endless member **35**, here comprising a chain, extends about the sprocket wheels **32** and **33** and is tensioned by the position of the tail shaft **29**. If desired, a pair of guide or idler pulleys or sprocket wheels **36**, **37** may also be included to direct the member **35** as required. The member **35** is secured to the table assembly **12**, such as by a clamp **38** so that a portion of the member **35** is movable with the table **12**.

In addition to the rotatably supported endless mem-

ber 35, the means 13 for driving the table 12 along the base 11 also includes a reversible motor 39 adjustably secured to the base 11, by means not shown, together with a power train for connecting the motor 39 to the sprocket wheel 34. The power train includes a variable pitch pulley 40 secured to the output shaft of the motor 39, which pulley is coupled by a belt 41 to a pulley 42 which serves as an input to a speed reducer mechanism 43. The speed reducer 43 has an output sprocket wheel 44 coupled by a sprocket chain 45 to the sprocket wheel 34. A guard 46 enclosed the pulleys 40 and 42, and the belt 41.

By positioning the motor 39 selectably so that the pulley 40 has a given effective size, the table assembly 12 will be driven by the means 13 in a given direction at a substantially constant rate. As the direction of the motor rotation is reversed, the direction of rotation of the shafts 26 and 29 is also reversed, thereby effecting table movement in the opposite direction. Thus the table assembly 12 may be driven past the finishing element 15 while being supported by the base 11, in either direction.

The table assembly 12 includes a chassis 47 to which is secured a set of four rollers 48. Each of the rollers 48 has an outwardly or axially diverging V-shaped section which receives the V-shaped section of the tracks 24, 25. This configuration prevents movement of the table transversely to the tracks 24, 25. To the chassis 47 there is secured a frame 49, such connection including a pivot pin 50 seen in FIGURE 2, and a slot and pin arrangement 51 for limiting the amount or angle which the frame 49 may be pivoted. One of the principal purposes of the pivot mechanism is to enable turning the frame 49 away from the finishing element 15, as shown in dash dot lines in FIGURE 2, thereby making it somewhat easier to load and unload the machine with workpieces.

The frame 49 has an upwardly directed workpiece supporting surface 52 which extends in parallel relation to the base 11. The frame 49 includes transverse members 53 which may be included if desired to present a generally annular supporting surface for the workpiece. At any event, the function of the members 53 must be included so that the workpiece will not slide parallel to the base 11 in reaction to the forces applied to the workpiece by the finishing element 15.

As best seen in FIGURE 9, a workpiece 54 may be received by the frame 49 and supported thereby.

The frame 49 is adapted to receive and support a plurality of transverse supporting member 55, 56 as shown in FIGURES 7 and 8. The transverse members 55 and 56 have an upper surface which is coplanar with the surface 52, and therefore functionally form a part thereof when employed. The members 55 and 56 are removably supported by the frame 49 by any convenient means, FIGURE 2 showing the member 55 as being supported by angular elements 57 disposed therebeneath and secured to the frame 49 in a removable fashion, thereby rendering the member 55 also removable.

As best seen in FIGURES 1 and 2, the table assembly 12 is also provided with one or more actuator elements 58, 59 rigidly secured to the chassis 47 for engagement with one or more of a series of switches 60—65. Since the actuating elements 58 and 59 move with the table 12, it is apparent that the engagement thereof with the various switches 60—65 is of an intermittent nature.

The support assembly 14 includes a foot 66 which supports a movable double slide 67 which in turn supports a column 68. The column 68 may be moved toward and away from the base 11 by moving the slide 67 with respect to the foot 66, and the column 68 may be moved parallel to the base 11 by moving the column 68 with respect to the slide 67. The column 68 supports a head assembly 69 which is vertically positionable thereon by means of a crank 70, and is angularly relatively adjustable with respect to the column 68 by means of another crank 71. The head 69 is manually positioned



when the machine is set up for a given type of workpiece, the adjustments affecting head positions thereafter not being adjusted. The head 69 supports a shaft 72 which is horizontaliy disposed and which extends transversely to the table path. The head 69 also supports a motor 73 which is coupled, as by pulleys and belts 74 to a driven member 75 which is rotatable about the axis of the shaft 72. The shaft 72 rockably or pivotably supports a yoke shaped arm 76 for angular movement about the axis of the shaft 72. The finishing element 15, in turn, is rotatably supported by an end of the arm 76 remote from the shaft 72. To this end, the finishing element 15 is provided with a shaft 77 which is rotatably carried by the arm 76, and which is provided with a pulley 78 which is driven through a series of belts 79 by the driven member 75.

The position of the motor 73 with respect to the head assembly 69 is adjustable so that the belt and pulley arrangement 74 is maintained taut. Similarly, the effective length of the yoke arm 76 between the shafts 72 and 77 is also adjustable so that the belts 79 may also be kept taut.

The head assembly 69 also supports a fluid actuator 80 which has a rod 81 which is engageable with a roller 82 carried by the distal end of an extension 83 of the arm 76. Upon extension of the rod 81 as shown in FIGURE 1, the finishing element 15 is held in the position as shown. Upon retraction of the rod 81, the arm 76 pivots about the shaft 72 so that the shaft 77 moves along the line indicated by the arrow, thereby moving the finishing element 15 toward the path of the table 12.

The arm 76 carrying the finishing element 15 is naturally unbalanced so that the finishing element 15 is actually lowered by the force of gravity in this embodiment. It has a total movement such that the periphery of the finishing element 15 may move to a position lower than the surface 52 of the frame 49. Thus, when a workpiece is supported by the surface 52, the finishing element 15 may engage it with a certain force. In this embodiment, this force is augmented by a spring assembly 84 which acts between the head 69 of the support 14 and the arm 76 to further bias the arm 76 and finishing element 15 toward the path of the table assembly 12. In this embodiment, the spring 84 is a compression spring, and therefore suitable anti-buckling casing means and end supports are included therewith. It can be seen that the actuator 80 and the arm 76 comprise a part of means for vertically positioning the finishing element 15 with respect to the table 12. Preferably, a guard 85 secured to the arm 76 and extending about the finishing element 15 is also provided.

To position the actuator 80, and hence the finishing element 15, an air supply 86 is connected to a solenoid actuated spring biased four-way valve 87 which communicates with the actuator 80. As best seen in FIGURE 4, the actuator 80 is a double-acting actuator which optionally is provided with a spring 88 which serves to raise the finishing element 15 in the event that fluid pressure is lost. The four-way valve 87 is also spring biased so that if electric power to the valve be lost, the spool thereof will be so moved that fluid pressure will act to raise the finishing element 15.

The valve 87, and hence the finishing element 15, and the motor 39, and hence the table 12, are operated by a control circuit which includes the switches 60—65. Therefore, the table driving means and the finishing element's vertical positioning means are under the control of means responsive to table movement.

The switches 60—65 are carried by a rail 89 which is secured to the base 11. Each of the switches may be moved along the rail 89 and clamped in any desired position along the path of table movement.

The control circuit also includes additional switches 90—94 carried by a control panel 95 best seen in FIGURE 1. The control circuit by which the embodiment

shown in FIGURE 1 is regulated is shown in FIGURE 5. The switch **90** is a master switch of the normally closed push button type, the opening of which, even momentarily, shuts down the entire machine. Control power passes from the switch **90** to the stop switch **92** and thence to the start switch **91**. Closing of the switch **91** completes the circuit to the coil of a relay **96**, which thereby closes to bring power to the motor **73**. A pair of thermal overload switches **97, 97** is included in the coil circuit. Closing of the relay **96** also closes a holding circuit including a contact **98** whereby current is maintained through the coil **96** when the momentary push button switch **91** is released. Thus the opening of the stop switch **92** interrupts the relay coil current to deenergize the motor **73**. Likewise opening the switch **90** also interrupts the coil current.

A relay **99** has contacts which connect the motor **39** to the line for driving the table **12** to the right as shown in FIGURE 1. A relay **100** has contacts for connecting the motor **39** to the line for driving the motor in the opposite direction and thereby driving the table to the left as shown in FIGURE 1. The relays **99** and **100** are directly electrically interconnected to prevent closing of one relay when the other is closed. To this end, the coil of the relay **99** is connected through a pair of normally closed contacts of the relay **100** while the coil of the relay **100** is connected through a pair of normally closed contacts of the relay **99**.

The circuit also includes a latch relay **106** for determining or controlling which of the relays **99** and **100** may be closed. As drawn, the relay coil **106***a* has last been energized thereby connecting the starting switches **93, 94** to the coil of the relay **99** as shown.

When the coil **106***b* of the latch relay **106** is energized, the contacts of the relay **106** move to the opposite position from that shown, thereby permitting the start switches **93, 94** to be utilized to initiate closing of the relay **100**. The circuit includes a fourth relay **101** for controlling power to the coil of the valve **87** to thereby regulate the vertical positioning means.

Once the starting switches **93, 94** have been closed, the control circuit initiates movement of the table to the right, thereafter effects lowering of the finishing element, thereafter raises the finishing element, thereafter reverses the direction of table travel and again consecutively lowers and raises the finishing element **15**, after which table movement is stopped so that the table may be unloaded and reloaded preparatory to the manual initiation of the next cycle.

Accordingly, the normally open manually operated momentary switches **93, 94** are first briefly closed by the operator. This allows current to flow through the normally closed contacts of the relay **100**, through the coil of the relay **99** to close the relay **99**, and thence through the thermal overload protectors **97, 97** of the drive motor **39**. Closing of the relay **99** also closes a holding circuit for the same which is powered through a lead **102**, a lead **103**, a normally closed portion of the switch **65**, through a pair of now-closed contacts of the relay **99**, through the normally closed contacts of the relay **100** to the coil of the relay **99**. Next, the actuating element **58** briefly opens the switch **60** which has no effect. Thereafter it closes the switch **61** which brings power from the lead **102** to the coil of the valve relay **101**, thereby closing such relay. Closing of the relay **101** brings power to the coil of the valve **87**, and also closes a holding circuit which extends through the normally closed portion of the switch **62**, through the relay contacts, and thence to the coil of the relay **101**. As shown in FIGURE 1, the switch actuator **59** will briefly actuate the switch **62** before the switch **61** is closed, which has no effect. Thereafter the actuator **59** will briefly actuate the switch **63**, which likewise has no effect. The table continues to feed to the right, with buffing or polishing of the workpiece taking place until the switch actuator **58** engages the switch **62**.



When the switch **62** is briefly actuated, the current through the normally closed portion thereof is briefly interrupted, thereby permitting the relay **101** to open and the finishing element to be raised or retracted. Brief actuation of the switch **62** also causes the latch relay **106** to be moved to its opposite position by the energizing of the coil **106***b* thereof. The changing of the position of the latch relay **106** has no immediate effect on the circuit, but it makes power available for the reverse drive relay **100** upon completion of a circuit.

If either of the switches **63** and **64** should be closed during travel to the right, there will be no effect on the circuit. However, the end of travel to the right is signalled by the momentary actuation of the switch **65**, wherein the normally closed portion is opened to break the holding circuit to the relay **99** and wherein the normally open portion is momentarily closed to bring current via a lead **104**, through the switch **65**, thence through the normally closed contacts of the relay **99** and thence to the coil of the relay **100** to close it. This initiates driving of the motor **39** in the opposite direction and also closes a holding circuit for the coil of the relay **100** which includes the switch **60**, and a pair of contacts of the relay **100** connected in series with each other to a source of power and to the normally closed contacts of the relay **99**. As the table moves to the left, closing of the switches **61** and **62** has no effect. However, closing of the switch **64** brings power through contacts in the relay **100** to the coil of the relay **101** to again lower the finishing element **15**. This initiates the polishing on the return stroke. Thereafter the switch actuator **59** actuates the switch **63** momentarily to interrupt a holding circuit which extends through the normally closed portion of the switch **63** for the relay **101** to thereby open the relay **101**. Actuating of switch **63** also momentarily closes the normally open contacts thereof to briefly energize the coil **106***a* of the relay **106** to reset the latch relay in the position as shown in the drawing preparatory for the initiation of the next cycle. Shortly after the actuation of the limit switch **63**, and the raising of the finishing element **15**, the end of the cycle is signalled and the table travel terminated by the actuation of the switch **60** by the switch actuator **58**. Opening of the switch **60** breaks the holding circuit for the coil of the relay **100** whereby power is removed from the motor **39**. Thus it will be noted that the control circuit for the relay **100** includes the normally open element of the limit switch **65** which closes the circuit, and which switch element is bypassed by the holding circuit which includes the switch **60**, in a manner similar to that in which the manual start switches are bypassed in the control circuit for the first or forward relay **99**. It will also be noted that the contact **105** of the latch relay **106**, together with the line connected thereto provides an interconnection which is completed by the latch relay **106** between the control circuits of the relays **99** and **100** whereby when power is directed to the relay **100**, the manual switches **93, 94** may be used to initiate reverse table movement, in the event that the machine was stopped with the table not fully returned to its original position.

It is also apparent that there is provided a third control circuit for the relay **101**, which includes one of the normally open momentary switches **61** or **64** whereby the finishing element **15** is lowered against the workpiece at the proper point in the cycle. Also, each of the switches **61** and **64** are thus provided with a holding circuit including respectively the normally closed portion of one of the switches **62** and **63**, the opening of which may be utilized to raise the finishing element, as may be done to clear a rim of a sink or to terminate finishing at a preselected point therealong.

It is also clear that the latch relay **106** is provided with a control circuit for each of its coils, such control circuits including the normally open portion of the switches **62** and **63** respectively, each of which may bring power to the coil **106***b* or **106***a* respectively whenever the relays

99 and 100 respectively are energized. Thus the normally open portions of the switches 62 and 63 are operative in response to table advance and table return respectively for directing power to the relays 100 and 99 respectively. It is to be noted that the switches 61—64 are referred to and claimed herein as momentary switches, while the switches 60 and 65, each of which has a part in a holding circuit, the opening of which terminates table movement, are referred to herein and claimed as limit switches.

It will be appreciated that the function of raising the finishing element 15 at the end of the advancing table movement may be eliminated, and that the function of lowering it after the table direction has been reversed may therefore also be eliminated. Likewise it is also possible to eliminate the interconnection feature between the control circuits for the relays 99 and 100. To this end, a slightly modified form of circuit may be employed, such as shown in FIGURE 6. The switches 90—94 and the control circuit for the motor 73 are identical to that shown in FIGURE 5. A relay 99*a*, corresponding to the relay 99 has been provided to control the forward operation of the motor 39, while a relay 100*a*, corresponding to the relay 100, has been provided to provide power to the motor 39 for the opposite direction of rotation thereof. A switch 63*a* corresponds to the normally closed portion of the switch 63 and performs a similar function. A switch 65*a* performs a function identical to that of the switch 65. A limit switch 60*a* performs a function identical to that of the limit switch 60, while a limit switch 61*a* performs a function similar to that of the momentary switch 61. There is also provided a relay 107 which is under the control of the control circuit for the relay 99*a*, which relay 107 provides power to the coil of the relay 100*a*.

The coil of the relay 99*a* is energized by closing of the start switches 93, 94 which brings power through a pair of normally closed contacts in the relay 100*a*, thence through a normally closed portion of the switch 65*a* and to the coil of the relay 99*a*. Closing of this circuit closes the contacts of the relay 99*a* whereby a holding circuit extending through the line 102, through a pair of now-closed contacts of the relay 99*a* and thence to the normally closed contacts of the relay 100*a*. Closing of the switches 93, 94 also brings power to the coil of the relay 107, the upper contact of which is a holding contact for the relay 107, and the lower contact of which brings power to the normally closed, but now open, contacts of the relay 99*a* and thence to the normally open portion of the switch 65*a* for future use.

Thereafter, closing of the momentary switch 61*a* brings power through a pair of now-closed contacts of the relay 99*a* to energize the coil of the relay 101 as before. This closing also closes the lowermost contact of the relay 101 as shown, which is a holding contact. At this point, the table continues to travel with the finishing element in a lowered position until the far limit of travel is reached, which is signalled by the momentary actuation of the switch 65*a*. By opening the normally closed portion thereof, the holding circuit to the relay 99*a* is interrupted, and by closing the upper or normally open portion thereof, power is allowed to flow to the coil of the relay 100*a*. Closing of the relay 100*a* also brings power via a line 108 through now-closed contacts of the relay 100*a* to the coil thereof to hold the relay energized. This condition continues until the momentary switch 63*a* is actuated to break the holding circuit to the valve solenoid 101 which raises the finishing element. Shortly thereafter, the limit switch 60*a* is momentarily opened which breaks the holding circuit to the relay 107 which thereby opens. Thus power to the relay 100*a* cannot be re-established by closing of the normally open portion of the switch 65*a* until the device has been properly cycled. Of course, opening of the limit switch 60*a* also breaks the current in the line 108 which is part of the holding circuit for the relay 100*a*, so that the opening of the switch 60*a* restores the circuit to the condition as shown in the drawing.

It is thus apparent that the holding circuit for the coil of the relay 99*a* and the holding circuit for the coil of the relay 107 each extend across or by-pass the manual switches 93 and 94. It is further clear that the limit switch 65*a* in the control circuit for the relay 100*a* is provided with electrical power by the closing of the relay 107 for use to return the table. It is also apparent that the limit switch 60*a* forms a part of both of the holding circuits, namely for the relay 107 and the relay 100*a*. It is apparent that this switch may be located thus in both of the circuits, and must be located in at least one of them.

The operation of the device with its elements connected as shown in FIGURE 6 is otherwise the same as that already described.

Although various minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such embodiments as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. In a finishing machine, the improvement comprising in combination: a fixed base; a workpiece supporting table movably carried directly by said base; means for driving said table along said fixed base; an elongated rail; means securing said rail to said base in spaced relation thereto so that said rail extends along the path of movement of said table and outwardly spaced therefrom; a plurality of switches individually adjustably positioned on said rail, said switches being accessible for adjustment in any position of said table; means carried by said table for intermittently engaging said switches as said table moves along said base; and means operated by said switches for controlling said driving means.

2. In a finishing machine having a finishing element, the improvement comprising in combination: a fixed base; a workpiece supporting table movably supported directly by said base adjacent to the finishing element; means for driving said table past the finishing element; means for vertically positioning the finishing element with respect to the path of said table; an elongated rail; means securing said rail to said base in spaced relation thereto so that said rail extends along the path of movement of said table; a plurality of switches individually adjustably positioned on said rail; means carried by said table for intermittently engaging said switches as said table moves along said base; and means operated by said switches for controlling both said driving and said vertical positioning means.

3. In a finishing machine, the improvement comprising in combination: a fixed base; a workpiece supporting table movably carried by said base; means carried by said base for driving said table along said base; an arm pivotally supported above said base for pivoting about an axis transverse to the direction of table movement; a finishing element rotatably secured to said arm remotely from its pivotal support and adapted to be rotated about an axis parallel to the pivotal axis; a fluid actuator operatively coupled to said arm for moving said finishing element toward and away from the path of said table for intermittently engaging the workpiece; and means carried by said fixed base and responsive to table movement for controlling both said driving means and said actuator, and operative to effect retraction of said finishing element at a predetermined point of table movement along said base, whereby a clearance between said finishing element and the workpiece is established in response to table position.

4. In a finishing machine, the improvement comprising in combination: a fixed base; a workpiece supporting table movably carried directly by said base, said table

being adapted to continually support the workpiece in a plane parallel to said base; means for driving said table along said base, said means including a reversible motor; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; a series of switches, including a plurality of switches responsive to table movement, for controlling said relays; and a third relay, responsive to a switch in said series of switches, and operative to select only one of said first and said second relays and to render the selected relay responsive to switch control.

5. In a finishing machine, the improvement comprising in combination: a fixed base; a workpiece supporting table movably carried directly by said base; means for driving said table along said base, said means including a reversible motor; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; said first and second relays being directly interconnected in a manner to prevent closing of either when the other is closed; a series of switches, including a plurality of switches responsive to table movement, for controlling said relays; and a third relay, responsive to a switch in said series of switches, and operative to select only one of said first and said second relays and to render the selected relay responsive to switch control.

6. In a finishing machine, the improvement comprising in combination: a base; a workpiece supporting table movably carried by said base; means for driving said table along said base, said means including a reversible motor; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; a third relay for controlling which of said first and second relays can be closed; a first control circuit having a normally open manually operated momentary switch for closing said first relay; a first holding circuit connected across said manual switch and operative to keep said first relay closed; a first momentary switch responsive to table advancement and operative to position said third relay to direct power toward said second relay; a first limit switch having a normally closed element in said first holding circuit and responsive to further advancement of said table and operative to open said first relay; a second control circuit responsive to operation of a normally open element in said first limit switch for closing said second relay; a second holding circuit connected across said normally open element of said first limit switch and operative to keep said second relay closed; a second momentary switch responsive to returning table movement and operative to position said third relay to direct power toward said first relay; and a second limit switch in said second holding circuit and responsive to further returning table movement and operative to open said second relay.

7. In a finishing machine, the improvement comprising in combination: a base; a workpiece supporting table movably carried by said base; means for driving said table along said base, said means including a reversible motor; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; a third relay for controlling which of said first and second relays can be closed; a first control circuit having a normally open manually operated momentary switch for closing said first relay; a first holding circuit connected across said manual switch and operative to keep said first relay closed; a first momentary switch responsive to table advancement and operative to position said third relay to direct power toward said second relay; a first limit switch having a normally closed element in said first holding circuit and responsive to further advancement of said table and operative to open



said first relay; a second control circuit responsive to operation of a normally open element in said first limit switch for closing said second relay; a second holding circuit connected across said normally open element of said first limit switch and operative to keep said second relay closed; a second momentary switch responsive to returning table movement and operative to position said third relay to direct power toward said first relay; a second limit switch in said second holding circuit and responsive to further returning table movement and operative to open said second relay; and an interconnection between said first and second control circuits completed by said third relay when said third relay is directing power toward said second relay, said interconnection being operative to enable said manually operated switch to close said second relay.

8. In a finishing machine, the improvement comprising in combination: a base; a workpiece supporting table movably carried by said base; means for driving said table along said base, said means including a reversible motor; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; a first control circuit having a normally open manually operated momentary switch for closing said first relay; a first holding circuit connected across said manual switch and operative to keep said first relay closed; a first limit switch having a normally closed element in said first holding circuit and responsive to advancement of said table and operative to open said first relay; a second control circuit responsive to operation of a normally open element in said first limit switch for closing said second relay; a second holding circuit connected across said normally open element of said first limit switch and operative to keep said second relay closed; and a second limit switch in said second holding circuit and responsive to returning table movement and operative to open said second relay.

9. In a finishing machine having a finishing element, the improvement comprising in combination; a workpiece supporting table movably supported adjacent to the finishing element; means for driving said table past the finishing element, said means including a reversible motor; means for vertically positioning the finishing element with respect to the path of said table; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; a third relay for controlling said vertical positioning means; a first control circuit having a normally open manually operated momentary switch for closing said first relay; a first holding circuit connected across said manual switch and operative to keep said first relay closed; a first limit switch having a normally closed element in said first holding circuit and responsive to advancement of said table and operative to open said first relay; a second control circuit responsive to operation of a normally open element in said first limit switch for closing said second relay; a second holding circuit connected across said normally open element of said first limit switch and operative to keep said second relay closed; a third control circuit having a normally open momentary switch responsive to table advancement and operative to position said third relay to be operative on said vertical positioning means to effect movement of the finishing element toward the path of said table; a third holding circuit connected across said normally open momentary switch of said third control circuit and operative to keep said third relay closed; a normally closed momentary switch in said third holding circuit responsive to returning table movement and operative to position said third relay to be operative on said vertical positioning means to effect movement of the finishing element away from the path of said table; and a second limit switch in said second

holding circuit and responsive to further returning table movement and operative to open said second relay.

10. In a finishing machine having a finishing element, the improvement comprising in combination; a workpiece supporting table movably supported adjacent to the finishing element; means for driving said table past the finishing element, said means including a reversible motor; means for vertically positioning the finishing element with respect to the path of said table; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; a third relay for controlling said vertical positioning means; a first control circuit having a normally open manually operated momentary switch for closing said first relay; a first holding circuit connected across said manual switch and operative to keep said first relay closed; a first limit switch having a normally closed element in said first holding circuit and responsive to advancement of said table and operative to open said first relay; a second control circuit responsive to operation of a normally open element in said first limit switch for closing said second relay; a second holding circuit connected across said normally open element of said first limit switch and operative to keep said second relay closed; a third control circuit having a normally open momentary switch responsive to table advancement and operative to position said third relay to be operative on said vertical positioning means to effect movement of the finishing element toward the path of said table; a third holding circuit connected across said normally open momentary switch of said third control circuit and operative to keep said third relay closed; a normally closed momentary switch in said third holding circuit responsive to returning table movement and operative to position said third relay to be operative on said vertical positioning means to effect movement of the finishing element away from the path of said table; and a second limit switch comprising a part of at least one of said second and third holding circuits and responsive to further table movement and operative to open said second and third relays.

11. In a finishing machine, the improvement comprising, in combination: a fixed base; a workpiece supporting table movably carried directly by said base, said table being adapted to continually support the workpiece in a plane parallel to said base; means for driving said table along said base, said means including a reversible motor; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; a series of switches spaced along said base, including a plurality of spaced switches responsive to normal table movement, for controlling said first and second relays; and a latch relay, the coil circuit of which is interruptable in response to actuation of a switch in said series of switches responsive to normal table movement, said latch relay being so connected that it is operative in one position thereof to supply power only to said second relay.

12. In a finishing machine, the improvement comprising in combination: a base; a workpiece supporting table movably carried by said base; means for driving said table along said base, said means including a reversible motor; a first relay adapted when closed to drive said motor in a table advancing direction; a second relay adapted when closed to drive said motor in a table returning direction; a third relay; a first control circuit having a normally open manually operated momentary switch for closing said first and third relays; first and third holding circuits bypassing said manual switch and operative to keep said first and third relays closed, respectively; a first limit switch having a normally closed element in said first holding circuit and responsive to advancement of said table and operative to open said first relay; a second control circuit powered through said third relay and responsive to operation of a normally open element in said first limit switch for closing said second relay; a second holding circuit bypassing said normally open element of said first limit switch and operative to keep said second relay closed; and a second limit switch in at least one of said second and third holding circuits and responsive to returning table movement and operative to open said second relay.

13. In a finishing machine, the improvement comprising in combination: a fixed base; a workpiece supporting table movably carried by said base; means carried by said base for driving said table along said base; a shaft supported in a horizontal attitude above said base and having an axis extending transversely to the path of said table; an arm carried by said shaft and rockable about the axis of said shaft; a finishing element rotatably secured to said arm remotely from the axis of said shaft, and adapted to be rotated about an axis parallel to the axis of said shaft; a fluid actuator operatively coupled to said arm for moving said finishing element toward and away from the path of said table for intermittently engaging the workpiece; a rotatably driven member rotatably supported by said shaft for rotation with respect to said shaft about said shaft axis; means rotatably coupling said driven member to said finishing element; and means carried by said fixed base and responsive to table movement for controlling both said driving means and said actuator, and operative to effect retraction of said finishing element at a predetermined point of table movement along said base, whereby a clearance between said finishing element and the workpiece is established in response to table position.

14. In a finishing machine, the improvement comprising in combination: a fixed base; a workpiece supporting table movably carried by said base; means carried by said base for driving said table along said base; a rigid support extending above said base; an arm pivotably carried by said support for pivoting about an axis transverse to the direction of table movement; a finishing element rotatably secured to said arm remotely from its pivotal support and adapted to be rotated about an axis parallel to the pivotal axis; a fluid actuator carried by said support and operatively coupled to said arm for drivingly pivoting said finishing element away from the path of said table for intermittently engaging the workpiece; a spring; means operatively connecting said spring between said rigid support and said pivotable arm so that said spring continuously applies a unidirectional force to said arm urging it toward the path of said table and aiding retraction of said actuator; and means carried by said fixed base and responsive to table movement for controlling both said driving means and said actuator, and operative to effect retraction of said finishing element at a predetermined point of table movement along said base, whereby a clearance between said finishing element and the workpiece is established in response to table position.

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