Oct. 16, 1934. F. E. CARDULLO 1,976,713

RAIL ELEVATING AND CLAMPING DEVICE

Filed Sept. 29, 1932 3 Sheets-Sheet 1

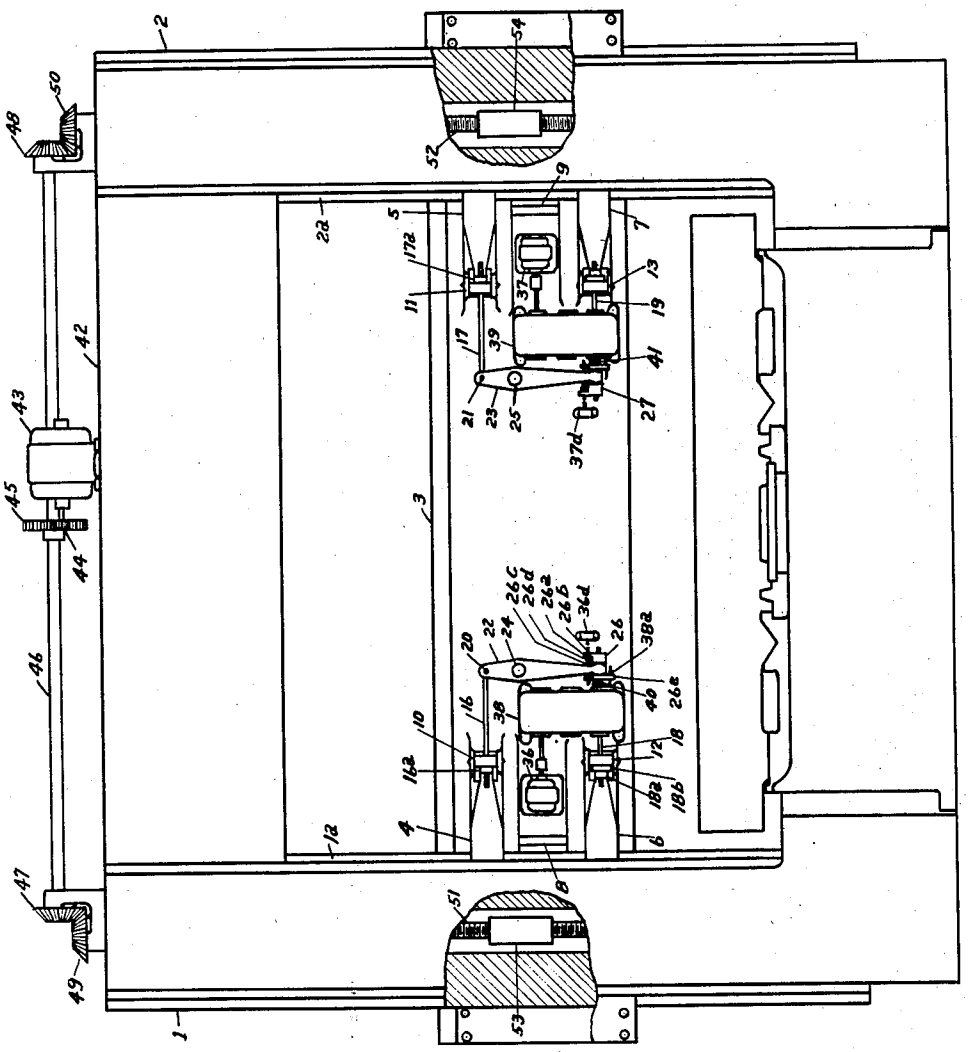


Fig. 1.

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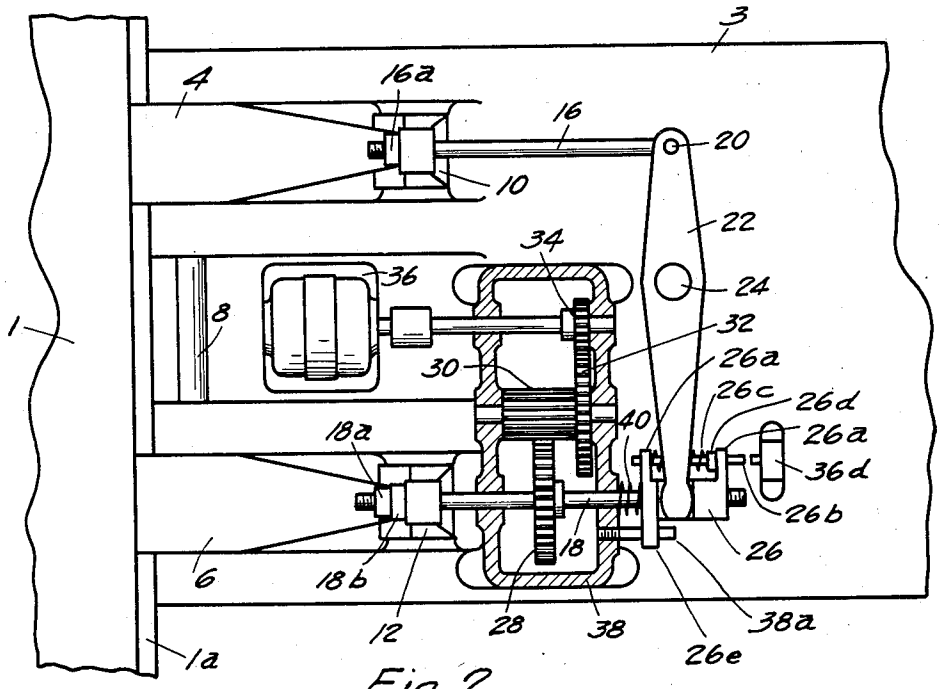


Fig. 2

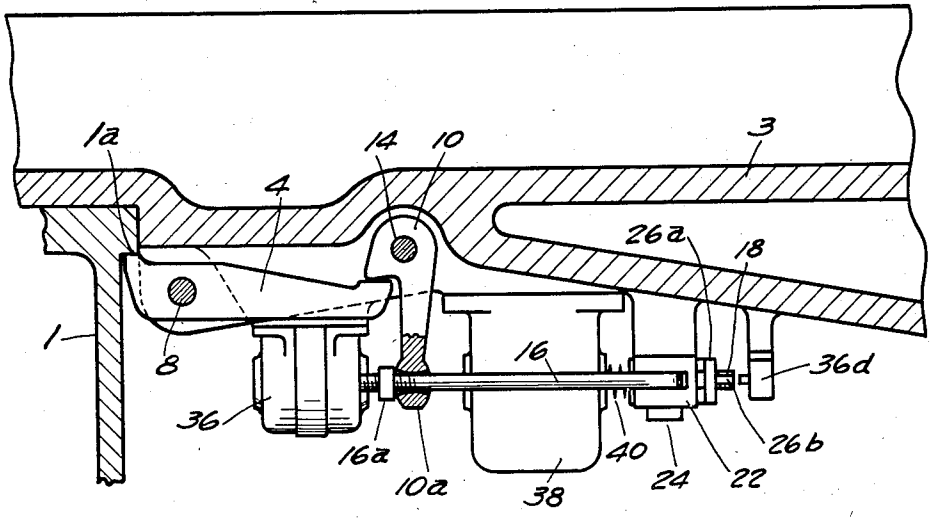


Fig. 3

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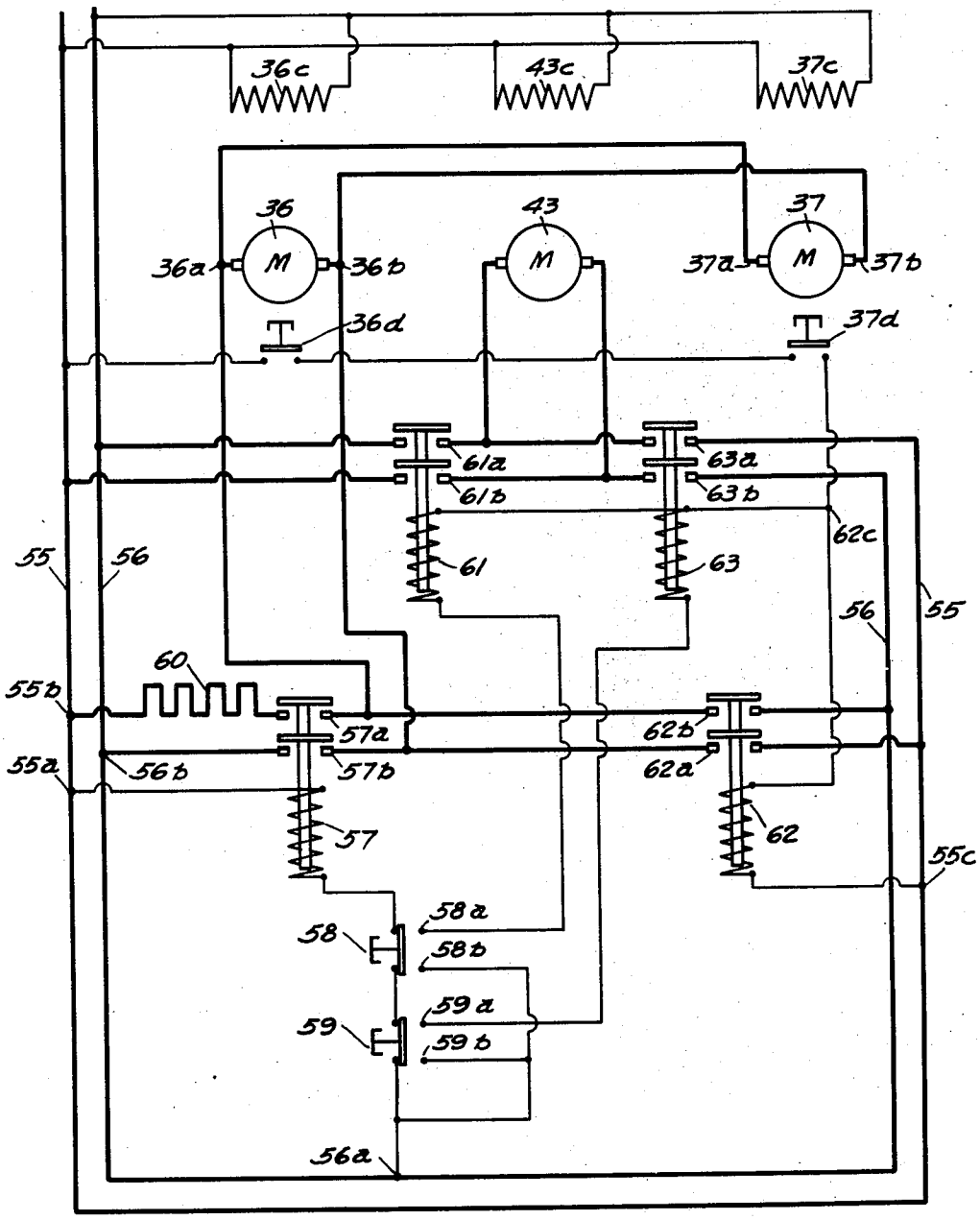


Fig. 4

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UNITED STATES PATENT OFFICE

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RAIL ELEVATING AND CLAMPING DEVICE

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Application September 29, 1932, Serial No. 635,432

12 Claims. (Cl. 90—37)

My invention relates to machines of that type which have a beam or rail supported by one or more uprights, columns or housings, to which the rail is clamped when in use, and on which it slides, in order that the height of the rail shall be proper for the service which it is to perform. More broadly, it relates to any machine having two or more elements in which one is sometimes movable relative to the others, and at other times clamped to one or more of them, when it is desirable to use power means for both moving and clamping. My invention provides power means for clamping the rail to the supporting member or members, and means for controlling the operation of the power means for clamping and the power means for elevating, in such a manner that the unclamping, elevating or lowering, and reclamping of the rail, will automatically occur in the proper order without attention on the part of the operator, except that he must press one of two push buttons until the rail has reached the desired position.

In the drawings, Figure 1 is a rear elevation of a double housing planer with part of the housings broken away to show the elevating screws and rail elevating nuts; Figure 2 is a view from the same position on a larger scale, of one of the clamping mechanisms with the gear box cut away to show the gearing; Figure 3 is a section through a part of the rail and housing illustrating the action of the clamp, the bellcrank lever, and the pull rod operating the bell-crank lever; and Figure 4 is an electrical diagram showing the connections, relays, push buttons, etc., for operating the various motors.

In the annexed drawings 1 and 2 are vertical members, variously known as housings, uprights or columns, on which slides the horizontal member or rail 3. To rail 3 are pivoted upper clamps 4 and 5 and lower clamps 6 and 7, the clamping surfaces of which engage ledges 1*a* and 2*a* formed on the uprights 1 and 2. Clamps 4, 5, 6 and 7 pivot about pins 8 and 9 which are set in holes bored through portions of the rail 3. Clamps 4, 5, 6 and 7 are levers, the short arms of which engage the ledges while the long arms are actuated by bellcranks 10, 11, 12 and 13 which pivot about pin 14 and a similar pin not shown set in holes bored through portions of the rail 3. In the long arms of bellcranks 10 and 11 are formed holes as at 10*a*, through which are passed pull rods 16 and 17. In bellcranks 12 and 13 are formed similar holes through which pass threaded shafts 18 and 19.

Pull rods 16 and 17 have threaded to them nuts 16*a* and 17*a* which bear against the long arms of the bellcranks 10 and 11. At the other end of the pull rods are formed eyes through which pass pins 20 and 21 which attach the pull rods to levers 22 and 23. These levers pivot on pins 24 and 25, which are fast to the back of the rail. The pull rods 16 and 17 are attached to the shorter arms of levers 22 and 23, the longer arms of which are forked so as to embrace nuts 26 and 27 which are threaded on shafts 18 and 19. On the ends of shafts 18 and 19, where they pass through holes in bellcranks 12 and 13 similar to the one shown at 10*a*, are fastened nuts as at 18*a* and ball thrust bearings as at 18*b*. To shaft 18 is pinned a gear 28 meshing with pinion 30. Pinion 30 is wide faced so that gear 28 can move axially through a distance of several inches. To the hub of pinion 30 is keyed gear 32 which is driven by pinion 34 which is turned by electric motor 36. The gear train mentioned above is mounted in case 38, which is fastened to the back of the rail. On shaft 19 and in case 39 is mounted a similar train of gears driven by motor 37. Between case 38 and nut 26 is spring 40 and between gear case 39 and nut 27 is spring 41.

When motor 36 is energized so as to rotate in the proper direction, threaded shaft 18 turns, drawing nut 26 toward bellcrank 12. Gear 28 slides axially with shaft 18, so that an equal pull is exerted on the end of bellcrank 12 and on the end of lever 22. Lever 22 transmits its pull through pull rod 16 to bellcrank 10. On account of the relative lengths of the two arms of lever 22 a greater pull is exerted on bellcrank 10 than is exerted on bellcrank 12. Bellcranks 10 and 12 actuate clamps 4 and 6 so that as a result the rail is clamped tightly to ledge 1*a* formed on vertical member 1, the upper part being more tightly clamped than the lower part. Motor 37 being energized at the same time actuates in a similar manner the corresponding parts on the other end of the rail, so that clamps 5 and 7 clamp the other end of the rail to vertical member 2. When the electric current causes the motors to revolve in the opposite direction, nuts 26 and 27 move away from bellcranks 12 and 13, and springs 40 and 41 by their action against the nuts 26 and 27, cause upper clamps 4 and 5 to be relieved. Springs 40 and 41 are not strong enough to cause any appreciable clamping action on the lower clamps 6 and 7.

Nut 26 is provided with lugs 26*a* in which are bored holes to receive plunger 26*b*. Plunger 26*b* slides in these holes and is held in place by spring 26*c* acting against collar 26*d*. The end of plunger 26*b* makes contact with push button 36*d*, when

threaded shaft 18 has been revolved sufficiently to unclamp the mechanism. As the threaded shaft unclamps the mechanism, spring 40 pushes nut 26 toward push button 36*d*, and when the unclamping has proceeded sufficiently, plunger 26*b* presses the push button, closing an electric circuit to be described later. In case the motor continues to revolve and the nut 26 continues to approach push button 36*d*, spring 26*c* will be compressed so that the push button is not damaged. Nut 27 carries a corresponding plunger and spring which engages push button 37*d* when motor 37 has completely unclamped the mechanism which it operates. In order to keep nuts 26 and 27 from turning with shafts 18 and 19, they are provided with lugs as at 26*e*, which engage studs as at 38*a*, the studs being screwed into cases 38 and 39, and fitting, with a little clearance, in holes bored in the lugs.

Across the top of the uprights 1 and 2 is stretched a brace 42 on which is mounted an elevating motor 43. The elevating motor is geared by pinion 44 and gear 45 to shaft 46 which reaches from one upright to the other. At the ends of shaft 46 are bevel pinions 47 and 48 meshing with bevel gears 49 and 50. Driven by bevel gears 49 and 50 are elevating screws 51 and 52 which are threaded to elevating nuts 53 and 54 fastened to the back of rail 3. When elevating motor 43 turns in one direction the train of gearing turns the screws in such a manner as to draw the rail up on the faces of the uprights 1 and 2, and when it turns in the other direction the screws turn in such a manner as to lower the rail upon the faces of the uprights.

Referring to Figure 4, the circuits for operating these motors are as follows: 55 and 56 are the two wires which energize the various motors. From junction 55*a*, a wire runs to coil 57 and thence to push button 58.

With the button in the position shown current will flow from line 55 through coil 57, through the normally closed terminals of push button 58, through the normally closed terminals of push button 59, and thence to junction 56*a* on wire 56. With push buttons 58 and 59 in their normal position, coil 57 will be energized, closing relay contacts 57*a* and 57*b*. When these contacts are closed current will flow from junction 55*b* on line 55 through resistance 60, and through relay terminals 57*a*, to motor armature terminals 36*a* and 37*a*. This current will return from motor armature terminals 36*b* and 37*b* through relay terminals 57*b* to junction 56*b* on line 56. This current tends to cause the motors to revolve in the direction which causes the clamping mechanism to clamp the rail to the uprights. Resistance 60 limits the current to a value where the motors will not over-heat and also limits the torque so that the clamping action will not be too great. In the electrical diagram shown, the clamping motors 36 and 37 are continuously energized when the push buttons 58 and 59 are in their normal positions, but if desired, provision may be made by ways well known in the art, to de-energize these motors by means of a timing relay which will permit the motors to be energized for a definite time after push button 58 or 59 returns to its normal position, and then de-energize the motors.

In order that motors 36, 37 and 43 shall be reversible, their field windings 36*c*, 37*c* and 43*c* are connected as shown, although if desired, additional controls may be employed in the manner well known in the art, to de-energize the fields when the armatures are de-energized.

If now it is desired to elevate the rail, push button 58 is pushed in until terminals 58*a* and 58*b* are connected. This breaks the circuit through coil 57 which in turn breaks the circuit through resistance 60, and the motors 36 and 37. However, a circuit is now completed from junction 56*a* through push button 58, coil 61, junction 62*c* and coil 62 to junction 55*c*. Coil 61 is a low resistance coil having few turns and coil 62 is a high resistance coil having many turns. The resistance of coil 62 limits the current in this circuit so that coil 61 cannot close the relay contacts 61*a* and 61*b*, but the current is great enough so that coil 62 closes the relay contacts 62*a* and 62*b*. Under these conditions current will flow from line 55 through contacts 62*a* to terminals 36*b* and 37*b* of motors 36 and 37, and return from armature terminals 36*a* and 37*a* through relay terminals 62*b* to line 56. Current flowing in this direction through motors 36 and 37 causes them to rotate in such a direction as to unclamp the mechanism, and since there is no external resistance in this circuit, the torque which they exert when they unclamp the mechanism is considerably greater than that which they exert when they clamp the mechanism, so that although they are stalled in the clamping position they will unclamp the mechanism to which they are geared.

When the motor armatures have revolved sufficiently so that the clamps are free, push buttons 36*d* and 37*d* will be closed by plungers 26*b* and 27*b* already mentioned, which action short circuits coil 62 across line 55, and permits current to flow directly from 56*a* through push botton 58, coil 61, junction 62*c* and push button terminals 37*d* and 36*d* to line 55.

Since coil 62 is of high resistance the current hitherto flowing in coil 61 has been too small to actuate the relay, but now that coil 62 is no longer in the circuit of coil 61, the current in coil 61 increases considerably, closing the relay terminals 61*a* and 61*b* which energizes elevating motor 43, causing the motor to elevate the rail. Meantime, since coil 62 is short circuited, relay terminals 62*a* and 62*b* automatically open, de-energizing motors 36 and 37, and causing them to stop rotating.

As soon as the operator's finger is removed from button 58 it returns to the position, shown, breaking the circuit through the terminals 58*a* and 58*b* which de-energizes coil 61 and causes motor 43 to stop, by opening relay terminals 61*a* and 61*b*. Meantime, current has been re-established through coil 57 which closes relay terminals 57*a* and 57*b*, causing the clamping motor to again reclamp the rail.

If the operator presses button 59, coil 57 will be de-energized, opening the circuit of motors 36 and 37 at terminals 57*a* and 57*b*, and as soon as the circuit is completed through 59*a* and 59*b*, coil 63 (which is a coil of low resistance similar to coil 61) will be energized, the current passing through junctions 62*c* and coil 62 back to line 55 at junction 55*c*. Since coils 62 and 63 are in series, the current is not sufficient to actuate relay 63, but relay 62 will be actuated, closing terminals 62*a* and 62*b*, and causing motors 36 and 37 to be so energized as to unclamp the rail. As soon as both clamping mechanisms are sufficiently unclamped so that terminals 37*d* and 36*d* are both closed, coil 62 will be short circuited, opening terminals 62*a* and 62*b* so that

motors 36 and 37 will be de-energized and caused to stop rotating, and the current will increase sufficiently through coil 63 to close terminals 63*a* and 63*b*. This will cause the current to flow through the armature 43 in such a manner as to lower the rail, and the rail will continue to lower until the operator takes his finger from button 59, when coil 63 will be de-energized, opening the circuit at terminals 63*a* and 63*b* and stopping the motor 43. At the same time the circuit through coil 57 will be completed, terminals 57*a* and 57*b* will be closed and motors 36 and 37 will rotate in the clamping direction until they stall.

It will be seen from the above description of this apparatus that I have provided means so that it is only necessary for the operator to press the proper push button in order to elevate or lower the rail. Immediately that he has done so the rail will unclamp. When the unclamping process is completed, it will cease and at the same time the rail will begin to elevate or lower and will continue to elevate or lower so long as the operator keeps his finger on the push button. As soon as he removes his finger from the push button, the rail will cease to elevate or lower, and the clamping motors will automatically reclamp the rail without any attention on his part. It is obvious that this same type of mechanism is adapted to move any sort of sliding member which is clamped to the member or members on which it slides, that there may be one or more clamps operated by one motor, or if convenient, by two or more motors. By appropriate modification of the clamping mechanism, the gearing, and the electrical circuits and controls, the principles disclosed may be applied to a wide variety of machines. The control device which initiates the cycle beginning with unclamping and ending with reclamping, in this disclosure comprises among other parts a manually operated push button. However, such a control device may be of an entirely different type or of a mechanical form adapted to be operated by the foot or by some other part of the body. I wish to include in the scope of my claims all such control devices, and have therefore designated the device not as manually operated means, but as manually operable means, since the hand will serve to operate any type of control device which can be operated by any other part of the body. By appropriate modification of the apparatus, the principles disclosed may be applied to pneumatic or hydraulic mechanisms, or such mechanisms used in connection with electrical mechanisms. I therefore do not wish to limit the scope of my invention to the particular mechanism shown, but to include all mechanisms which fall within the scope of the appended claims.

I claim:

1. In a machine, a support member, a movable member, a first power means for moving the movable member, clamping means for clamping the movable member to the support member, a second power means for actuating the clamping means, manually operable control means adapted to cause the second power means to unclamp and re-clamp the movable member, and control means actuated by the clamping means when in the unclamped position adapted to cause the first power means to move the movable member.

2. In a machine, a support member, a movable member, a first power means for moving the movable member, clamping means for clamping the movable member to the support member, a second power means for actuating the clamping means, manually operable control means adapted to cause the second power means to unclamp and re-clamp the movable member, and control means actuated by the clamping means when in the unclamped position adapted to cause the first power means to move the movable member and to limit the motion of the second power means.

3. In a machine, a support member, a movable member, a first power means adapted to move the movable member, clamping means for clamping the movable member to the support member, a second reversible power means for actuating the clamping means, manually operable control means adapted when in a normal position to cause the second power means to clamp the movable member, and when manually operated to cause the second power means to unclamp the movable member, and control means actuated by the clamping means when in the unclamped position, adapted to cause the first power means to move the movable member.

4. In a machine, a support member, a movable member, a first power means adapted to move the movable member, clamping means for clamping the movable member to the support member, a second reversible power means for actuating the clamping means, manually operable control means adapted when in a normal position to cause the second power means to clamp the movable member, and when manually operated to cause the second power means to unclamp the movable member, and control means actuated by the clamping means when in the unclamped position, adapted to cause the first power means to move the movable member and to limit the motion of the second power means.

5. In a machine, a support member, a movable member, a first reversible power means adapted to move the movable member, clamping means for clamping the movable member to the support member, a second reversible power means for actuating the clamping means, automatic control means operated by the clamping means when in the unclamped position adapted to limit the motion of the second power means, a first manually operable control means adapted when in a first position to cause the second power means to clamp the movable member and when in a second position to cause the second power means to unclamp the movable member, and acting jointly with the automatic control means to cause the first power means to move the movable member in a first direction, and a second manually operable control means adapted when in a first position to cause the second power means to clamp the movable member and when in a second position to cause the second power means to unclamp the movable member, and acting jointly with the automatic control means to cause the first power means to move the movable member in a second and opposite direction.

6. In a machine, a support member, a movable member, a first power means for moving the movable member, clamping means for clamping the movable member to the support member, a second reversible power means for actuating the clamping means, a first control means adapted when actuated to cause the operation of the first power means, a second control means adapted when actuated to cause the operation of the second power means for clamping, a third control means adapted when actuated to cause the operation of the second power means for un-

clamping, a fourth control means actuated by the clamping means when unclamped, and adapted when actuated to prevent the actuation of the third control means, and manually operable control means adapted when in one position to actuate the second control means, and when in the other position to actuate the third control means and acting jointly with the fourth control means to actuate the first control means.

7. In a machine of the class specified, a support member, a movable member, a first reversible motor for moving the movable member on the support member, clamping means for clamping the movable member to the support member, a second reversible motor for actuating the clamping means, a first relay adapted to energize the first motor for motion in one direction, a second relay adapted to energize the first motor for motion in the opposite direction, a third relay adapted to energize the second motor for clamping, a fourth relay adapted to energize the second motor for unclamping, a first push button, or the like, adapted when in one position to actuate the third relay and when in the other position to actuate the fourth relay and permit the actuation of the first relay, a second push button, or the like, adapted when in one position to actuate the third relay and when in the other position to actuate the fourth relay and permit the actuation of the second relay, and a third push button, or the like, normally open, and closed by the clamping mechanism when in the unclamped position, adapted when closed to prevent the actuation of the fourth relay and to permit the actuation of the first and second relays.

8. In a machine, a support member, a sliding member adapted to slide on the support member, a first power means for moving the sliding member in either desired direction on the support member, clamping means for clamping the sliding member to the support member, a second power means for actuating the clamping means, automatic control means actuated by the clamping means when in the unclamped position, a first manually operable control means adapted when in one position to energize the second power means for clamping, and when in the other position to energize the second power means for unclamping and acting jointly with the automatic control means to energize the first power means for moving the sliding member in one direction, and a second manually operable control means adapted when in one position to energize the second power means for clamping, and when in the other position to energize the second power means for unclamping and acting jointly with the automatic control means to energize the first power means for moving the sliding member in the other direction.

9. In a machine of the class specified, a pair of uprights, a cross rail to slide vertically on the uprights, an elevating motor adapted to rotate in either direction, means for causing the rotation of the elevating motor to raise or lower the cross rail on the uprights in accordance with the direction of its rotation, a first clamping means for clamping one end of the rail to one upright, a second clamping means for clamping the other end of the rail to the other upright, a first reversible clamping motor adapted to actuate the first clamping means, a second reversible clamping motor adapted to actuate the second clamping means, automatic control means actuated by the clamping means when both are in the unclamped position and adapted when actuated to de-energize the clamping motors, a first manually operable switch adapted when in one position to energize the clamping motors for clamping, and when in the other position to energize the clamping motors for unclamping and acting jointly with the automatic control means to energize the elevating motor for elevating the rail, and a second manually operable switch adapted when in one position to energize the clamping motors for clamping, and when in the other position to energize the clamping motors for unclamping and acting jointly with the automatic control means to energize the elevating motor for lowering the rail.

10. In a machine, a fixed member, a movable member, a first reversible power means for moving the movable member, clamping means for clamping the movable member to the fixed member, a second reversible power means for actuating the clamping means, an automatic control means actuated by the clamping means when in the unclamped position, a first manually operable control means adapted alternatively to energize the second power means for unclamping and acting jointly with the automatic control means to energize the first power means for moving the movable member in one direction, or to energize the second power means for clamping, and a second manually operable control means adapted alternatively to energize the second power means for unclamping and acting jointly with the automatic control means to energize the first power means for moving the movable member in the other direction, or to energize the second power means for clamping.

11. In a machine, a support member, a movable member, a first power means adapted to move the movable member, clamping means for clamping the movable member to the support member, a second reversible power means for actuating the clamping means, a first control means for energizing the first power means, a second manually operable control means adapted when in its normal position to cause the second power means to clamp the movable member and when moved therefrom to cause the second power means to unclamp the movable member, and a third control means actuated by the clamping means when in the unclamped position adapted to act jointly with the second control means to operate the first control means.

12. In a machine, a support member, a movable member, a first power means adapted to move the movable member, clamping means for clamping the movable member to the support member, a second reversible power means for actuating the clamping means, a first control means for energizing the first power means, a second manually operable control means adapted when in its normal position to cause the second power means to clamp the movable member and when moved therefrom to cause the second power means to unclamp the movable member, and a third control means actuated by the clamping means when in the unclamped position adapted to limit the motion of the second power means, and acting jointly with the second control means, to operate the first control means.

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