

May 8, 1923.

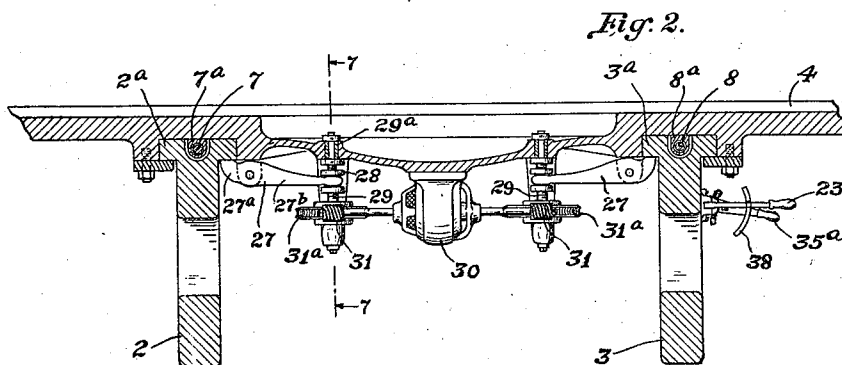
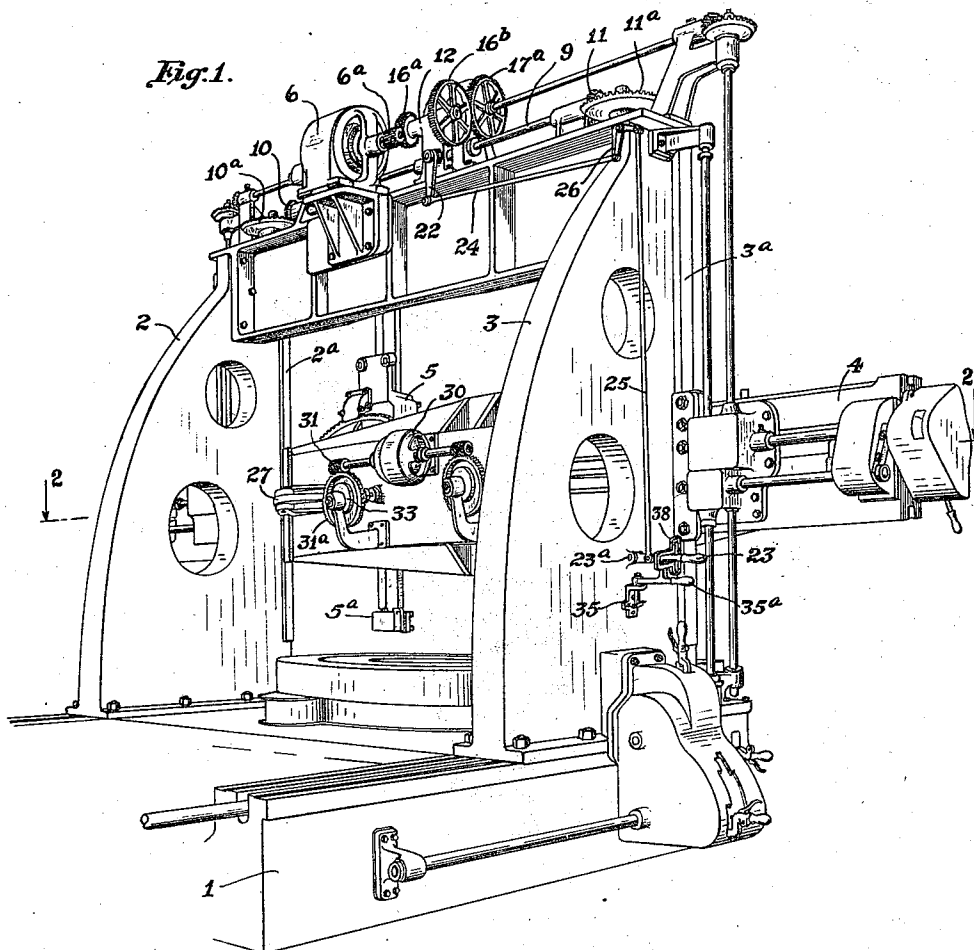
W. T. SEARS

1,454,080

CLAMPING MECHANISM FOR METAL WORKING MACHINES

Filed June 16, 1920

2 Sheets-Sheet 1



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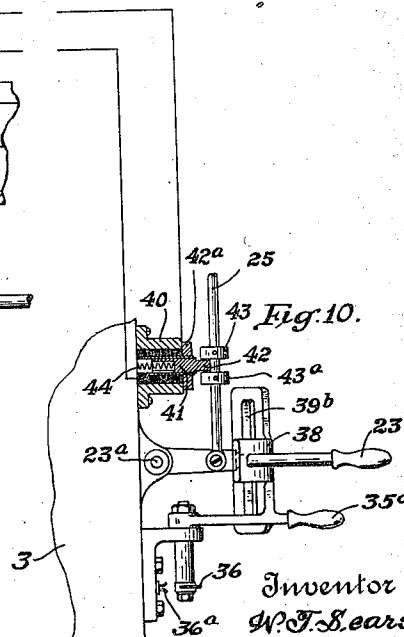
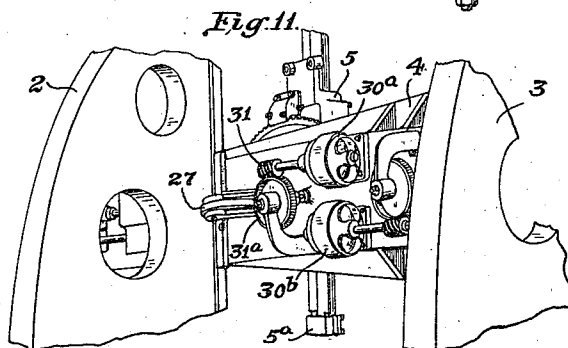
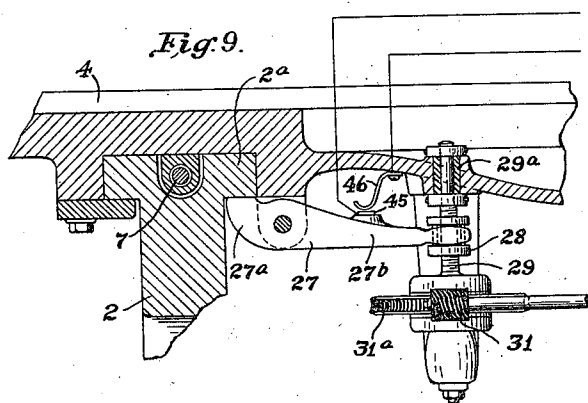
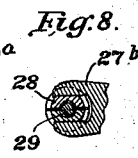
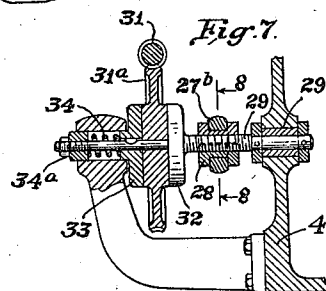
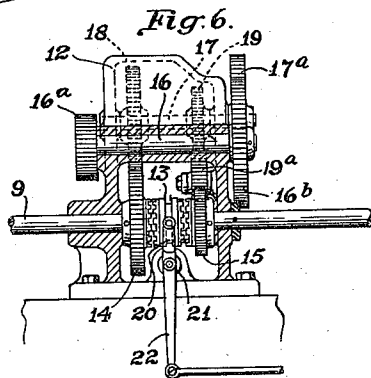
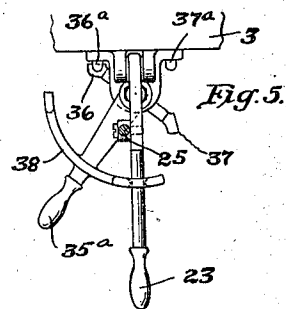
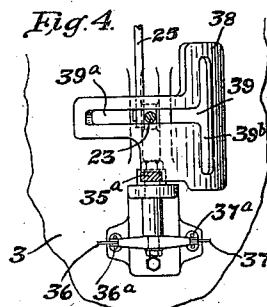
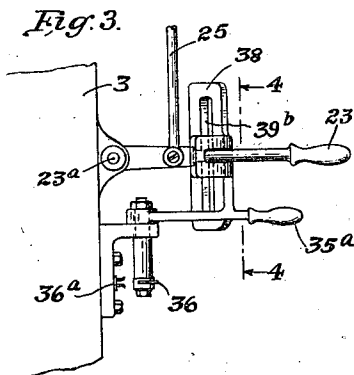
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W. T. SEARS.

CLAMPING MECHANISM FOR METAL WORKING MACHINES

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2 Sheets-Sheet 2



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Patented May 8, 1923.

1,454,080

UNITED STATES PATENT OFFICE.

WILLARD T. SEARS, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO NILES-BENIENT-POND COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

CLAMPING MECHANISM FOR METAL-WORKING MACHINES.

Application filed June 18, 1920. Serial No. 389,425.

To all whom it may concern:

Be it known that I, WILLARD T. SEARS, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Clamping Mechanism for Metal-Working Machines, of which the following is a specification.

This invention relates to metal working machines and particularly to machines of the type wherein a cutter-supporting rail is vertically adjustably mounted on an upright or uprights adjacent the work table of the machine. More specifically the invention is particularly applicable to vertical boring mills and planers, and one object of the invention is the provision of an improved clamping mechanism for securing the rail to the uprights, such improvement preferably, though not necessarily, taking the form of a rotary clamping motor or motors mounted on the cutter-supporting rail.

Another object of the invention resides in providing an interlocking mechanism for preventing the throwing-in of the rail elevating and lowering mechanism while the rail is in the clamped position. This mechanism may consist of an interlock between the controlling element of the rail moving means and the controlling element of the clamping means, of an interlock between the controlling element of the rail moving means and the clamp itself, or of a combination of both these mechanisms.

Another object of the invention is to provide an interlocking mechanism between the controlling means for the rail moving mechanism and the controlling means for the clamping mechanism whereby simultaneous operation of such two controlling means is prevented, and which interlocking mechanism furthermore permits the operation of the first or second mentioned controlling means only when the second or first mentioned controlling means respectively is in the unclamped and inoperative positions respectively.

It is another object of the invention to provide a clamping mechanism operated by power means, preferably comprising electric motor means mounted on the rail, such construction also preferably providing an interlocking mechanism between the controlling switch for the clamping motor or motors and a controlling lever for the rail moving

means whereby the operation of the lever or switch is permitted only when the switch or lever respectively is in the unclamping and inoperative positions respectively.

A further object of the invention resides in the provision of the above second mentioned interlocking mechanism between the controlling element of the rail moving means and the rail clamp itself whereby the operation of the rail moving means is positively prevented until the clamp is released from clamping engagement with the rail.

Under normal conditions, the first interlocking mechanism above defined is ample to prevent any strain or breakage of the machine due to the rail moving mechanism being thrown into operation while the rail is in clamped position. However, should some of the mechanism fail to function, it is possible that such a breakage might occur. It is therefore a further object of the invention to provide a double interlocking mechanism whereby such an occurrence is positively prevented, such mechanism preferably taking the form of a combination of the two interlocking mechanisms above defined whereby the rail moving means is positively prevented from operation until the clamp is released from clamping engagement with the rail.

Other objects of the invention will appear as the description proceeds.

Referring to the figures of the drawings:

Figure 1 is a rear perspective view of a boring mill illustrating the present invention.

Fig. 2 is a horizontal section thereof taken on the line 2—2 of Fig. 1, certain parts being omitted.

Fig. 3 is a detail side elevation of the controlling lever and switch and the interlocking mechanism therebetween.

Fig. 4 is a front view thereof taken on the line 4—4 of Fig. 3.

Fig. 5 is a plan view thereof, the switch handle being shown in a different position.

Fig. 6 is a sectional view through the gear box showing the gearing for driving the rail elevating and lowering mechanism.

Fig. 7 is a sectional view through one of the clamp operating screws taken on the line 7—7 of Fig. 2, and illustrating the frictional driving connection therefor.

Fig. 8 is a detail cross sectional view taken on the line 8—8 of Fig. 7 and illustrating the

engagement of a clamping arm with its operating nut.

Figs. 9 and 10 are fragmentary enlarged sectional views of the machine corresponding to Figs. 2 and 3 respectively, but showing a second interlocking mechanism for positively preventing the operation of the rail moving means until the clamping mechanism is released from clamping engagement with the rail.

Fig. 11 is a fragmentary rear elevation of the cutter-supporting rail showing a modified form of the invention wherein is provided a separate motor for each clamping element.

In machines of the type herein described and illustrated, wherein a cutter-supporting rail is vertically adjustable on its support and is adapted to be clamped to such support, a mechanism for preventing the throwing-in of the rail moving means while the rail is locked, is very essential if breakage of such operating parts of the machine is to be positively prevented. Such a mechanism may be embodied in several forms, certain of which are herein disclosed, all of such mechanisms being of such construction that the simultaneous operation of the rail moving means and the clamping means, to move the rail vertically and to clamp the rail to its support respectively, is positively prevented.

In the drawings, I have illustrated my invention as applied to a vertical boring mill although it will be readily understood that the invention is not so limited since it may with equal facility be applied to other machines either having a single upright, as, for example, an open side planer, or having two uprights as in ordinary planers and like machines. Also while I have illustrated the interlocking mechanism as combined with a particular form of clamping means it will be understood that such mechanism is adapted to operate as readily with other forms of clamping means. Other details of the invention may be modified within the scope of the claims appended hereto.

Referring to the drawings, 1 represents the base of a boring mill having the uprights 2 and 3 preferably adjustably mounted thereon, as illustrated. A cutter-supporting rail 4 is vertically adjustably mounted on the guides 2^a and 3^a of the uprights and a saddle 5 supporting a tool holder 5^a is movable horizontally along the rail. The rail is moved on the uprights and the saddle is moved on the rail by means of a motor 6 and the connections illustrated in Fig. 1. The saddle and its operating mechanism are not within themselves a part of the present invention and therefore will not be further described herein.

The rail elevating and lowering means preferably comprises the screws 7 and 8

driven from the motor 6 as above stated. Each screw is mounted against longitudinal movement within its upright and is in threaded engagement with projections 7^a and 8^a respectively on the rail. The connecting means between the motor and screws for rotating the latter in either direction is illustrated in Figs. 1 and 6. This mechanism comprises a shaft 9 having bevel gears 10 and 11 at the opposite ends thereof in driving engagement with bevel gears 10^a and 11^a keyed to the screws 7 and 8 respectively. This shaft extends through the gear box 12 and has splined thereto a double toothed clutch element 13 adapted to be engaged with the clutch teeth of either of the two gears 14 and 15. These gears are driven from the motor through the gear 6^a on the motor shaft engaging a gear 16^a on a shaft 16, a gear 16^b on the shaft 16 engaging a gear 17^a on a shaft 17, and gears 18 and 19 on the shaft 17 to the gears 14 and 15 loose on the shaft 9. It will be noted that an idler gear 19^a is interposed between the gears 15 and 19 whereby the gear 15 is rotated in a direction opposite to that of the gear 14. It will now be seen that the shaft 9, and therefore the screws 7 and 8, may be rotated in either direction by engaging the clutch element 13 with one or the other of the gears 14 and 15. The clutch is operated by means of an arm 20 mounted on a rocker shaft 21 and engaging a peripheral groove in the element 13. An arm 22 secured to the shaft 21 is connected to an operating means, as a lever 23, through linkage comprising rods 24 and 25 engaging the arm 22 and lever 23 respectively, the other ends of such rods being operatively connected by a bell crank 26 pivoted to the frame of the machine. It will be seen that the lever 23 is pivoted at 23^a and that vertical movement thereof in one direction or the other will cause the rail moving screws to be operated in either a right or left hand direction and thus elevate or lower the rail 4 on the uprights.

The rail clamping means is preferably mounted on the rail and, as illustrated, comprises an element 27 pivoted to the rail adjacent each upright. The short arm 27^a of each element 27 is adapted to clampingly engage its upright and the long arm 27^b thereof is preferably engaged by a nut 28 mounted on a clamping screw 29 journaled in the machine frame at 29^a. As shown in Fig. 8 the arm 27^b non-rotatably engages the nut 28 and the nut may be made in one or two pieces as illustrated. Rotation of the screw in one direction or the other is adapted to move the element to a clamping or unclamping position respectively. I preferably operate the clamping screws by rotary electric motor means mounted on the rail with the clamping means. Such motor means may comprise a single motor for both clamps, as

illustrated at 30 in Figs. 1 and 2, or a separate motor for each clamp, as illustrated at 30^a and 30^b in Fig. 11. The connection between each screw and the motor preferably comprises a worm 31 and a worm wheel 31^a, the latter being mounted on the screw and the former being driven from the motor. Such a connection prevents the reaction of the clamping means in its clamping position from rotating the motor in an unclamping direction even though the electric current to the motor is cut off. When using a separate motor for each clamp, the worm wheel may be keyed directly to its screw 29. However in order to be sure that both clamping elements are in tight clamping engagement with their uprights, when using a single motor for both clamps, it is necessary to provide a special connection between the motor and such elements. As a convenient means for performing this function, I frictionally mount each worm wheel 31^a on its screw between two friction plates 32 and 33, as illustrated in Fig. 7. The plate 32 is secured rigidly or integrally to the screw and the plate 33 is splined for longitudinal movement thereon. A spring 34 adjustable by means of the nut 34^a threaded onto the screw serves to hold the plate 33 in frictional contact with the worm wheel. By this construction it will be seen that when either of the clamps is seated to clamping position, its worm wheel slips as the motor continues to run whereby the other clamp is brought up to a like clamping position before any slipping thereof takes place. The nuts 34^a may be adjusted to bring the two springs 34 under an equal compression whereby both clamps will bind with an equal pressure.

The rail moving means is preferably controlled by a hand lever 23 heretofore described and the motor is controlled by a switch 35, these elements and their cooperating parts being illustrated in Figs. 3, 4, and 5. The switch 35 comprises a handle 35^a and two contact knives 36 and 37 adapted to engage the poles 36^a and 37^a respectively. The contact of the knife 36 and pole 36^a is adapted to rotate the motor in an unclamping direction and the contact of the knife 37 and pole 37^a is adapted to rotate the motor in its clamping direction. The interlocking means between the lever and switch as herein illustrated comprises a plate 38 secured to the switch handle 35^a and having a slot 39 therein adapted to cooperate with the lever. This slot as shown is T-shaped and the lever extends through the slot in such manner as to permit the lever to be moved vertically only when the switch is in the unclamping position, illustrated in Fig. 5. It will be seen that when the switch is in any other position than the unclamping position the lever is in the horizontal portion 39^a of the slot which position corresponds to the neutral

position of the clutch 13. Also when the switch is in the unclamping position and the lever is in the vertical portion 39^b of the slot 39 above or below the horizontal portion 39^a the switch is locked from movement from the unclamping position. In this manner the plate serves as an interlocking mechanism positively preventing the engagement of the clutch 13 except when the switch is in an unclamping position and prevents a clamping contact of the switch while the clutch is in other than a neutral position.

Under normal conditions the interlocking mechanism between the lever 23 and the switch handle 35^a as just described is fully ample to protect the machine from any breakage due to the throwing-in of the clutch 13 while the rail is in a clamped position. However, if for any reason the motor or its cooperating mechanism should fail to function it is possible that such a breakage might occur. As a means to positively prevent the throwing-in of the clutch 13 and therefore the operation of the rail moving mechanism while the rail is clamped, I provide another form of interlocking mechanism shown in Figs. 9 and 10. It should be understood that this construction may be used as an interlocking mechanism separate and distinct from the interlocking mechanism heretofore described or may be used in conjunction therewith, as illustrated in Fig. 10. This construction comprises a solenoid 40 within which is a core 41 having a projection 42 thereon extending through a plate 42^a and between two collars 43 and 43^a on the rod 25. A spring 44 mounted within the solenoid serves to keep the projection normally in its outward position and in engagement with the rod 25 between the collars. The terminals of the coil of the solenoid are connected to a contact 45 on one of the clamping arms, as illustrated in Fig. 9, and to a spring 46 on the frame extending to a position adjacent the contact 45. By this construction the rod 25, and therefore the clutch 13, is positively locked in its neutral position until the clamping arm 27 comes to an unclamping position whereupon the contacts 45 and 46 engage and the locking member 42 is drawn from engagement with the rod 25 and collars 43 and 43^a. It will be understood that when separate motors are used for each clamping element the electric circuit to the solenoid should include both such elements whereby both elements must be in the unclamped position before the clutch can be operated from its neutral position. When using both interlocking mechanisms, as illustrated in Figs. 9 and 10, the last described interlock positively prevents the throwing-in of the clutch until the clamping means is in its unclamped position and the interlock between the lever 23 and the switch handle 35^a prevents the movement

of the switch to its clamping position until the lever and clutch have again been brought back to neutral position.

What I claim is:

- 5 1. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, clamping means on the rail for securing the rail to the upright, and a rotary electric motor on the rail for operating the clamping means.
- 10 2. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, clamping means on the rail for securing the rail to the upright, a rotary electric motor for operating the clamping means, and a driving connection between the motor and the clamping means so constructed that in its clamping position the reaction of the clamping means cannot rotate the motor in an unclamping direction even though the electric current to the motor is cut off.
- 15 3. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means on the rail adapted to engage both uprights to secure the rail thereto, and rotary electric motor means for operating the clamping means.
- 20 4. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means on the rail adapted to engage both uprights to secure the rail thereto, rotary electric motor means on the rail for operating the clamping means, and a driving connection between the motor means and the clamping means so constructed that in its clamping position the reaction of the clamping means cannot rotate the motor means in an unclamping direction even though the electric current to the motor means is cut off.
- 25 5. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, a clamping arm pivoted to the rail adjacent each upright, each arm being adapted to engage its upright to secure the rail thereto, and rotary electric motor means operatively connected to the arms for operating the same.
- 30 6. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, a clamping means on the rail adjacent each upright, each clamping means being adapted to engage its upright to secure the rail thereto, a rotary electric motor on the rail, and a frictional connection between the motor and each of the clamping means.
- 35 7. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, a clamping means on the rail adjacent each upright, each clamping means being adapted to engage its upright to secure the rail thereto, a rotary electric motor on the rail, and a frictional connection between the motor and each of the clamping means, such connection comprising two worms driven by the motor and engaging two worm wheels respectively on the clamping means.
- 40 8. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a vertical guideway on one side of the upright, a cross rail mounted to slide vertically on the guideway, power means to move the rail vertically, clamping means for securing the rail against vertical movement on the guideway, rotary power means for operating the clamping means, and an interlocking mechanism permitting the operation of the rail moving means only when the clamping means is in its inoperative position.
- 45 9. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a vertical guideway on one side of the upright, a cross rail mounted to slide vertically on the guideway, power means to move the rail vertically, clamping means on the rail for securing the rail against vertical movement on the guideway, rotary power means for operating the clamping means, and an interlocking mechanism permitting the operation of either the rail moving means or the clamping means only when the other of the said two means is in its unclamped and inoperative positions respectively.
- 50 10. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, power means to move the rail vertically, an element for controlling the operation of the power means, clamping means on the rail for securing the rail to the upright, power means for operating the clamping means, an element for controlling the last named power means, and an interlocking mechanism permitting the operation of either the first or second element only when
- 55 60 65
- 70 75 80 85 90 95 100 105 110 115 120 125 130

the other element is in the unclamping and inoperative positions respectively.

11. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, clamping means on the rail for securing the rail to the upright, an electric motor for operating the clamping means, and an interlocking mechanism permitting the operation of the rail moving means only when the clamping means is in its inoperative position.

12. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, a lever for controlling the operation of the rail moving means, clamping means on the rail for securing the rail to the upright, an electric motor for operating the clamping means, a switch for controlling the motor, and an interlocking mechanism permitting the operation of either the lever or the switch only when the switch or the lever respectively is in the unclamping and inoperative positions respectively.

13. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, clamping means on the rail for securing the rail to the upright, an electric motor on the rail for operating the clamping means, a switch for controlling the motor, a driving connection between the motor and the clamping means comprising a worm wheel on the clamping means engaged by a worm driven from the motor, and an interlocking mechanism permitting the operation of the rail moving means only when the switch is in a clamp releasing position.

14. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, power means to move the rail vertically, clamping means for securing the rail to both uprights, power means for operating the clamping means and an interlocking mechanism permitting the operation of either of the said power means only when the other power means is in its inoperative position.

15. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, power means to move the rail vertically, clamping means on the rail for securing the rail to both uprights, power means on the rail for operating the

clamping means, and an interlocking mechanism permitting the operation of either of the said means only when the other means is in its inoperative position.

16. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means for securing the rail to the uprights, an electric motor for operating the clamping means, and an interlocking mechanism preventing the operation of the rail moving means until the electric current has been turned on the motor for releasing the clamping means and preventing a clamping contact of the current during the operation of the rail moving means.

17. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means on the rail for securing the rail to the uprights, motor means mounted on the rail for operating the clamping means, and an interlocking mechanism permitting the operation of the rail moving means only when the clamping means is in its inoperative position.

18. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means on the rail for securing the rail to one of the uprights, an electric motor mounted on the rail, a driving connection between the motor and the clamping means so constructed that in its clamping position the reaction of the clamping means cannot rotate the motor in an unclamping direction even though the electric current to the motor is cut off, and an interlocking mechanism permitting the operation of the rail moving means only when the clamping means is in its inoperative position.

19. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means on the rail for securing the rail to one of the uprights, an electric motor mounted on the rail, a driving connection between the motor and the clamping means comprising a worm wheel on the clamping means engaged by a worm driven from the motor, and an interlocking mechanism permitting the operation of the rail moving means only when the clamping means is in its inoperative position.

20. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means on the rail for securing the rail to the uprights, a single electric motor for operating the clamping means, and an interlocking mechanism permitting the operation of either of the said means only when the other means is in its inoperative position.

21. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means on the rail adjacent each upright, each clamping means being adapted to engage its upright to secure the rail thereto, an electric motor mounted on the rail, a frictional connection between the motor and each clamping means, and an interlocking mechanism permitting the operation of the rail moving means only when the clamping means is in its inoperative position.

22. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, clamping means on the rail adjacent each upright, each clamping means being adapted to engage its upright to secure the rail thereto, an electric motor mounted on the rail, a frictional connection between the motor and each clamping means, such connection comprising two worms driven by the motor and engaging two worm wheels frictionally secured to the clamping means respectively, and an interlocking mechanism permitting the operation of either of the said means only when the other means is in its inoperative position.

23. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, a clamping arm pivoted on the rail adjacent each upright, one end of each arm being adapted to engage its upright to secure the rail thereto, operating means engaging the other end of each arm, a single electric motor for operating both clamping arms, an interlocking mechanism permitting the operation of the rail moving means only when the clamping means is in its inoperative position.

24. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a guideway on one side of each upright, a cross rail mounted to slide vertically on the

guideways, power means to move the rail vertically, a lever for controlling the rotation of the power means in either direction, clamping means on the rail adapted to engage both uprights to secure the rail thereto, rotary power means for operating the clamping means, a handle for controlling the last named power means, and an interlocking mechanism permitting the operation of either the lever or the handle only when the handle or lever respectively is in the unclamping and inoperative positions respectively.

25. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, a lever for controlling the movement of such means in either direction, clamping means on the rail adapted to engage the upright to secure the rail thereto, an electric motor for operating the clamping means, a switch for controlling the motor, and an interlocking mechanism permitting the operation of the lever only when the switch has been thrown to a clamp-releasing position.

26. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, screw means to move the rail vertically, a lever for controlling the rotation of the screw means in either direction, clamping means on the rail adapted to engage both uprights to secure the rail thereto, electric motor means on the rail for operating the clamping means, a switch for controlling the motor means, and an interlocking mechanism permitting the operation of either the lever or the switch only when the switch or lever respectively is in the unclamping and inoperative positions respectively.

27. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, screw means to move the rail vertically, mechanism comprising a clutch for operating the screw means in either direction, a lever for controlling the clutch, clamping means on the rail adapted to engage both uprights to secure the rail thereto, power means for operating the clamping means, a handle for controlling the power means, and an interlocking mechanism permitting the operation of either the lever or the handle only when the handle or the lever respectively is in the unclamping and inoperative positions, respectively.

28. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the

table, a cross rail mounted to slide vertically on the uprights, screw means to move the rail vertically, a lever for controlling the rotation of the screw means in either direction, clamping means on the rail adapted to engage the uprights to secure the rail thereto, electric motor means for operating the clamping means, and a switch for controlling the motor means comprising a handle having means thereon for engaging the lever in such manner as to permit the operation of either the switch or lever only when the lever or switch respectively is in the neutral and clamp releasing positions respectively but preventing the simultaneous operation of both.

29. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, screw means to move the rail vertically, a lever for controlling the rotation of the screw means in either direction, clamping means on the rail adapted to engage one of the uprights to secure the rail thereto, an electric motor for operating the clamping means, and a switch for controlling the motor comprising a plate having a T-slot therein, the lever extending through such slot in such manner that the lever is locked from movement except when the switch is thrown to a clamp releasing position.

30. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, an element for controlling the operation of the rail moving means, clamping means on the rail for securing the rail to the upright, an electric motor for operating the clamping means, and a positive interlocking mechanism permitting the operation of the said element only when the clamping means is disengaged.

31. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, an element for controlling the operation of the rail moving means, clamping means on the rail for securing the rail to both uprights, rotary power means for operating the clamping means, and a positive interlocking mechanism permitting the operation of the said element only when the clamping means is disengaged.

32. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, an element for controlling the operation of the rail moving means, clamping means on the rail for securing the rail to the upright, power means for operating the clamping means, and an interlocking mechanism including a solenoid having means controlled thereby and adapted to positively engage and secure the said element from operation when the clamping means is in the clamped position, the clamping means in its unclamped position being adapted to make an electric contact energizing the solenoid whereby the securing means controlled thereby is disengaged from the said controlling element.

33. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, an element for controlling the operation of the rail moving means, a clamping arm pivoted to the rail for securing the rail to the upright, power means for operating the clamping arm, and an interlocking mechanism, including a solenoid having means controlled thereby and adapted to positively engage and secure the said element from operation when the clamping arm is in the clamped position, the clamping arm in its unclamped position being adapted to make an electric contact energizing the solenoid whereby the securing means controlled thereby is disengaged from the said controlling element.

34. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, an element for controlling the operation of such means in either direction, clamping means for securing the rail to the upright, a second element for controlling the clamping means, an interlocking mechanism permitting the operation of either the first or second element only when the second or first element respectively is in the unclamped and inoperative positions respectively, and other interlocking mechanism positively preventing the operation of the first element until the clamping means is in the unclamped position.

35. In a machine of the class described, the combination of a base, a work table mounted thereon, an upright adjacent the table, a cross rail mounted to slide vertically on the upright, means to move the rail vertically, an element for controlling the operation of such means in either direction, clamping means on the rail for securing the rail to the upright, an electric motor for operating the clamping means, a switch for controlling the motor, an interlocking mechanism permitting the operation of either the element or the switch only when the switch

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or element respectively is in the unclamping and inoperative positions respectively, and other interlocking mechanism comprising a solenoid having means for positively locking the said element from movement until the clamping means is in the unclamped position, the said locking means being withdrawn from locking position by the solenoid which is energized through an electric contact made by the clamping means in its unclamped position.

36. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, an element for controlling the operation of such means in either direction, clamping means for securing the rail to the uprights, a second element for controlling the clamping means, an interlocking mechanism permitting the operation of either the first or second element only when the second or first element respectively is in the unclamped and inoperative positions respectively, and other interlocking mechanism positively preventing the operation of the first element until the clamping means is in the unclamped position.

37. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, an element for controlling the operation of such means in either direction, clamping means on the rail for securing the rail to the uprights, an electric motor for operating the clamping means, a switch for con-

trolling the motor, and interlocking mechanism permitting the operation of either the element or the switch only when the switch or element respectively is in the unclamping and inoperative positions respectively, and other interlocking mechanism comprising a solenoid having means for positively locking the said element from movement until the clamping means is in the unclamped position, the said locking means being withdrawn from locking position by the solenoid which is energized through an electric contact made by the clamping means in its unclamped position.

38. In a machine of the class described, the combination of a base, a work table mounted thereon, two uprights adjacent the table, a cross rail mounted to slide vertically on the uprights, means to move the rail vertically, an element for controlling the operation of such means in either direction, a clamping arm pivoted to the rail adjacent each upright, one end of each arm being adapted to engage its upright to secure the rail thereto, operating means engaging the other end of each arm, a second element for controlling the arm operating means, an interlocking mechanism permitting the operation of either the first or second element only when the second or first element respectively is in the unclamping and inoperative positions respectively, and other interlocking mechanism positively preventing the operation of the first element until the clamping means is in the unclamped position.

In testimony whereof, I hereto affix my signature.

WILLARD T. SEARS.