

July 4, 1950

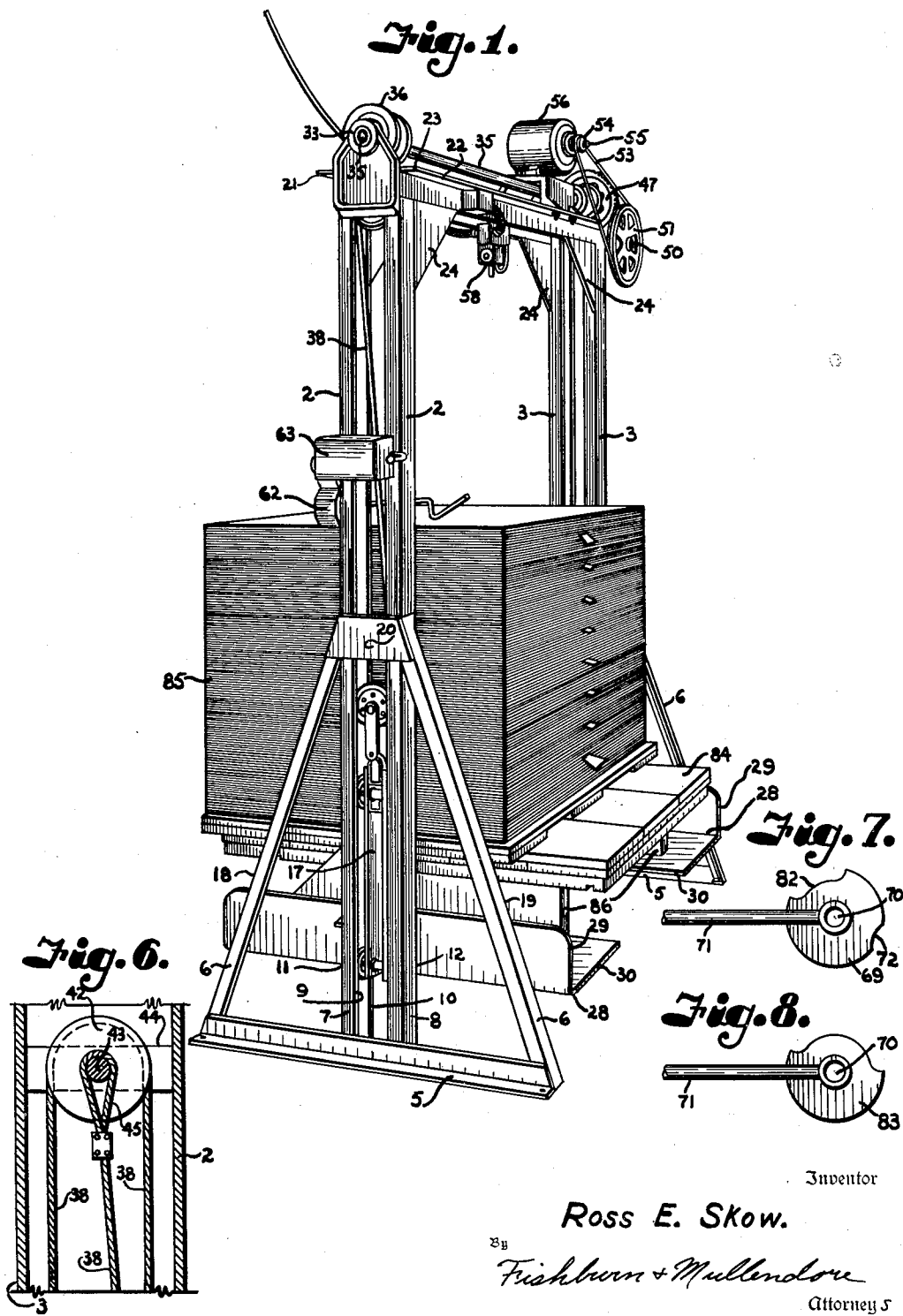
R. E. SKOW

2,513,433

ELEVATOR FOR RAISING WORKPIECES

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3 Sheets-Sheet 1



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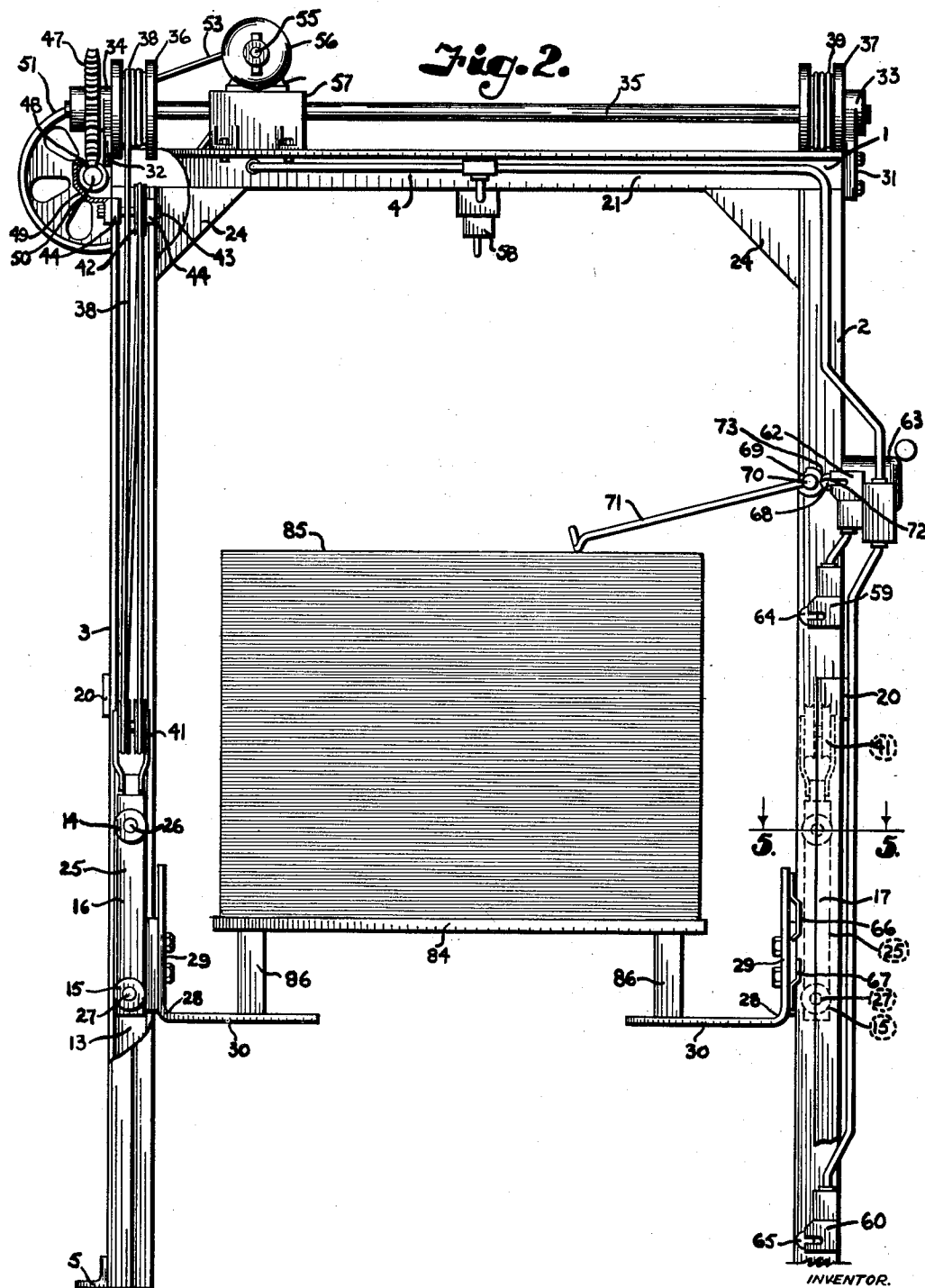
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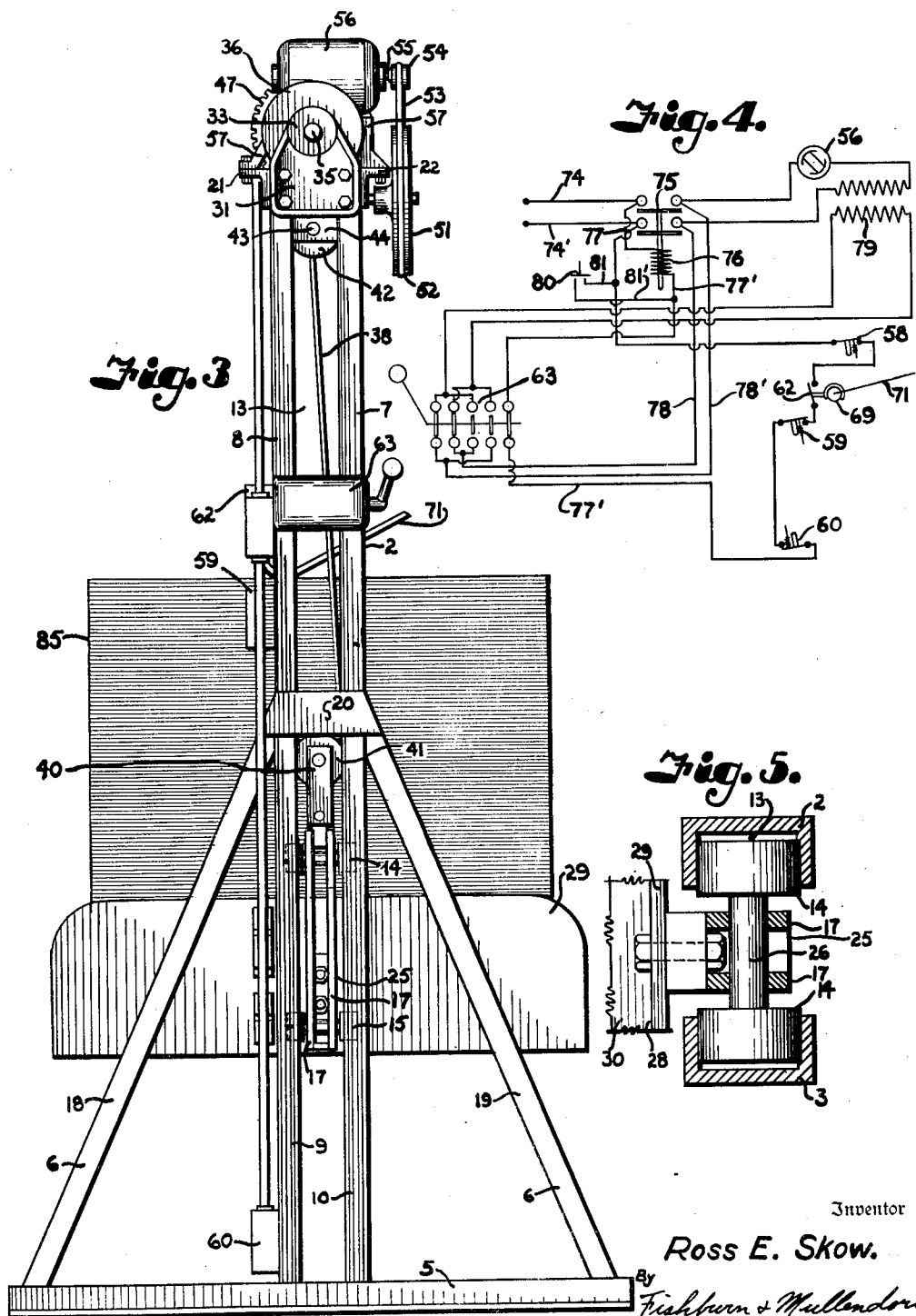
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,513,433

ELEVATOR FOR RAISING WORKPIECES

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12 Claims. (Cl. 187—35)

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This invention relates to elevators for raising and/or lowering workpieces relatively to the working level of a machine in which the workpieces are processed; for example, stacks of paper to the table of a die or cutting press.

In presses of this character it has been the practice to load a stack of paper sheets upon a low platform truck and to wheel the loaded truck into a position adjacent the press. The operator of the press would then remove stacks of the sheets and lift them to the cutting table. Such sheets are usually of relatively large area and the sheets to be lifted are heavy and difficult to handle with the result that the operator becomes fatigued or he may strain or even injure himself.

Therefore, the principal objects of the present invention are to provide an elevator for this purpose that is of simple, inexpensive construction that may be operated with a small inexpensive motor so that when the operator takes off one lift of paper the elevator automatically raises the next lift to the proper height.

Other objects of the invention are to provide an elevator with an automatic control for automatically stopping the elevator when the stacks of sheets or other workpieces reach the desired level; and to provide for adjustment of the automatic control to maintain a proper level or height of the stack for the convenience of the individual operator of the machine, that is, if a tall operator is working with the aid of the elevator, the control would be set to stop the lift at a higher point than for a shorter operator.

In accomplishing these and other objects of the invention hereinafter pointed out, I have provided improved structure, the preferred form of which is illustrated in the accompanying drawings wherein:

Fig. 1 is a perspective view of an elevator constructed in accordance with the present invention and which is adapted for raising workpieces such as stacks of paper to a convenient level relative to a machine in which the paper is to be processed.

Fig. 2 is a side elevational view.

Fig. 3 is an end elevational view.

Fig. 4 is a wiring diagram of one type of electric circuit that may be employed in the elevator.

Fig. 5 is a fragmentary cross section through one side of the frame particularly illustrating the rollers for guiding the lifts of the elevator.

Fig. 6 is a detail section showing the anchorage for the fixed ends of the elevating cables.

Fig. 7 is a view of the cam of the automatic level control switch for controlling the level of a lifting type of elevator.

Fig. 8 is a view of the cam for the level control switch for a lowering type of elevator.

Referring more in detail to the drawings:

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1 designates an elevator constructed in accordance with the present invention and which may include a gantry-shaped frame having laterally spaced uprights 2 and 3 connected at their upper ends by a cross member 4. The uprights 2 and 3 each include an angle-shaped base member 5 having vertical flanges 6 to which are attached spaced channels 7 and 8 comprising the uprights. The channels 7 and 8 are arranged with the side flanges 9 and 10 in facing relation to cooperate with the web portions 11 and 12 of the channels in forming vertical ways 13 for pairs of wheels 14 and 15 of travelers of carriages 16 and 17 that are adapted to move up and down the ways of the respective uprights as later described. The channels are supported in upright position by braces 18 and 19 having the lower ends fixed to the ends of the flanges 6 and their upper ends fixed to cross members 20 that tie the channels in spaced relation as shown in Fig. 1. The cross member 4 includes spaced angle members 21 and 22. The angles are arranged so that one of their flanges turns downwardly for attachment to the webs 11 and 12 of the upright channels, and the other flanges 23 thereof turn outwardly for mounting the lifting machinery later to be described. The connections of the angle members with the channels are further reinforced by gusset plates or corner braces to provide operating rigidity without anchoring of the base angles 5. However, small screws may be used to secure the base angles to the floor to prevent skidding of the machine out of position.

The travelers or carriages 16 and 17 include elongated body members 25 adapted to move in the spaces between the channels of the uprights and which carry cross shafts 26 and 27 adjacent the upper and lower ends for mounting wheels 14 and 15 that roll in the ways when the travelers are raised and lowered as later described. Fixed to the lower ends of each member 25 are transverse angles 28 having vertical flanges 29 and horizontal flanges 30 which constitute shelves or lifts for carrying the workpieces to be raised as later described.

Fixed to the upper end of each upright are brackets 31 and 32 having bearings 33 and 34 respectively for journalling the ends of a cross shaft 35. Fixed to the cross shaft over the top of the uprights 2 and 3 are winding drums 36 and 37 carrying cables 38 and 39 presently described. Pivotaly connected with the upper ends of the travelers by means of straps 40 are grooved pulleys 41 and cooperating therewith below the respective winding drums are stationary pulleys 42 rotatably mounted on pins 43 having the ends journaled in plates 44 connecting the flanges of the upright channels. The cables have their free ends provided with eyes 45 that are mounted on the cross pins 43 on which the stationary pulleys

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rotate and the cables extend downwardly in the ways and are reeved in the grooves of the traveling pulleys from where they extend upwardly and the upper ends are attached to the winding drums.

The cables are of a length so that when they are substantially unwound from the winding drums the travelers are in their lowermost position with the horizontal flanges 30 of the angle members 28 substantially resting upon the floor. The shaft 35 is rotated to wind the cables 38 and 39 on the drums 36 and 37 and effect raising of the travelers 16 and 17 by means of a reduction mechanism including a worm gear 47 fixed to a projecting end of the shaft 35 which meshes with a worm 48 that is carried in a housing 49 that is attached to the upper end of the upright 2. The worm 48 is mounted on a shaft 50 having one end projecting laterally from the upright 2 to mount a relatively large diameter driven pulley 51 having its periphery provided with a groove 52 for receiving an endless belt 53 operating over a relatively small driving pulley 54 carried on the armature shaft 55 of a motor 56. The motor 56 is mounted on a suitable base 57 that is carried by the horizontal flanges 23 of the angles 21 and 22 previously described.

When the elevator is lifting, the thrust of the worm 48 on the worm gear 47 is toward the frame and against the bearing 34 so that the thrust does not tend to throw the frame out of alignment.

The combination of the small and large pulleys together with the worm and worm gearing permits the use of a relatively inexpensive fractional horsepower motor for operating the elevator since the reduction in speed is sufficient to rotate the winding drums at speeds suitable to provide the desired movement of the lifts.

With the construction thus far described, it is obvious that energization of the motor will operate the worm gear through the pulleys 51 and 54 by means of the endless belt 53 so that the worm turns at a considerable lower speed than the armature shaft 55 of the motor 56. The worm 48 meshing with the worm gear 47 turns the drum shaft 35 at a substantially reduced speed so as to wind the cables 38 and 39 on the drums or to pay the cables from the drums when raising and lowering the lifts. The winding drums and method of reeving the cables provide for lifting relatively heavy loads; for example, loads of more than one ton with a fractional horsepower motor.

In order to provide for automatic operation of the motor to limit the upper and lower travel of the carriages or travelers and to provide for automatically stopping the lift at any intermediate positions, the elevator is equipped with an upper limit or safety switch 58 depending from the cross member 4, upper and lower control switches 59 and 60 attached to the upright 2, and an increment stop or level control switch 62 adjustably attached to one of the upright members of the frame at the level desired by the operator of the machine (not shown) with which the elevator is to be associated. The motor is also controlled by a manually operated reversing switch 63 that is preferably attached to the frame in convenient reach of the operator. The switches 59 and 60 have rollers 64 and 65 that are respectively actuated responsive to contact by spring leaf actuators 66 and 67 located on vertical flange of the angle 28 at that side of the machine (see Fig. 2). The actuators thus move with the elevator carriage so that when the elevator car-

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riages are in their lowermost position the actuator 67 will engage the roller 65 of the lower switch 60 and when the elevator carriages are in their upper position the actuator 66 engages the roller 64 of the switch 59 to open circuit to the motor at predetermined upper and lower limits of the carriages.

The level control or increment switch 62 has an actuating roller 68 which engages a cam 69 that is oscillatably mounted on the stud 70 projecting laterally from the upright 2 at a point above the upper limit switch. Connected with the cam is an actuating arm 71 that projects over the stack of sheets as shown in Fig. 2. When the arm 71 is in down position as shown in Fig. 2, the roller 68 engages a dwell 72 in the cam so that the leveling switch is in closed position but as the stack is raised the arm swings upwardly to move a lobe 73 of the cam into contact with the roller to open the switch and stop movement of the stack as later described.

The motor 56 is connected with current supply conductors 74 and 74' in which is interposed a main switch 75 that is operated by the switches previously described, by means of a solenoid 76 that is connected in circuit with the current supply conductors 74 and 74' by conductors 77 and 77'. The conductor 77 connects the switches 59, 60 and 68 in series and circuit is completed by connecting the conductor 77' with the conductor 74'. Thus, when the switches 58, 59, 60 and 62 are closed, current is flowing through the solenoid 76 to hold the main switch 75 closed to effect operation of the motor 56, however, when any one of the switches 58, 59, 60 or 62 is open, circuit is interrupted to the solenoid 76 and the main switch 75 opens to stop operation of the motor.

The manually operated reversing switch 63 is connected by suitable conductors 78 and 78' with the main circuit supply wires and the field windings 79 of the motor to effect reversal of the motor 56. The reversal switch 63 may also include contacts to control the current flow to the switches 59, 60 and 58. When one of the control switches is open and the reversing switch has been actuated to operate the motor in the desired direction, the solenoid 76 is initially actuated by a push button switch 80 that is connected with the conductors 77' and 77 by conductors 81 and 81' to establish direct flow of current through the solenoid 76 and effect closure of the main switch 75. The cam 69 also has a dwell 82 to permit closure of the level switch when the arm 71 is raised to an out of the way position. When the elevator is used for lowering the work a cam 83 as shown in Fig. 8 is substituted for the cam 69.

In using the elevator constructed and assembled as described, and assuming that the carriages are in their lowermost position with the intumed flanges 30 of the angles 28 resting on the floor, a platform 84 is placed on the truck or dolly (not shown) to carry a stack of sheets 85 and are transported to the elevator where the truck is moved between the lifts. The platform 84 has depending foot portions 86 that are spaced apart so that they pass over the flanges 30 of the lifts to be supported thereby when the motor is actuated to raise the carriages and lift the platform from the truck. When the elevator is in its lowermost position the actuator 67 is engaging the roller 65 of the switch 60. The motor, however, may be started by positioning the reversing switch 63 and closing the push button switch 80. Closing of the push button switch 80

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establishes a flow of current through the solenoid 76 of the main switch 15 so that the main switch is closed and current is supplied to the motor 56. As soon as the actuator 67 leaves the roller 65, the switch 60 closes to complete and hold the circuit through the solenoid. If the increment stop or leveling switch 62 is used, the platform will be raised until the top sheet strikes the actuating arm 71 of the cam 69 and the switch opens the circuit to the solenoid 76 and permits opening of the main switch 15. The uppermost sheets are then in position to be conveniently removed from the elevator and slid onto the work table of the press or other machine whereupon the switch arm 71 drops to again close the circuit to the motor and the platform 84 is raised until it is again stopped by the stack of sheets engaging the arm 71. The operations are thus continued until all of the sheets have been removed or until the actuator 66 engages the roller 64 of the switch 59 which stops upward movement of the elevator.

Should the stop switch 62 not be used and an exceptional high stack of sheets applied in the elevator, the motor will be automatically stopped by contact of the uppermost sheet with the upper limit switch 53, which stops the motor and prevents injury to any of the operating mechanism of the elevator.

When the platform is in its uppermost position and the sheets have been removed therefrom, the platform is lowered by positioning the reversing switch 53 and closing the push button switch 39 which effects closing of the main switch to operate the motor in the direction to lower the platform. When the carriages have reached their lowermost position the actuator 67 engages the roller 65 to effect opening of the solenoid circuit. The platform may then be removed from the rails for reloading with another stack of sheets.

It is to be noted in lifting heavy loads and the use of wider platforms does not greatly increase the stress upon the angle members of the carriages since the supports for the platforms are close to the vertical flanges of the angle members. Lighter and narrower platforms result in increasing the spacing between the points of support and the vertical flanges but the lighter loads make compensation and the stress curve is substantially flat. This is also true of the stresses in the main channel members of the frame.

From the foregoing it is obvious that I have provided an elevator which is of simple and inexpensive construction and which may be readily adjusted to position a stack of sheets relative to the work table of a machine so that the operator may remove a predetermined number of the sheets onto the work table with a minimum of lifting effort.

What I claim and desire to secure by Letters Patent is:

1. An elevator of the character described including a frame, lifting means mounted for vertical movement on the frame for elevating a stack of workpieces, winding drums rotatably mounted on the frame, cables operable on the winding drums and connected with the lifting means, a motor, a speed reduction driving mechanism connecting the motor with the winding drums, an electric circuit connected with the motor for supplying current to the motor, a reversing switch connected in the circuit for reversing rotation of the motor to effect alternate raising and lowering of the lifting means, limit switches in said circuit to limit the up and down movement of the lifting means, means movable

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with the lifting means for actuating the limit switches, and an increment stop and leveling switch in said circuit for stopping the lifting means at increments intermediate the stops by said limit switches.

2. An elevator of the character described including a frame provided with spaced uprights, lifts mounted for vertical movement on the uprights and adapted for carrying a stack of workpieces to be elevated, a cross shaft rotatably mounted on the frame at the upper ends of the uprights, winding drums on the shaft, cables operable on the winding drums and connected with the lifts, a motor, a speed reduction driving mechanism connecting the motor with said shafts, an electric circuit connected with the motor for supplying current to the motor, a reversing switch connected in the circuit for reversing rotation of the motor to effect alternate raising and lowering of the lifts, limit switches in said circuit to limit the up and down movement of the lifts, and means movable with one of the lifts for actuating the limit switches.

3. An elevator of the character described including a frame provided with spaced uprights, lifts mounted for vertical movement on the uprights and adapted for carrying a stack of workpieces to be elevated, a cross shaft rotatably mounted on the frame at the upper ends of the uprights, winding drums on the shaft, cables operable on the winding drums and connected with the lifts, a motor, a worm gear on the shaft, a worm meshing with the worm gear, a pulley connected with the worm, a pulley on the motor, a belt operating over the pulleys, an electric circuit connected with the motor for supplying current to the motor, a reversing switch connected in the circuit for reversing rotation of the motor to effect alternate raising and lowering of the lifts, limit switches in said circuit to limit the up and down movement of the lifts, and means movable with one of the lifts for actuating the limit switches.

4. An elevator of the character described including a gantry-shaped frame provided with spaced uprights, carriages mounted for vertical movement on the uprights, lifting rails on the carriages and adapted for carrying stacks of workpieces to be elevated, a cross shaft rotatably mounted on the frame on the upper ends of the uprights, winding drums on the shaft, cables operable on the winding drums and connected with the carriages, a motor, a speed reduction driving mechanism connecting the motor with said shaft, an electric circuit connected with the motor for supplying current to the motor, a reversing switch connected in the circuit for reversing rotation of the motor to effect alternate raising and lowering of the carriages, limit switches in said circuit to limit the up and down movement of the carriages, means movable with one of the carriages for actuating the limit switches, and an increment switch in said circuit having an actuator engageable with the workpieces to stop the motor intermediate the stops effected by the limit switches.

5. An elevator of the character described including a frame provided with spaced uprights having vertical ways, carriages mounted in said ways and adapted for carrying workpieces to be elevated, a cross shaft rotatably mounted on the frame on the upper ends of the uprights, winding drums on the shaft, pulleys on the carriages, pulleys mounted at the upper ends of the uprights, cables having ends anchored adjacent said last-

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named pulleys and reeved over said pulleys with opposite ends attached to the winding drums, a motor on the frame, a speed reduction driving mechanism connecting the motor with the cross shaft, an electric circuit connected with the motor for supplying current to the motor, a reverse switch connected with the motor to effect raising and lowering of the carriages in said ways, limit switches in said circuit to limit up and down movement of the carriages, and means movable with one of the carriages for actuating the limit switches.

6. An elevator of the character described including a frame provided with spaced uprights having vertical ways, carriages mounted in said ways and adapted for carrying workpieces to be elevated, a cross shaft rotatably mounted on the frame on the upper ends of the uprights, winding drums on the shaft, pulleys on the carriages, pulleys mounted at the upper ends of the uprights, cables having ends anchored adjacent said last-named pulleys and reeved over said pulleys with their opposite ends attached to the winding drums, a motor on the frame, speed reduction driving mechanism connecting the motor with the shaft, an electric circuit connected with the motor for supplying current to the motor, a reverse switch connected with the motor to effect raising and lowering of the carriages in said ways, limit switches in said circuit to limit up and down movement of the carriages, means movable with one of the carriages for actuating the limit switches, and an increment switch in said circuit having an actuator engageable with the workpieces to stop the motor intermediate the stops effected by the limit switches.

7. An elevator of the character described including a frame provided with spaced uprights having vertical ways, carriages mounted in said ways and adapted for carrying workpieces to be elevated, a shaft rotatably mounted on the frame at the upper ends of the uprights, winding drums on the shaft, pulleys on the carriages, pulleys mounted at the upper ends of the uprights, cables having ends anchored adjacent said last-named pulley and reeved over said pulleys with their opposite ends attached to the winding drums, a motor on the frame, speed reduction driving mechanism connecting the motor with the shaft, and means for controlling the motor.

8. An elevator of the character described including a frame provided with spaced uprights having vertical ways, carriages mounted in said ways and adapted for carrying workpieces to be elevated, a cross shaft rotatably mounted on the frame at the upper ends of the uprights, winding drums on the shaft, cables operable on the winding drums and connected with the carriages, a worm gear on the shaft, a worm carried by the frame and meshing with the worm gear, a motor on the frame, a pulley and belt connection between the motor and the worm for driving the worm at a reduced speed with respect to the motor, an electric circuit for supplying current to the motor, and means in said circuit automatically operable by one of the carriages for stopping operation of the motor in different positions of the carriages.

9. An elevator of the character described including a frame, lifting means mounted for vertical movement on the frame, means including an electrical motor for actuating the lifting members to elevate a stack of workpieces, an electric circuit connected with the motor for supplying

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current to the motor, a reversing switch connected in the circuit for reversing rotation of the motor to effect alternate raising and lowering of the lifting means, limit switches on said frame and connected in said circuit to limit the up and down movement of the lifting means, and limit switch actuators movable with one of the lifting means for actuating the limit switches.

10. An elevator of the character described including a frame, lifting means mounted for vertical movement on the frame, means including an electrical motor for actuating the lifting means to elevate a stack of workpieces, an electric circuit connected with the motor for supplying current to the motor, a reversing switch connected in the circuit for reversing rotation of the motor to effect alternate raising and lowering of the lifting means, limit switches on said frame and connected in said circuit to limit the up and down movement of the lifting means, means movable with one of the lifting means for actuating the limit switches, and an increment stop and leveling switch on the frame and connected in said circuit for stopping the lifting means at increments intermediate the stops by said limit switches.

11. An elevator of the character described including a frame, lifting means mounted for vertical movement on the frame, means including an electrical motor for actuating the lifting means to elevate a stack of workpieces, an electric circuit connected with the motor for supplying current to the motor, a reversing switch connected in the circuit for reversing rotation of the motor to effect alternate raising and lowering of the lifting means, limit switches on said frame and connected in said circuit to limit the up and down movement of the lifting means, means movable with one of the lifting means for actuating the limit switches, an increment stop and leveling switch on the frame and connected in said circuit, a cam oscillatably supported on said frame for actuating said stop switch, and an arm connected with the cam and projecting into the path of the workpieces for moving the cam to effect stopping of the lifting means at increments intermediate the stops by said limit switches.

12. An elevator of the character described including a frame provided with spaced uprights having vertical ways, carriages mounted in said ways and adapted for carrying workpieces to be elevated, a shaft rotatably mounted on the frame at the upper ends of the uprights, winding drums on the shaft, pulleys on the carriages, pulleys mounted at the upper ends of the uprights, cables having ends anchored adjacent said last-named pulley and reeved over said pulleys with their opposite ends attached to the winding drums, a motor on the frame, speed reduction driving mechanism connecting the motor with the shaft, and means responsive to predetermined movements of the carriages for controlling the motor.

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