Feb. 12, 1957 F. J. SEHN ET AL 2,781,136

MATERIAL HANDLING APPARATUS

Filed Dec. 27, 1955 3 Sheets-Sheet 1

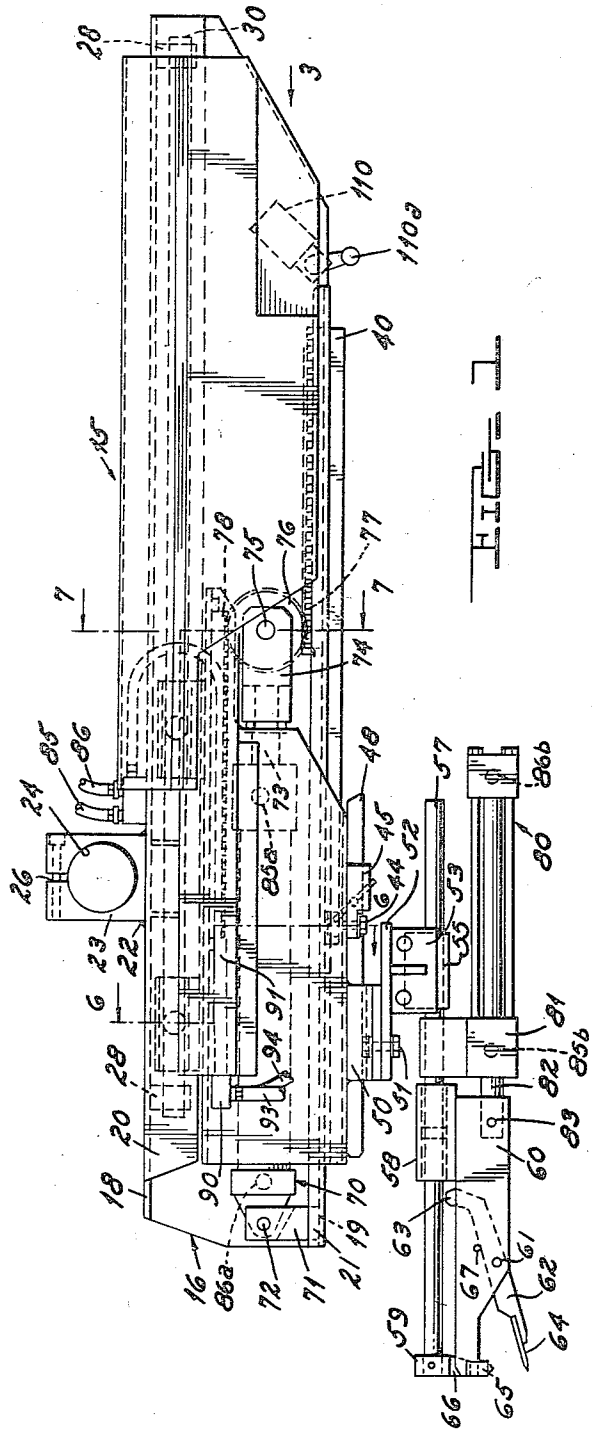


FIG. 1

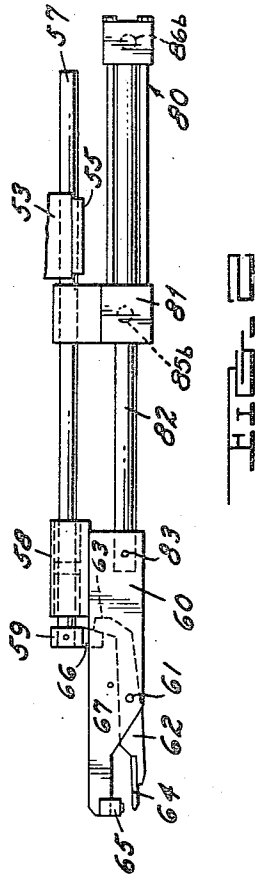


FIG. 2

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Filed Dec. 27, 1955 3 Sheets-Sheet 2

FIG. 3

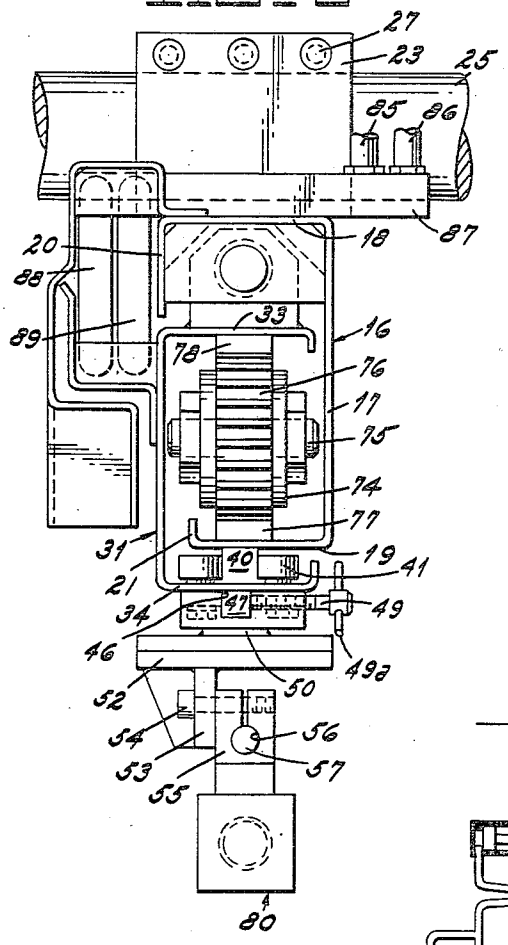


FIG. 4

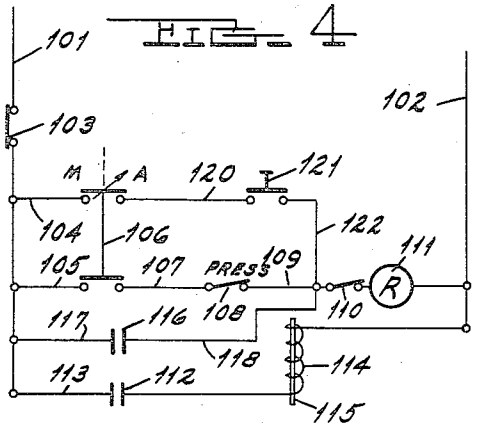
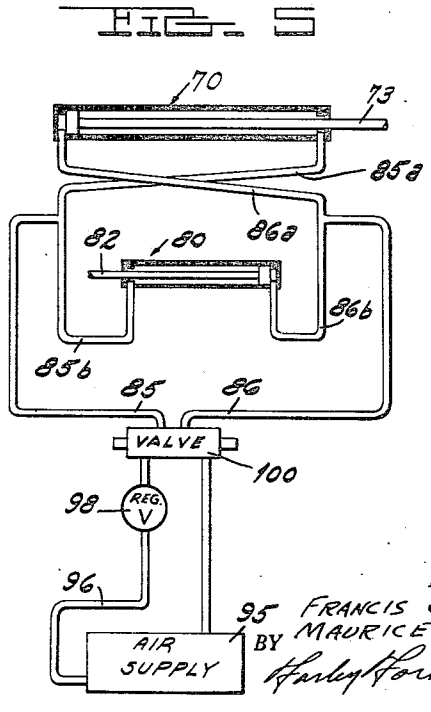


FIG. 5



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MATERIAL HANDLING APPARATUS

Filed Dec. 27, 1955 3 Sheets-Sheet 3

FIG. 6

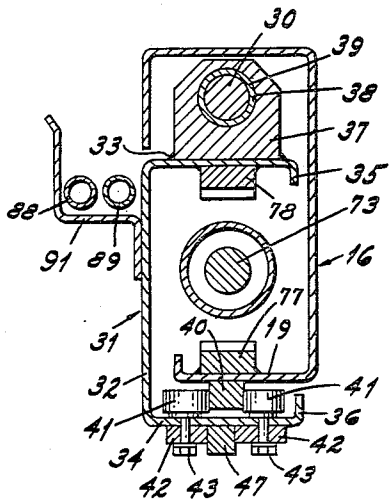


FIG. 7

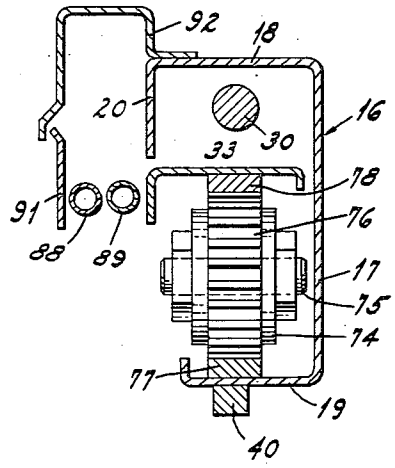


FIG. 8

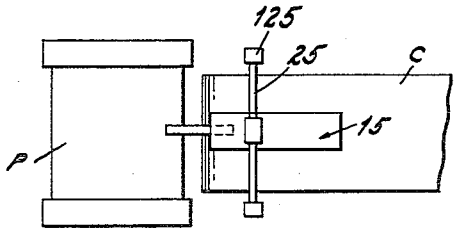
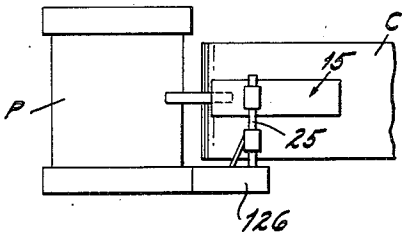


FIG. 9



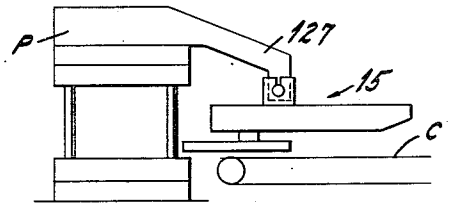


FIG. 10

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2,781,136

MATERIAL HANDLING APPARATUS

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Application December 27, 1955, Serial No. 555,413
7 Claims. (Cl. 214—1)

The present invention relates to a material handling apparatus for a press or the like machine, and more particularly to an apparatus for the handling of sheet metal and the like into or out of a press or a similar production machine.

In the interest of efficient and economical handling of materials to and from various production machines, and also for increased employee safety, various types of material handling apparatus have been provided. This is particularly true in the handling of sheet metal to and from a production press or similar machine. The present invention provides an improved material handling apparatus which is adapted for such use.

One of the primary advantages of the present apparatus resides in its adaption to and convenient mounting upon or adjacent to a press or the like. The entire handling apparatus of the present invention may be readily suspended from a single supporting element, such as a bar or rod, the bar or rod either being positioned upon the press to project therefrom or being positioned adjacent the press.

Another advantage of the material handling apparatus of this invention is that the apparatus is automatically operable through a predetermined cycle to insert or remove material from the production machine. In addition, the device may be manually operated, if such is desired. The control apparatus for the device of this invention is quite simple in its construction and operation, preferably utilizing a pair of pneumatic cylinders which are operated in predetermined sequence by the subjection of the pneumatic actuating mechanisms to loads of different magnitudes, thus limiting the need for expensive, complicated, and troublesome pneumatic control mechanism. In fact, the apparatus of the present invention requires only a single actuating valve movable to two positions to alternately advance and retract the mechanism, and a very simple electrical control circuit which serves the sole function of actuating the single control valve.

Other advantages of the apparatus of the present invention include the use of fabricated sheet metal parts for the supporting structure and the frame of the apparatus, and the utilization of a simple double rack and single pinion change-speed drive for actuating the apparatus toward and away from the press or other production machine, thus greatly increasing the material handling efficiency and the production speed of the machine.

It is, therefore, an important object of the present invention to provide an improved material handling apparatus for the insertion or removal of sheet metal from a press or similar production machine.

Another important object of the present invention is the provision of a material handling apparatus for a production machine which is suspended from a single supporting element forming a part of or placed in juxtaposition to the production machine.

Another important object is the provision of an automatically or manually operative material handling apparatus which is provided with a simplified, inexpensive, and trouble-free actuating mechanism.

A further important object is to provide an improved material handling apparatus wherein a pair of fluid pressure cylinders are operated sequentially by virtue of the load imposed upon the cylinder-actuated parts and under the control of a single actuating valve.

Still another important object is the provision of an automatically operative material handling apparatus in which a fluid pressure control valve is actuated by an electric circuit including a part actuated by a press or the like and through which a holding circuit for a valve is energized, the holding circuit being interrupted upon the completion of movement of the fluid pressure actuated portion of the apparatus, thereby actuating the valve to effect return movement of the apparatus.

It is yet another important object of this invention to provide an improved material handling apparatus wherein a double rack and single pinion change-speed drive is utilized to increase the effective stroke and the operating speed of a fluid pressure cylinder which supplies the source of power ofr the apparatus.

Another and further important object to the present invention will become apparent from a study of the drawings which are described in detail hereinafter and from the appended claims.

As shown in the drawings:

Fig. 1 is a side elevation of a material handling apparatus of the present invention particularly adapted for the retraction of finished parts from a press or the like;

Fig. 2 is a fragmentary view similar to Fig. 1 illustrating the workpiece-engaging portions of the apparatus in an adjusted position;

Fig. 3 is an enlarged end elevational view of the apparatus shown in Fig. 1;

Fig. 4 is a diagrammatic view of a typical control circuit utilizable for either manual or automatic control of the apparatus;

Fig. 5 is a schematic representation of the pneumatic actuating mechanism controlled by the circuit of Fig. 5;

Fig. 6 is an enlarged sectional view, with parts shown in elevation, taken along the planes 6—6 of Fig. 1;

Fig. 7 is an enlarged sectional view, with parts shown in elevation, taken along the planes 7—7 of Fig. 1; and

Figs. 8, 9 and 10 are schematic views illustrating different modes of adapting the apparatus to press.

On the drawings:

In Fig. 1, reference numeral 15 referred generally to a material handling apparatus of the present invention.

The apparatus 15 includes a longitudinally extending sheet metal main frame indicated generally at 16 and comprising a vertically extending side plate 17 joining upper and lower laterally extending legs 18 and 19 terminating in vertically extending flanges 20 and 21, respectively. The upper lateral leg 18 is secured, as by welding at 22, to a centrally located, upstanding attachment block 23 which is generally rectangular in shape and which has a cylindrical aperture 24 adapted to receive therethrough a fixed mounting element 25 (Fig. 3). The block 23 forms a split clamp and a plurality of clamping screws 27 are utilized to secure the block 23 upon the mounting element 25 in secure assembly. The mounting block 23 is preferably located at the center of gravity of the assembly 15 (when the assembly is in the position shown in Fig. 1) and this, together with the clamping screws 27, retain the mounting frame 16 against tilting movement.

Secured to the under surface of the leg 18 to depend therefrom are a plurality of longitudinally spaced hangers 28 which are centrally apertured to receive therethrough a fixed slide shaft 30 (Figs. 1, 6 and 7). This shaft 30 support a longitudinally movable frame element indicated generally at 31 and of the same general shape as the fixed frame 16. More particularly, the movable frame 31 includes a side plate 32, upper and lower laterally extending legs 33 and 34 respectively, and terminal vertically extending flanges 35 and 36. The upper surface of the leg 33 carries a slide block 37 apertured, as at 38, to re-

ceive therethrough a bearing bushing 39 surrounding the slide shaft 30.

It will be appreciated that provision of the bearing 39 and the block 37, in combination with the shaft 30, makes possible longitudinal relative sliding movement between the fixed frame 16 and the sliding frame 31. This relative longitudinal movement is guided by an elongated guide block 40 depending from the lower lateral leg 19 of the frame element 16 and contacted by a pair of rollers 41 carried by the lower leg 34 of the sliding frame 31 and laterally spaced to receive the guide block 40 therebetween. The rollers 41 are secured to the sliding frame 31 by support blocks 42 underlying the sliding frame and secured thereto by suitable means, as by nuts 43.

The rollers 41, in combination with the guide block 40, not only guide the frame for longitudinal movement, but prevent relative oscillating movement between the fixed frame 16 and the sliding frame 31 about the shaft 30.

The lower leg 34 of the sliding frame 31 has secured thereto, as by screws 44, an additional mounting block 45 which is provided with a central rectangular opening 46 through which a return cut-off cam 47 projects. This cam 47 also projects between the roller mounting blocks 42, as best shown in Figs. 3 and 6. The return cut-off cam 47 is provided at one end with a cam face 48 for a purpose to be hereinafter more fully described, and a set screw 49, manually operable through a handle 49*a*, is carried by the block 45 to accommodate longitudinal adjustment of the cut-off cam 47 for a purpose to be hereinafter more fully described.

In advance of the block 45, the lower leg 34 of the movable frame element 31 has secured thereto, as by welding, a support block 50 fixedly attached, by nuts and bolts 51 or the like, to a second depending support block 52 (Figs. 1 and 3). The second support block 52 is provided with a fixed depending flange 53 which is attached, as by a screw 54, to a shaft block 55 having an aperture 56 through which extends an additional slide shaft 57.

The fixed slide shaft 57 is surrounded by a tubular supporting collar 58 movable along the shaft toward an end stop 59, the slide collar 58 carrying with it a lower forwardly projecting, gripper frame 60 having pivoted thereto, as by pivot 61, a vertically movable gripping arm 62, which terminates at its rear end in an upstanding cam projection 63 and having at its forward end a gripper finger 64 which is cooperable with a depending fixed gripper projection 65 (Figs. 1 and 2) for grasping a sheet metal press part therebetween. The slide shaft stop 59 is provided with a depending stop portion 66 which is cooperable with the rear cam projection 63 on the gripper arm 62 to move the gripping finger upwardly toward and into closely spaced relationship to the gripper projection 65 when the element 60 is moved forwardly with the slide 58 on the shaft 57. The forward or finger end of the arm 62 is heavier than the rear or cam end 63 so that the arm is over-balanced to its neutral or non-actuated released position illustrated in Fig. 1. A laterally projecting stop pin 67 is carried by the plate 60 to prevent undesired pivoting movement of the arm beyond its released position.

To effect relative longitudinal movement between the mounting frame 16 and the slide frame 31, a fluid pressure actuated cylinder, preferably pneumatic, indicated generally at 70 is utilized. One end of the cylinder is supported from the lower leg 19 of the fixed frame 16, as upon a bracket 71 and a pivot pin 72. The cylinder actuating rod 73 (Fig. 6) is provided with a terminal clevis 74 (Fig. 1) carrying an axle pin 75 upon which is disposed a pinion 76.

This pinion 76, as best shown in Fig. 3, meshes with a first or fixed rack 77 carried by the lower leg 19 of the fixed frame 16, and simultaneously meshes with an upper movable rack 78 which is carried by the upper leg 33 of the slide frame 31. It will be appreciated that actuation of the cylinder 70 will move the actuating rod 73 thereof longitudinally of the fixed frame 16. Such movement will necessarily cause longitudinal displacement of the pinion 76. This pinion 76, being meshed with the fixed rack 77, will be forced to rotate, and rotation of the pinion will effect a corresponding longitudinal displacement of the upper rack 78 which is movable with the slide frame 31 relative to the fixed frame 16, such movement of the slide frame being guided by the shaft 30 and the guide block 40. Because of the pinion and rack arrangement, the upper rack 78, and the movable frame 31 will be displaced through a distance equal to twice the displacement of the cylinder piston and actuating rod 73. It will be appreciated that this gear speed increase will effect rapid longitudinal displacement of the movable frame 31 and those parts attached thereto and will increase the effective stroke of the actuating rod 73.

A second actuating cylinder 80 is provided to actuate the gripping mechanism. This cylinder 80 is supported in fixed position upon the slide shaft 57 through a mounting block 81, and the actuating rod 82 of the cylinder 80 is connected to the gripper block 60 by suitable means, as by pin 83. Obviously, actuation of the cylinder 80 will extend the actuating rod 82 thereof to project the gripping element 60 forwardly to its position illustrated in Fig. 2 of the drawings, wherein the cam portion 63 of the gripper 62 will abut the stop 66, and the finger 64 will be moved upwardly into its gripping position for cooperation with the fixed gripping projection 65.

Fluid pressure for actuating the cylinders 70 and 80 is provided through a pair of conduits 85 and 86 (Fig. 3) which communicate with a conduit box 87 disposed upon the upper leg 18 of the fixed frame 16, and from the conduit box 87 through conduits 88 and 89 to a second conduit box 90 mounted upon the upstanding leg 32 of the movable frame 31 through a protective shield 91. A second shield 92 is carried by the upper leg 18 of the fixed frame 16. From the second conduit box 90, conduits 93 and 94 lead to the cylinder 80.

The supply of actuating fluid to the cylinders 70 and 80 is best illustrated in the greatly simplified schematic sketch of Fig. 5, wherein it is seen that fluid is supplied from an air supply 95 through a pressure line 96 and a regulator valve 98 to a control valve 100, actuated as hereinafter explained and effective to introduce fluid under pressure to the opposite ends of the cylinders 70 and 80 through a pair of fluid transmission lines 85 and 86. The lines 85 and 86 branch, as at 85*a* and 85*b*, and 86*a* and 86*b*, to supply fluid to the cylinders 70 and 80. Each of the cylinders 70 and 80 is the double acting type, and fluid introduced through the branch conduits 85*a* and 85*b* will serve to actuate the actuating rods 73 and 82 of the cylinders in one direction, while fluid introduced through the branch lines 86*a* and 86*b* will serve to energize the cylinders 70 and 80 so as to move the actuating rods 73 and 82, respectively, thereof, in the opposite direction.

When the pneumatic system is in the condition of Fig. 5, and the pistons occupy their relative positions as shown therein, the machine is at rest, both of the actuating rods are retracted, the movable frame 31 is at its furthest left position at which it is telescoped within the fixed frame 16, and the actuating rod 82 is telescoped within its cylinder 80 so that the gripping arm 62 is in its released position as illustrated in Fig. 1.

If the valve 100 were now actuated to interconnect the line 96 and the line 86, fluid will be introduced simultaneously into the conduits 86*a* and 86*b* to subject both of the cylinders 70 and 80 to fluid pressure. However, due to the resistance of the much heavier movable frame to movement, and because of the gear speed advantage of the double rack and pinion arrangement, the lighter resistance to the movement of the actuating rod 82 will cause this rod to be first actuated toward the left (Figs. 1 and 5). This actuation of the cylinder 80 will cause the gripper plate 60 to be moved forwardly toward the workpiece, and the gripper arm 62 to be actuated upon abutment of the cam end 60 with the cam stop 66 to move the gripper

finger into cooperative relation with the gripper stop 65. This movement completes the cycle of operation of the cylinder 80, and continued movement of the actuating rod will be impossible.

The resultant increased pressure within the cylinder 70 will cause actuation of the actuating rod 73 toward the right, that is to extend the actuating rod and the pinion 76 toward the right, causing actuation of the slidable frame 73 toward the right or from its telescoped position, thus retracting the movable frame and the gripping finger carried thereby from the press or other production machine. The workpiece, thus will be drawn from the press toward the right. When the actuating rod 73 approaches its furthest extended position, the condition of the valve 100 is reversed connecting the pressure line 96 to conduit 85 and consequently to conduits 85*a* and 85*b*. The first result will be that the cylinder 80 will receive fluid under pressure at its lefthand end, retracting the actuating rod 82 into the cylinder to move the gripping finger toward the right away from the stop 66, the overbalanced gripping arm will necessarily release the workpiece. Upon the completion of movement of the actuating rod 82, pressure will build up in the line 85*a* and will actuate the actuating rod 73 in a leftward direction, thus returning the slide frame 31 to its retracted position illustrated in Fig. 1. The machine thus returns to its inactive position of Fig. 1 and the cycle of operation has been completed.

The means for actuating the valve 100 to cause this cycle of operation are schematically illustrated in the wiring diagram of Fig. 4, wherein current of the desired voltage and from a convenient source enters the circuit through lead lines 101 and 102. A manual off-on switch 103 is provided in the lead line 100 and branch leads 104 and 105 connect the lead line 101 to the opposite sides of a dual action selector switch 106. When the switch 106 is in its "auto" position, indicating automatic operation, the switch connects the line 105 to a line 107 which leads to a press switch 108 which is closed, to the position shown in Fig. 4, whenever the press operation has ceased and the press is open. When the press is operating, or in its closed position, the switch 108 is open.

From the switch 108, a line 109 leads to a normally closed limit switch 110 which is connected through a circuit relay 111 to the other lead line 102. The circuit relay 111 is effective to operate contacts 112 connected to the lead line 101 through conductor 113 and through the coil windings 114 of a solenoid having a coil 115, to the other lead line 102. The solenoid core 115 actuates the valve 100, when the windings 114 are energized, and the solenoid core 115 moves the valve 100 to its position to interconnect the fluid lines 96 and 86, as hereinbefore described. When the solenoid windings 114 are de-energized, the valve 100 is moved to its position preferably under spring load to interconnect the pressure line 96 and the fluid flow line 85. Thus, when the circuit of Fig. 4 is set for automatic operation, as illustrated in Fig. 4, and the press is open so as to close the switch 108, the solenoid windings 114 will be energized, the valve 100 will be moved to its position to actuate the apparatus 15 to retract a workpiece from the press.

Further, it will be noted that the relay 111 and the contacts 112 in effect form a holding circuit to retain the solenoid energized even though the switch 108 may be opened by the return of the press to its actuated or closed position. This holding circuit is completed from the lead line 101 through a conductor 117 and additional relay contacts 116 which, through a conductor 118, by-passes the press switch 108 to retain current flow through the relay 111 and the limit switch 110. However, upon opening of the limit switch 110, the relay 111 is de-energized, the contacts 112 will be opened, the solenoid windings 114 will be de-energized and the solenoid core 115 will return to position valve 100 in such a manner as to interconnect the lines 96 and 85.

This limit switch 110 is carried by the fixed frame 16 and is indicated generally at 110 in Fig. 1. The limit switch 110 has an actuating arm 110*a* which is adapted to be abutted by the return cut-off cam 48 when the carriage or movable frame member 31 approaches its fully extended position. The opening of the switch 110 will de-energize the solenoid windings 114 as hereinbefore described, and the press material handling apparatus will be returned to its position in Fig. 1, as hereinbefore described.

For manual operation, the switch 106 is merely actuated to close the circuit between branch line 104, and conductor 120 which passes through a push-button switch 121 and a conductor 122 to the limit switch 110 and the relay 111 as hereinbefore described. Thus, the manual operation merely by-passes the press switch 108, and the same cycle will be performed as hereinbefore described, with the exception that the cycle will be manually initiated.

It will thus be appreciated that the present invention provides a new and novel material handling apparatus for a press or a similar production machine. Although the specific embodiment of the invention illustrated in the drawings shows an apparatus for removing workpieces from a press, it would be appreciated that the same principles may be applied and the same structure utilized for the feeding of parts to a press or similar machine.

The extreme simplicity of the control mechanism for the device of the present invention will be readily evident. The utilization of a simple hydraulic control valve, and the extremely simple control circuit which is provided for the control of this valve result in an inexpensive, extremely simple, practically foolproof construction.

The advantages of suspending the entire apparatus from a single overhead support will be readily appreciated by those skilled in the art, and these advantages are specifically illustrated in Figs. 8, 9, and 10. In Fig. 8, the device is suspended independently of a press P by supporting the support element 25 upon a pair of uprights or stanchions 125 displaced to either side of a conveyor C and, if desired, forming a part of the conveyor supporting structure. In Fig. 9, the device is illustrated as being supported upon an arm 126 extending laterally from the press P and carrying the support member 25 in such manner as to dispose the device 15 over the conveyor belt C. In Fig. 10, the device 15 is supported upon an overhead arm 127 depending from an upward portion of the press P and effective to dispose the device over the conveyor belt C. In each of the Figs. 8–10, inclusive, the device is shown schematically with the gripping mechanism extending into the press in position to retract a workpiece therefrom. Retraction of the gripping mechanism and the release thereof will deposit the workpiece upon the conveyor belt C for removal from the press location.

Another important advantage resides in the use of the stamped slides 16 and 31. The relatively light slides reduce the inertia factor so that there is no substantial inertia load imposed upon the pneumatic actuating system either in starting or stopping relative movment at either end of the stroke. This low inertia factor will be particularly appreciated by those skilled in the art and familiar with the grave inertia problems involved in the actuation and use of the prior art devices using massive and heavy cast or fabricated structural elements.

While a preferred embodiment of my invention has been disclosed and described above in detail, it will be understood that numerous modifications might be resorted to without departing from the scope of my invention as defined in the following claims.

We claim:

1. A handling apparatus for sheet material or the like comprising a fixed frame, a movable frame carried by said fixed frame for relative translatory movement, a carrier frame carried by said movable frame for relative translatory movement and having means for engaging

a workpiece, change-speed gearing means interconnecting said fixed frame and said movable frame, first fluid pressure operated actuating means for energizing said gearing means to effect relative movement between said movable frame and said fixed frame, second fluid pressure operated actuating means for effecting relative movement between said carrier frame and said movable frame, and control means for said first and second actuating means, including a source of fluid under pressure and valve means for simultaneously introducing fluid from said source into both of said actuating means, said second actuating means being first actuated because of the lighter loads imposed thereon due to said change speed gearing.

2. In a handling apparatus for a press or the like, a pair of relatively telescopically movable elements, first actuating means for effecting relative telescopic movement of said elements in either direction, work piece engaging means guided by one of said elements for reciprocatory movement relative thereto, second actuating means for effecting relative movement of said engaging means and said one element, and control means for said actuating means including a control valve and valve operating means responsive to relative movement of said elements in one direction to move the valve so that the differing effective loads on the actuating means will cause actuation of said second actuating means and then of said first actuating means without additional valve movement.

3. In a handling apparatus for a press or the like, a pair of relatively telescopically movable elements relatively extensible toward and retractable from the press, first actuating means for effecting relative movement of said elements and including overspeed gearing operatively interposed between said elements, gripping means guided by one of said elements for reciprocatory movement toward and away from the press, second actuating means for effecting movement of said gripping means, and control means for sequentially operating said first and second actuating means, said first actuating means being subjected to an effective working load substantially greater than that to which the second actuating means is because of the presence of said overspeed gearing, whereby upon the subjection of both actuating means to the same pressure, the second actuating means initially moves the gripping means toward the press and the first actuating means then relatively retracts the elements from the press.

4. A handling apparatus for sheet material or the like comprising a fixed frame, a movable frame carried by said fixed frame for relative translatory movement, a carrier frame carried by said movable frame for relative translatory movement and having means for engaging a work piece, overspeed gearing interconnecting said fixed frame and said movable frame, first fluid pressure operated actuating means for energizing said gearing means to effect relative movement between said movable frame and said fixed frame at the mechanical disadvantage of said overspeed gearing, second fluid pressure operated actuating means for effecting relative movement between said carrier frame and said movable frame, and a control valve for simultaneously introducing fluid from a source of fluid pressure into both of said actuating means, said second actuating means being first actuated because of the lighter effective load imposed thereon due to said overspeed gearing.

5. An apparatus for use in handling a work piece for a press comprising a pair of relatively telescopically movable elements, means for suspending one of the elements adjacent the press, the other of said elements being reciprocable with respect to the one element and the press in a plane substantially parallel to the working plane of the press, work piece engaging means carried by said other element for reciprocatory movement relative thereto and for movement therewith in substantially the working plane of the press, reciprocation of said engaging means with said other element bodily displacing a work piece in the working plane of the press, and reciprocation of said engaging means with respect to said other element effecting selective engagement and release of a work piece by said means, and separately energizable actuating means for effecting movement of said other of said elements and said engaging means respectively, said actuating means including an overspeed gear set having a reaction member on said one element, an output member on said other element, and an input member interposed between the reaction member and the output member for engagement therewith, first fluid pressure means for operating said input member, second fluid pressure means for reciprocating said engaging means, and a control valve for venting pressure fluid to said first and second fluid pressure means, said second fluid pressure means being first actuated due to the interposing of said overspeed gearset between said first fluid pressure means and said other element.

6. A handling apparatus for sheet material or the like comprising a fixed frame, a movable frame carried by the fixed frame for relative translatory movement, a carrier frame carried by said movable frame for relative translatory movement and having means for engaging a work piece, overspeed gearing including a reaction gear on said fixed frame, an output gear on said movable frame, and an input gear interposed between the reaction and the output gears, first fluid pressure operated actuating means for energizing said input gear to effect relative movement between said movable frame and said fixed frame at a mechanical disadvantage because of said overspeed gearing, second fluid pressure operated actuating means for effecting relative movement between said carrier frame and said movable frame, and control means for said first and second actuating means including a source of fluid pressure and a valve interposed between the source and both of said actuating means, said second actuating means being first actuated due to said overspeed gearing to effect relative movement between the carrier frame and the movable frames, and the first actuating means being actuated only after the relative carrier frame and movable frame movement is complete.

7. An apparatus for handling a work piece for a press or the like comprising a pair of relatively telescopically movable elements, work piece engaging means guided by one of said elements for relative translatory movement, first telescopic piston and cylinder means, an overdrive gear set actuated by the first piston and cylinder means and including an output gear on one of said elements, a reaction gear on the other element, and an input gear driven by said first piston and cylinder means, a second telescopic piston and cylinder means connected between said one element and said engaging means, and control means including a control valve movable to a pair of positions and interposed between a source of fluid pressure and both of said piston and cylinder means, and valve operating means responsive to relative movement of said elements for moving said valve from one position to another position, said first piston and cylinder means being movable only after completion of movement of the second piston and cylinder means when the valve is moved to either of its positions.

References Cited in the file of this patent

UNITED STATES PATENTS

394,420	Wellman	Dec. 11, 1888
412,851	Kennedy et al.	Oct. 15, 1889
479,883	James	Aug. 2, 1892
807,118	Kelly	Dec. 12, 1905
1,550,907	Lacke	Aug. 25, 1925
2,324,817	Bratley	July 20, 1943
2,609,776	Sahlin	Sept. 9, 1952
2,725,154	Hendricks	Nov. 29, 1955
2,763,229	Sahlin	Sept. 18, 1956