June 3, 1930. E. L. DONNELLY 1,761,881

AUTOMATIC SHEET STACKER

Filed Oct. 31, 1928 4 Sheets-Sheet 1

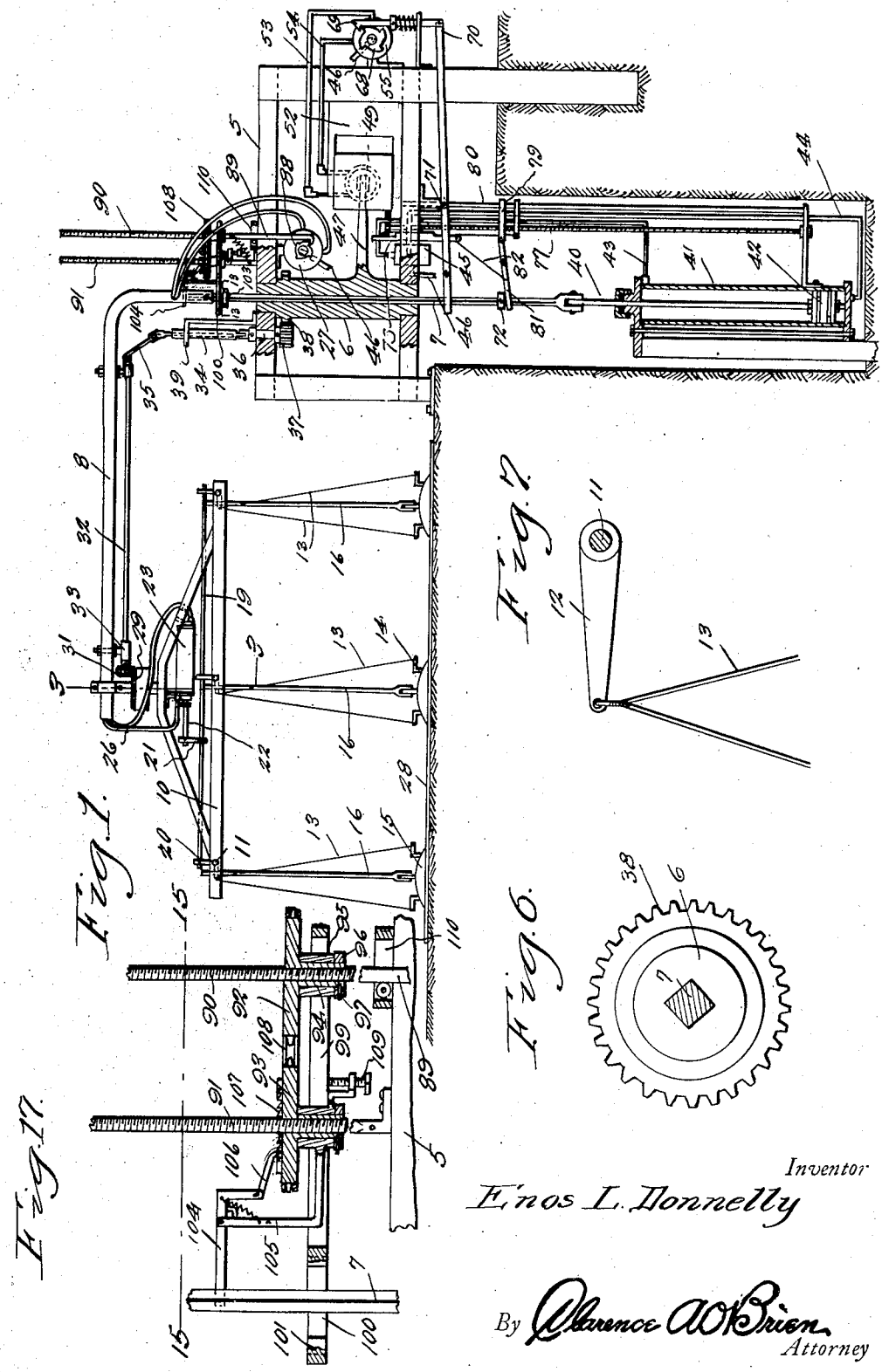

Fig. 1.

Fig. 2.

Fig. 6.

Fig. 11.

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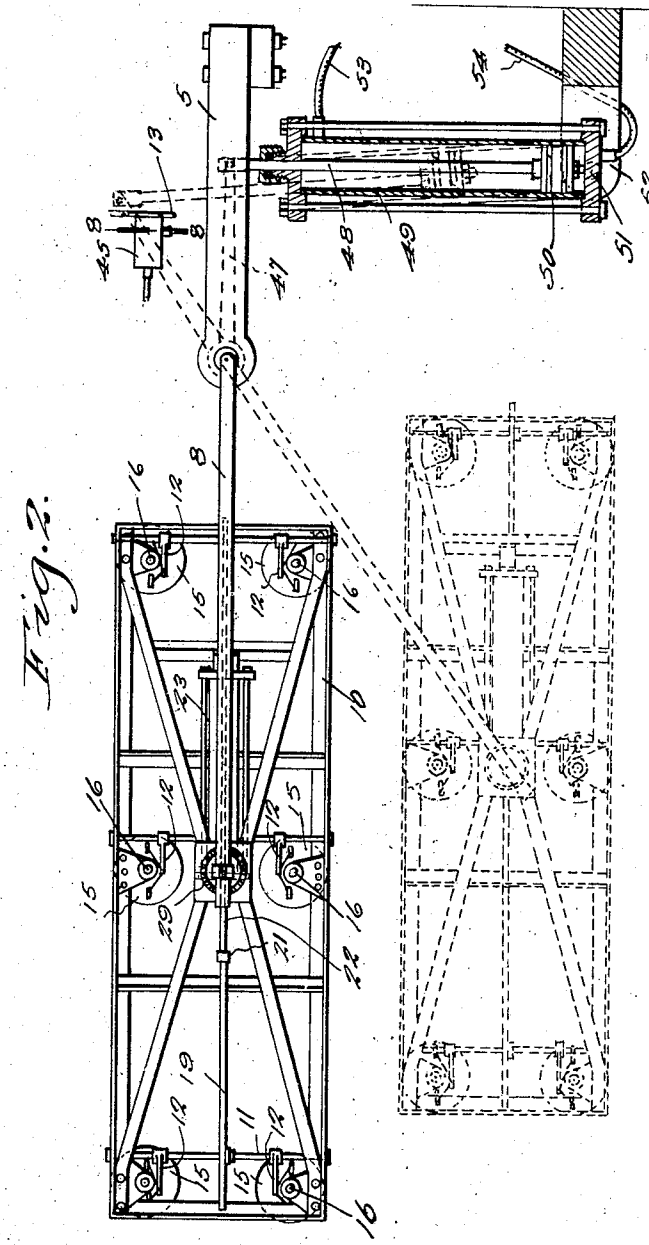

Fig. 2.

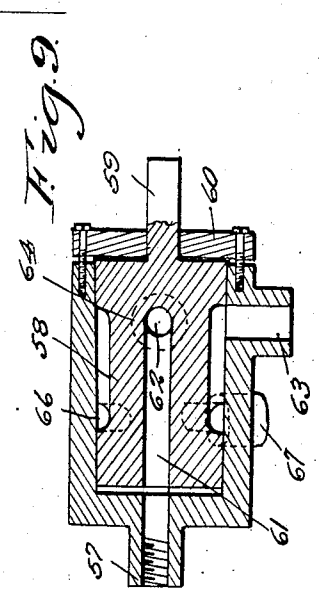

Fig. 9.

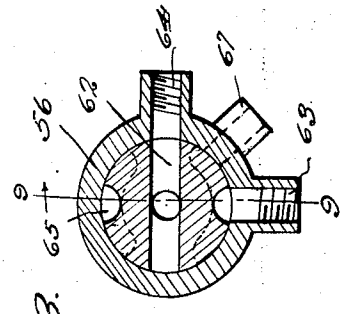

Fig. 8.

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AUTOMATIC SHEET STACKER

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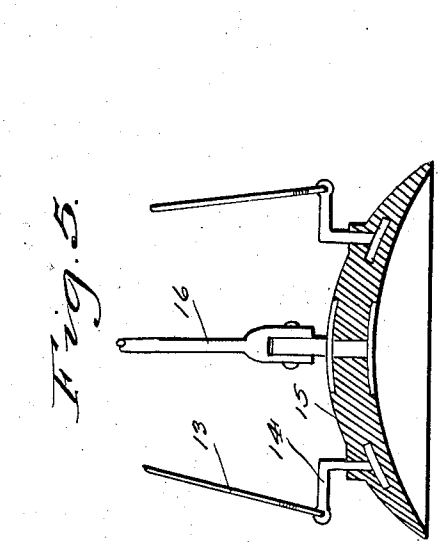


Fig. 5.

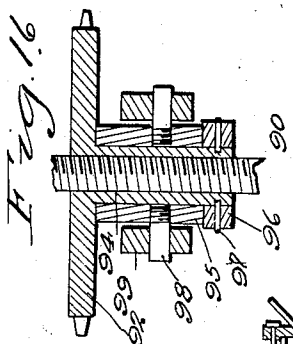


Fig. 16.

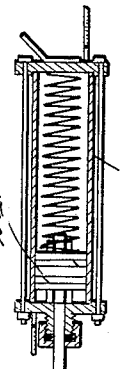
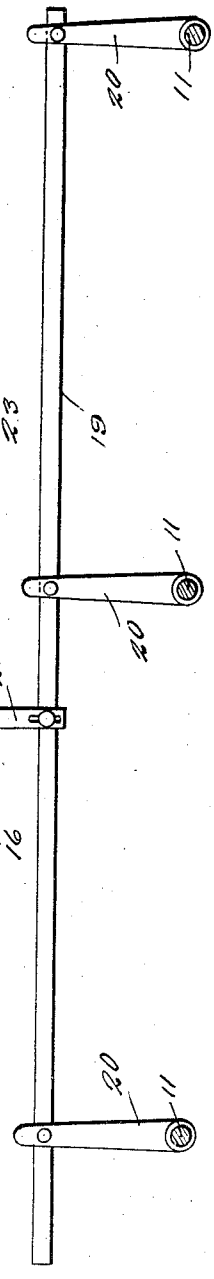


Fig. 4.



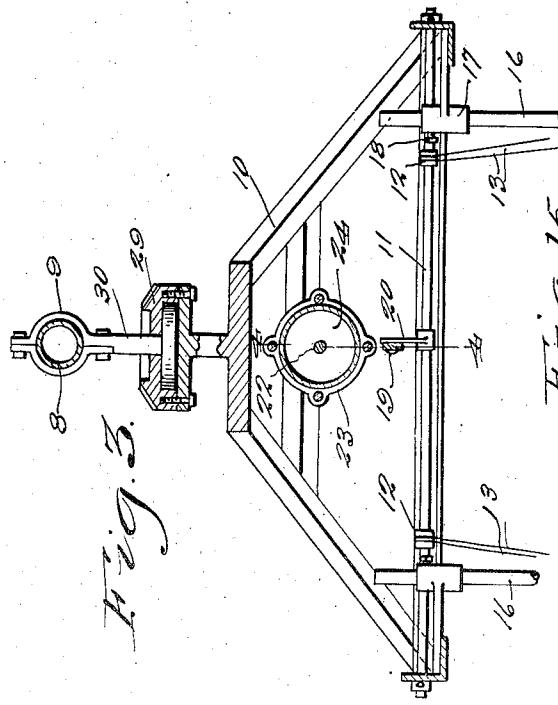


Fig. 3.

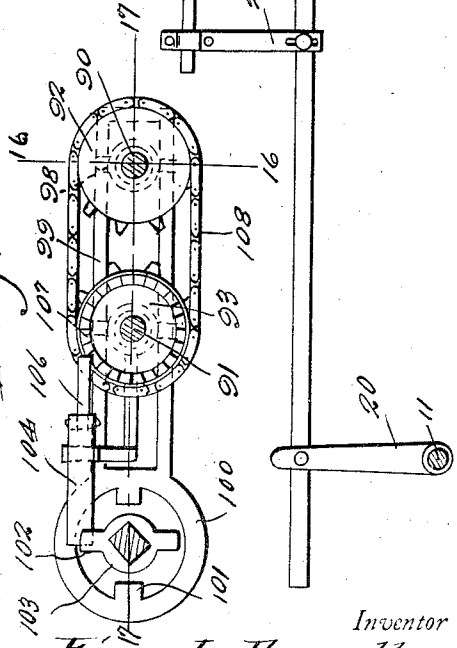


Fig. 15.

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Fig. 15.

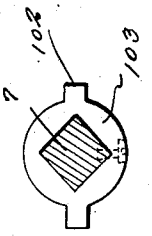


Fig. 14.

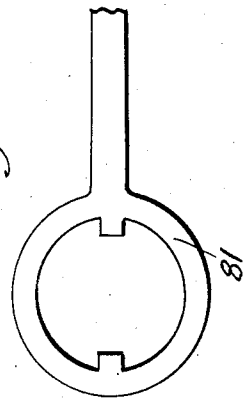


Fig. 12

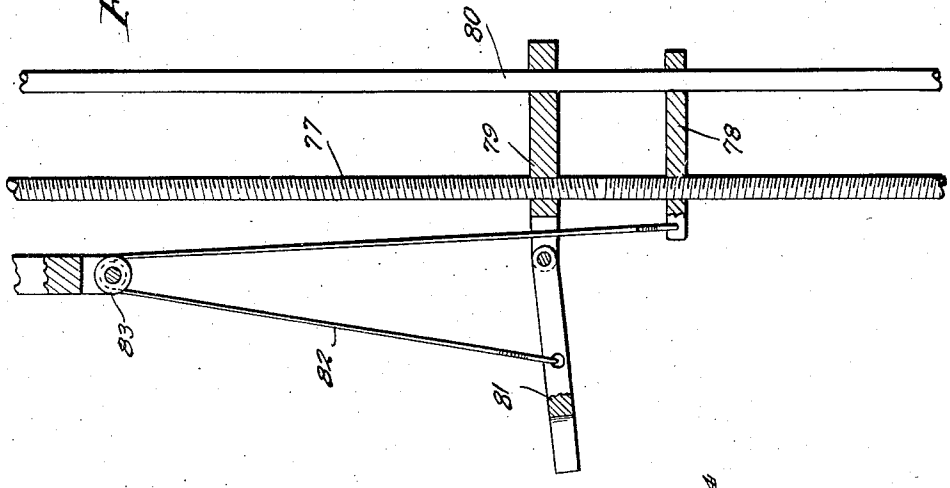


Fig. 10.

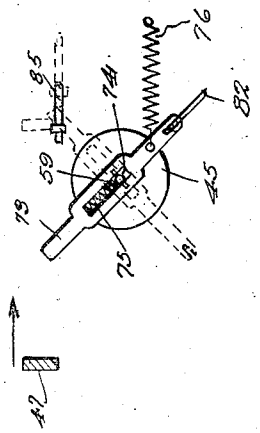
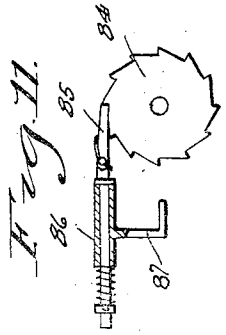


Fig. 11.



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UNITED STATES PATENT OFFICE

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AUTOMATIC SHEET STACKER

Application filed October 31, 1928. Serial No. 316,247.

The present invention relates to automatic sheet stackers designed particularly for use in the sheet metal industry where sheets of material are to be moved from one stack to another, or in feeding sheets from a stack to the rolling mill or the like and removing the sheets from the mill and stacking the same.

One of the important objects of the invention is to provide an apparatus of this character embodying means for engaging the uppermost sheet of the stack and lifting, swinging and lowering the same while maintained in a horizontal position, the position of the sheet when lowered, being parallel to its original position, the mechanism provided for accomplishing such movement of the sheet being automatic in its operation.

A further important object of the invention is to provide a set of vacuum cup sheet metal gripping members adapted upon engagement with the sheet for lifting and moving the same together with means for automatically releasing the sheet upon a predetermined movement of the apparatus.

Another important object is to provide a stacker arm mounted for vertical and horizontal swinging movement and providing said arm and said control means for the vacuum cup with an automatic adjusting apparatus whereby to automatically adjust the extent of vertical movement of the arm as well as the interval between each releasing action of the cup in accordance with the increase or decrease of the stack of sheet material.

A further important object of the invention is to provide an apparatus of this character arranged for operation by fluid pressure.

Other objects and advantages reside in the special construction, combination and arrangement of the various elements forming the invention as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a view in side elevation of the apparatus in assembled position, and with parts broken away and in section,

Figure 2 is a top plan view of the stacker arm and associated mechanism,

Figure 3 is a vertical transverse sectional view through the vacuum cup supporting frame, taken substantially along a line 3—3 of Figure 1.

Figure 4 is a fragmentary longitudinal sectional view thereof taken substantially along a line 4—4 of Figure 3,

Figure 5 is a vertical sectional view through one of the vacuum cups,

Figure 6 is a sectional view through the stacker arm showing the gear provided for retaining the sheet in parallel position during swinging of the arm,

Figure 7 is a fragmentary detail of one of the hangers for the vacuum cup,

Figure 8 is a transverse sectional view through one of the control valves, taken substantially along a line 8—8 of Figure 2,

Figure 9 is a longitudinal sectional view through the valve, taken along a line 9—9 of Figure 8,

Figure 10 is a detail of the pivoted arm actuating one of the valves through the vertical movement of the stacker arm,

Figure 11 is a detail of the pawl and ratchet mechanism for the vertical adjusting screw for controlling the extent of vertical movement of the stacker arm,

Figure 12 is a fragmentary elevational view, with parts broken away and shown in section, of the vertical adjusting screw and pivoted valve control lever carried thereby,

Figure 13 is a detail of the stop member associated with the vacuum cup release control mechanism,

Figure 14 is a detail of the control member associated with the vacuum cup release mechanism,

Figure 15 is a plan view of the automatic adjusting mechanism for the vacuum cup release means,

Figure 16 is a sectional view through one of the socket wheels thereof, taken along a line 16—16 of Figure 15, and

Figure 17 is a vertical sectional view through the automatic adjusting mechanism

for the releasing of the vacuum cup, taken along a line 17—17 of Figure 15.

Referring now to the drawings in detail, for the purpose of illustration the invention is shown mounted in operative position for removing a sheet of material, such as sheet metal, from one stack to another, although it is to be understood that the apparatus is equally well adapted for use in connection with coal rolling mills for feeding the sheets of metal from the stack to the mill and for removing the sheets from the mill and stacking the same.

The apparatus in its present embodiment includes a frame 5 within which is journalled a vertically disposed shaft 6 having a bore of square shape in cross section extending therethrough and within which is slidably mounted a square shaped standard 7. To the upper end of the standard 7 is attached a tubular horizontal arm 8 to the outer end of which is attached a clamping member 9 providing means for suspending a substantially rectangular shaped vacuum cup supporting frame 10.

The frame 10 is horizontally disposed as clearly illustrated in Figure 1 of the drawings and is provided with a plurality of rock shafts 11 extending transversely of the frame upon each of which is secured a plurality of laterally extending arms 12 with cables 13 attached at their outer ends and secured to vacuum cup releasing levers 14 arranged adjacent the edges of a series of vacuum cups 15, of a construction well known in the art, said cups being suspended from the frame 10 by vertical rod 16. By forcing the center of the cups downwardly by the downward movement of the frame 10, the cups will be flattened out upon the surface of the sheet of material. Accordingly by releasing the cables 13 of any upward pull and allowing the cups to return to their normal position upon the upward movement of the frame, a vacuum will be created at the under side of the cup causing the edges thereof to grip the material for lifting the same. The releasing of the cup will be accomplished by raising the frame 10 while retaining the cup in a flattened condition by the proper manipulation of the cable 13.

The vacuum cup 15 may be adjusted vertically with respect to the frame by means of socket 17 carried by the frame and through which the upper ends of the rod 16 are slidably inserted and retained in position therein by set screws 18.

The rock shafts 11 are connected for uniform movement by a longitudinally extending tie rod 19 connected to the shafts through levers 20, said tie rod being provided with an upwardly extending arm 21 to the upper end of which is secured the outer end of a stem 22 inserted through one end of a cylinder 23 carried by the frame, and with its inner end attached to a piston 24 operatively arranged within said cylinder.

The piston 24 is operated by a fluid pressure, preferably compressed air, admitted into the opposite end to the cylinder 23 through air hose 26 extending through the tubular arm 8 and extending to a control valve 27. This control valve is of a two-way construction so as to alternately admit air into the opposite end of the cylinder for reciprocally actuating the piston.

Upon the movement of the piston in one direction the tie rod 19 is actuated so as to partially rotate each of the rock shafts 11 and through their connection with the vacuum cup releasing levers 14 to break the vacuum and permit disengagement of the cup from the sheet of material, indicated at 28 in Figure 1 of the drawings. The movement of the piston in the opposite direction permits a return of the cups to their normal position for gripping the sheet of material and hoist the same upon the vertical movement of the standard 7 in a manner to be presently explained.

In order that the sheet may be moved from one position to another, in parallel relation, the upper portion of the frame 10 is provided with a bevel gear 29 rotatably mounted on a hanger 30 depending from the clamp 9 and from which gear the frame 10 is suspended. The bevel gear 29 is operated through a pinion gear 31 attached to a shaft 32 journaled in bearing brackets 33 carried by the arm, said shaft being disposed parallel thereto.

The inner end of the shaft 32 is connected to a vertically disposed telescoping shaft section 34 through a universal coupling 35, the lower portion of the telescoping shaft section indicated at 36 being journaled in the frame 5 and is provided at its lower end with a pinion gear 37 operable through a gear 38 formed on the shaft 6.

The upper member of the telescoping shaft section 34 is slidably disposed in a guide bracket 39. It will be apparent from the foregoing that the rotary movement of the shaft 6 for swinging the arm 8 will be transmitted to the frame 10 so as to rotate the frame in a direction opposite from the swinging movement of the arm and thus maintain the same in parallel relation with respect to the sheets of material to be stacked. At the same time the telescoping sections of the shaft permits the gears to be maintained in constant engagement during the vertical movement of the arm.

The lower end of the standard 7 is attached to the outer end of a vertically disposed piston rod 40 extending through one end of a cylinder 41 and having a piston 42 attached at its lower end and operatively arranged in said cylinder. Air hose or pipes 43 and 44 are connected respectively at the upper and

lower ends of the cylinder and extend to a control valve 45 to which a feed pipe 46 is attached and connected with a suitable supply of air under pressure (not shown).

This control valve 45, like the control valve 27, is adapted to alternately feed air into the opposite end of the cylinder for reciprocally actuating the piston 42 and thus raise and lower the frame 10 through the standard and arm 7 and 8 respectively.

An arm 47 extends radially from one side of the shaft 6 to the outer end of which is pivotally attached the outer end of a piston rod 48 extending through one end of a cylinder 49 and with its opposite end attached to a piston 50 operatively arranged within said cylinder.

The end of the cylinder 49, remote from the arm 47, is pivotally mounted upon a pair of trunnions 51 supported on a bracket 52 attached to the frame 5. The cylinder 49 is horizontally disposed, as clearly illustrated in Figures 1 and 2 of the drawings and is also connected at its opposite ends with air hose 53 and 54 communicating with a control valve 55.

This control valve 55 is likewise adapted to alternately admit compressed air into the opposite ends of the cylinder 49 for reciprocally actuating the piston 50 therein and thus to rock the shaft 6 through the connection of the piston with the arm 47. In this manner provision is made for the forward and backward swinging of the arm 8 in a horizontal plane.

The construction of the control valves 27, 45 and 55 is illustrated in detail in Figures 8 and 9 of the drawings. Each of the valves include a cylindrical casing 56 having a connection 57 at one end for attaching a feed pipe extending to a suitable source of air under pressure.

A rotor 58 is operatively mounted within the casing having a stem 59 extending outwardly through the cover plate 60 of the casing disposed at the end thereof opposite from the connection 57.

The end of the rotor adjacent the air intake connection 57, is formed with a central bore 61 communicating with said connection, said bore terminating within the rotor in a pair of oppositely extending air passages 62. The air passages 62 extend laterally through the walls of the rotor and are adapted to communicate selectively with connections 63 and 64 formed in the walls of the casing at angles of ninety degrees with respect to each other and to which the air hose leading to the opposite ends of the cylinders are respectively attached.

At diametrically opposite sides of the rotor 58 is a pair of longitudinally extending grooves 65 terminating at one end in a circumferentially extending groove 66, each of said circumferential grooves extending only part way about the surface of the rotor. An exhaust port 67 is formed in the casing 56 in a position for communicating with the respective grooves 66 upon a predetermined positioning of the rotor and when either of the grooves 65 are in a position for communication with either of the connections 63 or 64.

As will be clearly observed from an inspection of Figure 8 of the drawings, the grooves 65 are arranged in position upon the rotor at angles of ninety degrees with respect to the lateral passages 62 so that when one of the lateral passages is in communication with one of the connections 63 or 64, one of the grooves 65 will be in communication with the other of said connections.

Thus when one air hose of the respective cylinders is in communication with the feed pipe connection 57, the other air hose is in communication with the exhaust or discharge port 67 so that the air from the discharge end of the piston will be permitted to discharge into the atmosphere.

To the stem 59 of the control valves 27 and 55 is attached a ratchet 68, the ratchet 68 of the valve 55 being operatively engaged by a pawl 69 operated through a lever 70 pivotally attached intermediate its ends at 71 to a portion of the frame 5 and with the end of the lever remote from the pawl terminating adjacent the standard 7 for engagement by a stop 72 adjustably carried on the standard for actuating the lever upon the upward movement thereof.

It will be observed from an inspection of Figure 1 of the drawing that the ratchet 68 is of a saw toothed construction whereby to provide for a quarter revolution of the rotor 58 of the valve upon each upward movement of the standard 7.

Accordingly each time the standard is raised the piston 50 in the cylinder 49 is actuated for swinging the arm in either a forward or reversed direction, as the case may be.

The control valve 45 for controlling the vertical movement of the standard 7 has the stem of its rotor provided with an arm 73, illustrated in detail in Figure 10 of the drawing, which extends transversely of the valve casing with its ends protruding at opposite sides thereof.

The stem 59 of the valve rotor is inserted in a slotted opening 74 of the arm to permit transverse sliding movement of the arm and is urged in one transverse direction by a spring 75 interposed in the slotted opening between the end thereof and said stem.

As illustrated in Figure 1 of the drawings, the arm 73 extends in a generally vertical direction with its upper end disposed in the path of movement of the arm 47 of the gear 6. Accordingly during the movement of the arm 47, the same will engage the upper end of the arm 73 so as to actuate the valve and moving

the rotor thereof in one position for admitting air to one end of the cylinder 41.

At the completion of the movement of the arm 47, for effecting a swinging movement of the stacker arm 8 from one of its extreme positions to the other, the arm 47 rides over the end of the arm 73 and the latter arm is then returned to its original position by a spring 76. Through this action the valve is then returned to its original position for admitting the air into the opposite end of the cylinder 41 whereby to actuate the piston 42 and alternately raise and lower the standard 7.

In order to regulate the extent of vertical movement of the stacker arm, in accordance with an increase or decrease in the size of the stack of the sheets, an automatic adjusting mechanism is provided for limiting such vertical movement of the stacker arm by actuating the valve at greater or more frequent intervals.

This adjusting mechanism comprises a vertically disposed screw 77 having its upper and lower ends reversedly threaded, as clearly illustrated in Figure 12 of the drawing and upon the lower end of which is threaded a block 78 and with a similar block 79 threaded on the upper portion thereof, the blocks thus being adapted for opposite vertical movement upon the rotation of the screw.

One end of each of the blocks is provided with a vertical opening through which a guide 80 is inserted permitting vertical sliding movement of the block on the guide, the guide serving to prevent rotary movement of the block during the rotation of the screw.

A trip 81 is pivotally attached to the upper block 79 and to which is attached one end of a cable 82 extending upwardly over a pulley 83 carried at the lower end of the arm 73 and extending downwardly with its opposite end attached to the lowermost block 78.

At the upper end of the screw 77 is arranged a ratchet wheel 84 with which a pawl 85 is operatively engaged and slidably mounted in a guide 86 secured to the frame by a bracket 87 and with one end arranged in the path of movement of the upper end of the arm 73 as clearly illustrated in Figure 10 of the drawings.

Accordingly upon each movement of the arm 73 in a direction toward the pawl, the ratchet wheel 84 associated therewith will be actuated for rotating the screw 77 and effecting an adjustment of the blocks 78 and 79 thereon.

The trip 81 is disposed in the path of movement of the stop 72 and adapted for engagement by said stop upon its downward movement. Accordingly upon each downward movement of the standard 7 the trip 81 is moved downwardly and through its engagement with the lower end of the arm 73 operates to return said arm to its original position after being released from the arm 47.

The cable 82 is always maintained in a taut condition through the opposite movement of the blocks 78 and 79 upon the screw and it will be apparent that as the block 79 is adjusted upwardly upon the screw the interval of engagement of the trip by the stop 72 is reduced to effect an earlier return of the arm 73.

The sliding connection of the arm upon the valve permits a disengagement of the arm from the upper horizontal swinging arm 47.

A mechanism is also provided for controlling the releasing action of the vacuum cup 15 through the actuation of the control valve 27 and adapted for adjustment so as to time the releasing action of the cup in accordance with the adjustment in the extent of vertical movement of the stacker arm. This control valve 27 also has its stem provided with a ratchet wheel 88, with which a pawl 89 is operatively engaged and extends vertically of the frame with its upper end formed into a screw 90.

A threaded rod 91 is disposed parallel with the screw 90 with its lower end rigidly secured to the frame 5. Sprocket wheels 92 and 93 are threaded on the screw 90 and rod 91 respectively for vertical adjustment, each of said sprocket wheels having their under side formed with a hub 94 fitted within a sleeve 95 and arranged to permit relative rotary movement between the hub and the sleeve.

The sleeve is retained in position upon the hub by a collar 96 secured to the hub by a set screw 97. Trunnions 98 extend from diametrically opposite sides of the sleeve 95 and are pivotally carried in a pair of spaced parallel frame members 99 disposed at opposite sides of the sleeve.

A ring member 100 is formed at the end of the frame members 99 remote from the pawl 89 and is disposed horizontally so as to permit the free vertical movement of the standard 7 therethrough. A pair of lugs 101 are disposed at diametrically opposite sides at the inner periphery of the ring and are adapted for engagement by a pair of projections 102 formed at diametrically opposite sides of a stop 103 secured to the standard above the frame 5.

The projections 102 are adapted to pass freely through the ring during the vertical movement of the standard 7 when the stacker arm 8 has been swung in one direction and are adapted for engagement with the lugs 101 of the ring during such vertical movement when the stacker arm has been swung into its operative position.

Upon the engagement of the lugs 101 by said projections of the stop the frame composed of the parallel members 99 will be pivotally actuated through its mounting on the rod 99 by the trunnion so as to actuate the pawl 89.

Each movement of the pawl 89 serves to

reverse the position of the control valve 27 whereby to control the engaging or releasing movement of the vacuum cup.

In order to regulate the interval between the reversing action of the cylinder controlling the vacuum cup in accordance with the variation in the extent of vertical movement of the standard, provision is made for vertically adjusting the sprocket wheels 92 whereby to adjust the ring 100 with respect to the stop 103.

For this purpose a bell crank lever 104 is pivoted upon a bracket 105 carried by the sleeve associated with the sprocket wheel 93 and to which lever is operatively attached a pawl 106 engageable with a set of ratchet teeth 107 formed on the upper face of the sprocket wheel 93.

A chain 108 operatively connects the sprocket wheels 92 and 93 for uniform rotation upon the threaded portion of the pawl 89 and rod 91. The bell crank lever 104 is enclosed with one end in the path of movement of the stop 103 so that upon the completion of each vertical movement of the stop the sprocket wheels 92 and 93 will be actuated.

An adjustable stop 109 is carried by one of the sleeves 95 for engaging the under side of the pivoted frame 99 whereby to limit the downward movement of the end of the frame disposed adjacent the pawl 89. The pawl 89 is also slidably extended through a guide 110 to insure the engagement thereof with its associated ratchet wheel.

It is to be understood that the stop 103 is positioned upon the standard 7 so that the projections 102 of the stop will engage the lugs 101 of the pivoted frame for reversing the position of the control valve 27 only upon each complete forward and backward swinging movement of the stacker arm so that the vacuum cup will be released from the sheet of material only when the arm has been swung into position upon the sheets which are being stacked, or in such a position where it is desired to release the sheets.

It will be apparent from the foregoing that by initially positioning the rotors of the respective valves in the proper manner with respect to the compressed air feed pipe extending to the opposite ends of the associated cylinders that the stacker arms will pick up the sheets of material singly, hoist the same and swing the sheets into a predetermined position whereupon the sheets are released from the vacuum cup and the arm is returned to its original position and lowered for repeating the operation.

It is obvious that my invention is susceptible to various changes and modifications in construction without departing from the spirit of the invention or the scope of the appended claims, and I accordingly claim all such forms of the device to which I am entitled.

Having thus described my invention, what I claim as new is:

1. A stacker comprising a rotatable standard mounted for vertical sliding movement, a horizontal stacker arm at the upper end of the standard, independent fluid pressure operating means for the standard and the arm arranged to reversibly actuate the same in their respective movements and automatic control means for said operating means providing for the movement of the standard and the arm in predetermined timed relation, and operable through the movement of said standards.

2. A stacker comprising a vertically and horizontally movable stacker arm, independent fluid pressure operating means for the arm arranged to reciprocally actuate the same in its respective movements and automatic control means for said operating means providing for the various movements of the arm in predetermined timed relation, and operable through the movement of said arm, said operating means comprising cylinders having pressure operated pistons arranged therein and means operatively connecting the same with the arm for the simultaneous vertical and horizontal movement thereof.

3. A stacker comprising a rotatable standard mounted for vertical sliding movement, a horizontal stacker arm at the upper end of the standard, work gripping elements carried at the outer end of the arm, means carried by the arm for releasing said gripping means from the work, independent fluid pressure operating means for the standard, for said arm and for said releasing means arranged to actuate the same in a predetermined timed relation and automatic control means for said operating means, said control means being operatively associated with the arm and responsive to a predetermined movement of the arm.

4. A stacker comprising a vertically and horizontally movable stacker arm, work gripping elements carried at the outer end thereof, means carried by the arm for releasing said gripping means from the work, independent fluid pressure operating means for the arm and said releasing means arranged to actuate the same in a predetermined timed relation and automatic control means for said operating means, and operable through the movement of the arm, said operating means for said arm and said work releasing means comprising cylinders having pressure operated pistons arranged therein, said arm operating means being operatively connected with the arm for the simultaneous vertical and horizontal movement thereof.

5. A stacker comprising a vertically and horizontally movable stacker arm, work engaging means carried by said arm, work releasing means carried by the arm and operatively connected with the engaging

means, fluid pressure operated means for the arm, automatic control means for said operating means operable to reverse the operation thereof, means carried by the arm operable through a predetermined movement thereof for actuating said control means and means for maintaining the work engaging means in a parallel position with the stacked work during the movement of the arm.

6. A stacker comprising a vertically and horizontally movable stacker arm, work engaging means carried by said arm, work releasing means carried by the arm and operatively connected with the engaging means, fluid pressure operating means for the arm and said work releasing means, automatic control means for said operating means and operable through a predetermined vertical movement of the arm and means for maintaining the work engaging means in a parallel position with the stacked work during the movement of the arm, said paralleling means comprising a gear operable through the horizontal swinging movement of the arm, a gear carried by said work engaging means and a flexible shaft carried by the arm having pinion gears at each end operatively connected with said first named gears.

7. A stacker comprising a vertically and horizontally movable stacker arm, independent fluid pressure operating means for actuating the arm in its respective movement, automatic control means for said operating means adapted to reverse the operation thereof at predetermined intervals and automatic means for decreasing the interval of the reversing movement of the vertical operating means with each complete movement of the arm.

8. A stacker comprising a vertically and horizontally movable stacker arm, independent fluid pressure operating means for actuating the arm in its respective movement, automatic control means for said operating means adapted to reverse the operation thereof at predetermined intervals and automatic means for decreasing the interval of the reversing movement of the vertical operating means when the arm reaches its predetermined position during its horizontal movement and operable by each successive vertical movement of the arm.

9. A stacker comprising a vertically and horizontally movable stacker arm, independent fluid pressure operating means for actuating the arm in its respective movement, automatic control means for said operating means adapted to reverse the operation thereof at predetermined intervals, work engaging vacuum cups carried by the arm, releasing means for the cups, automatic control means for said operating means and said vacuum cup releasing means, said control means for the operating means being adapted to reverse the operation thereof at predetermined intervals and automatic means for decreasing the interval of the reversing movement of the vertical operating means and in the operation of said releasing means.

10. A stacker comprising a vertically and horizontally movable stacker arm, independent fluid pressure operating means for actuating the arm in its respective movement, automatic control means for said operating means adapted to reverse the operation thereof at predetermined intervals, work engaging vacuum cups carried by the arm, releasing means for the cup, automatic control means for said operating means and said vacuum cup releasing means, said control means for the operating means being adapted to reverse the operation thereof at predetermined intervals and independent means for automatically decreasing the interval of the reversing movement of the vertical operating means and for the operation of said releasing means.

11. A stacker comprising a vertically and horizontally movable stacker arm, independent fluid pressure operating means for actuating the arm in its respective movement, automatic control means for said operating means adapted to reverse the operation thereof at predetermined intervals, work engaging vacuum cups carried by the arm, releasing means for the cup, automatic control means for said operating means and said vacuum cup releasing means, said control means for the operating means being adapted to reverse the operation thereof at predetermined intervals and independent means for automatically decreasing the interval of the reversing movement of the vertical operating means and for the operation of said releasing means, said last named automatic means being operable uniformly by successive vertical movement of the arm when the arm reaches a predetermined position during its horizontal movement.

12. A stacker comprising a vertically and horizontally movable stacker arm, independent fluid pressure operating means for actuating the arm in its respective movement, automatic control means for said operating means adapted to reverse the operation thereof at predetermined intervals, work engaging vacuum cups carried by the arm, releasing means for the cup, automatic control means for said operating means and said vacuum cup releasing means, said control means for the operating means being adapted to reverse the operation thereof at predetermined intervals and independent means for automatically decreasing the interval of the reversing movement of the vertical operating means and for the operation of said releasing means, said last named automatic means being operable uniformly by successive vertical movement of the arm when the arm reaches a predetermined position during its

horizontal movement, and operating means carried by the arm for said last named automatic means and adapted to uniformly actuate the same upon the vertical movement of the arm in one direction.

13. A stacker comprising a vertically and horizontally movable stacker arm, reversible fluid pressure operating means for the arm, automatic control means for said operating means adapted to reverse the operation thereof at predetermined intervals, work engaging vacuum cups carried by the arm, releasing means for the cups, automatic control means for said operating means and vacuum cup releasing means, independent means for automatically decreasing the intervals in reversing movement of the vertical operating means and for the operation of said releasing means, said automatic control means comprising fluid pressure control valves communicating with the operating means for reversing the movement thereof, actuating means for the valves and operating means carried by the arm engageable with said valve actuating means and arranged for operating the valves upon a predetermined movement of the arm.

14. A stacker comprising a vertically and horizontally movable stacker arm, reversible fluid pressure operating means for the arm, automatic control means for said operating means adapted to reverse the operation thereof at predetermined intervals, work engaging vacuum cups carried by the arm, releasing means for the cups, automatic control means for said operating means and vacuum cup releasing means, independent means for automatically decreasing the intervals in reversing movement of the vertical operating means and for the operation of said releasing means, said automatic control means comprising fluid pressure control valves communicating with the operating means for reversing the movement thereof, actuating means for the valve and operating means carried by the arm engageable with said valve actuating means and arranged for operating the valve upon a predetermined movement of the arm, and means connecting the valve actuating means with the automatic reversing and control means for maintaining the same in uniform relative position.

In testimony whereof I affix my signature.

ENOS L. DONNELLY.