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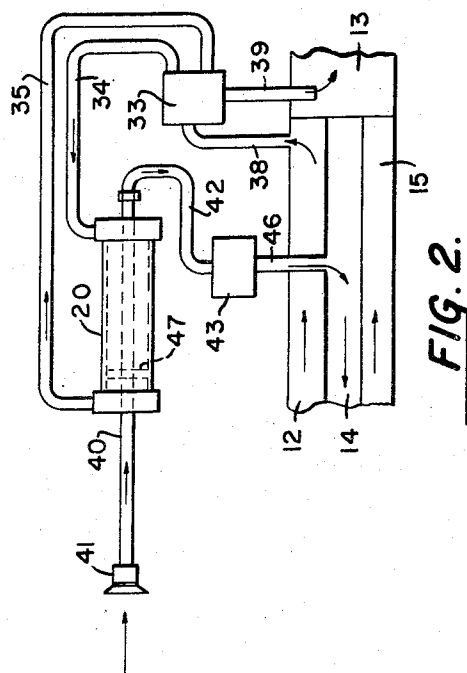
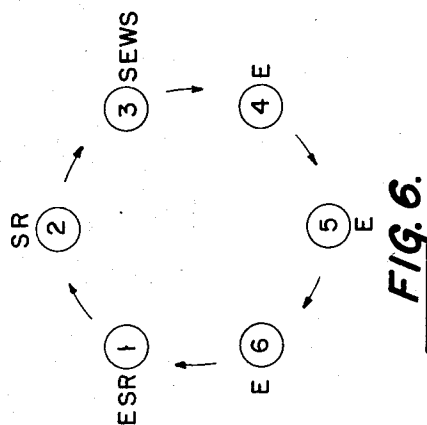
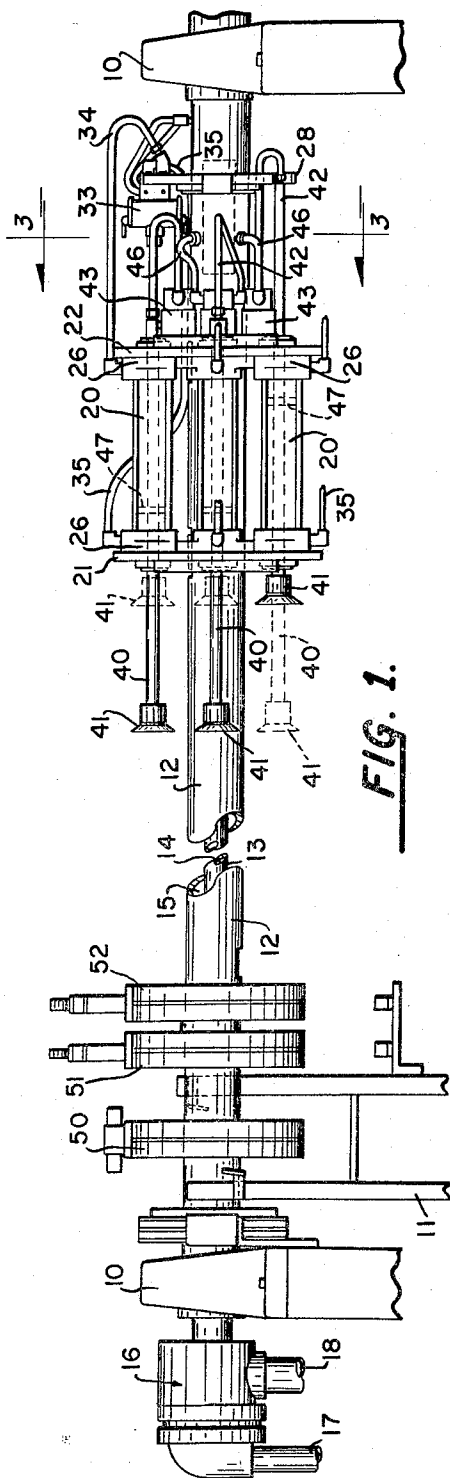
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3,016,153

TRANSFER MECHANISM

Filed June 9, 1958

3 Sheets-Sheet 1



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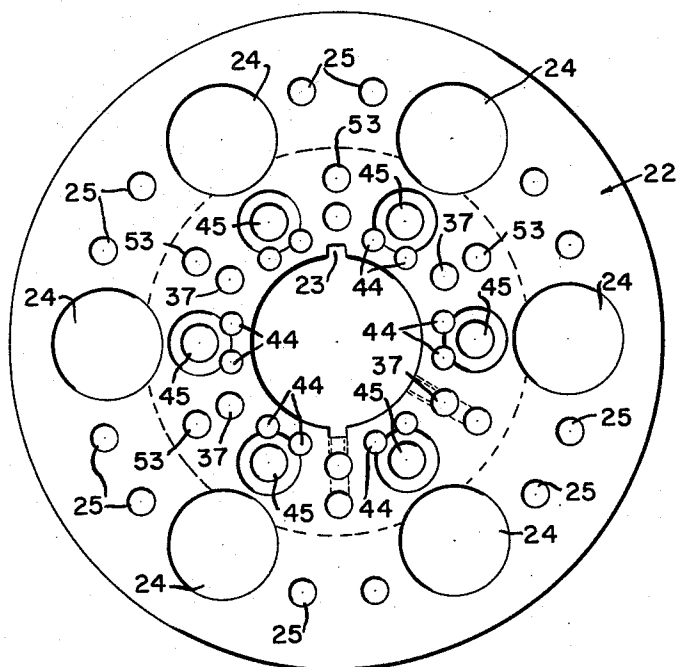
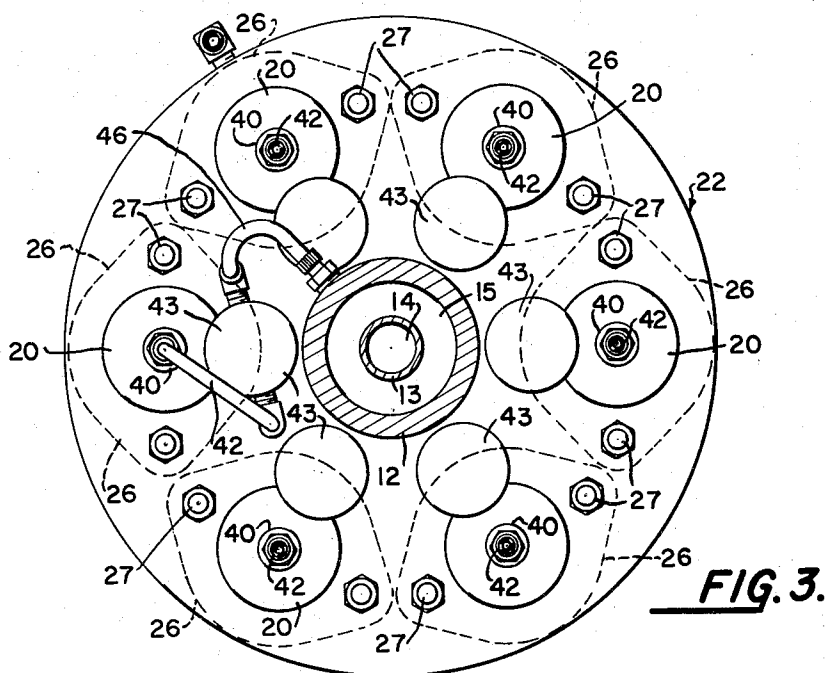
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3 Sheets-Sheet 2



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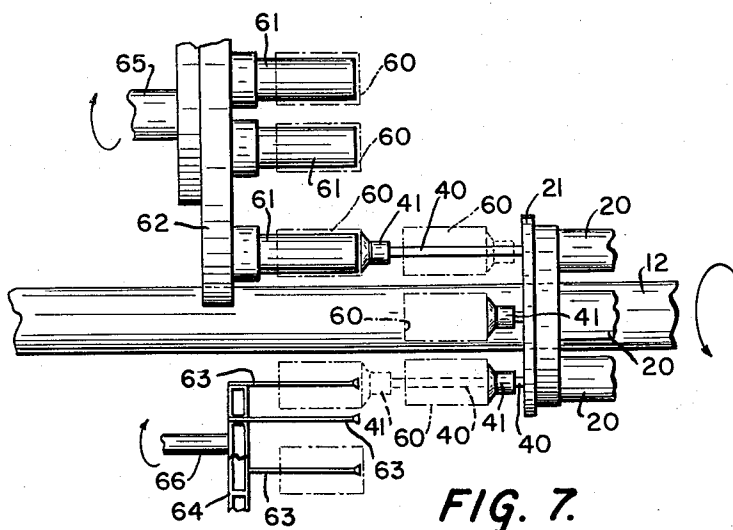
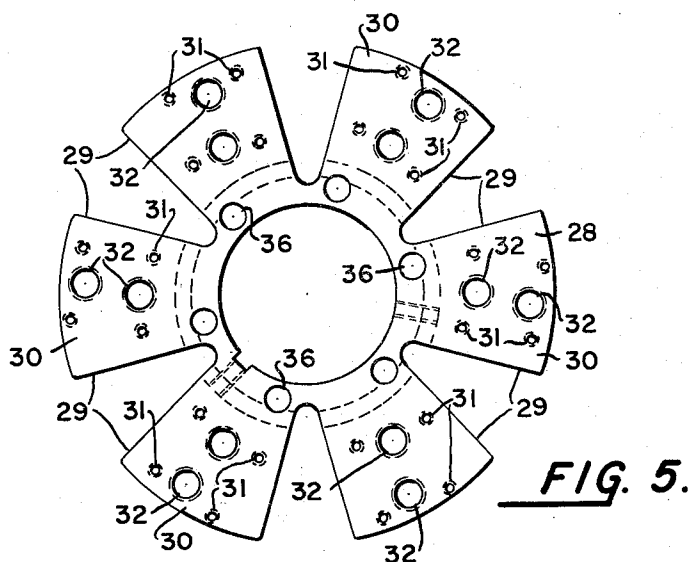
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TRANSFER MECHANISM

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3 Sheets-Sheet 3



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3,016,153

TRANSFER MECHANISM

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5 Claims. (Cl. 214—1)

This invention relates to transfer mechanism for removing cans, tubes and the like from the mandrels of printing or other machines and placing them on a conveyor for subsequent operation thereon.

The main object of my invention is to provide mechanism efficient for its intended purposes, whereby the cans, tubes and the like are transferred, one by one, by engagement of suction means with one end of the can or other article to be transferred, without marring the article or its printed surface.

Another object of the invention is to provide suction cup-carrying hollow piston rods having reciprocatory movement in cylinders which are mounted on a rotated carrier, and means for creating vacuum in said cups.

A novel feature of my invention is the provision of a rotatable hollow shaft on which the cylinder carrier is mounted, the shaft being provided with two separate passageways, one a vacuum passageway communicating with the hollow piston rods and the other a pressurized air passageway for conveying air to the cylinders for reciprocating the piston rods therein.

Other objects and advantages will be apparent from the drawings and following specification.

In the drawings:

FIG. 1 is an elevational side view of transfer mechanism embodying my invention.

FIG. 2 is a diagrammatic view showing one of six cylinders and a suction cup-carrying rod mounted therein, together with the hollow drive shaft and tubes which convey air under pressure from the hollow shaft to and from the cylinder, and the vacuum tube between the hollow drive shaft and the cup-carrying piston rod.

FIG. 3 is a transverse vertical sectional view on an enlarged scale, in the plane of the line 3—3 of FIG. 1.

FIG. 4 is an elevational view of the rearward cylinder carrier plate, detached.

FIG. 5 is a similar view of the air valve carrier, detached.

FIG. 6 is a diagrammatic view indicating the six positions successively occupied by each cup-carrying piston rod.

FIG. 7 is a top plan view of parts of the transfer mechanism, a printing machine from which cans are being removed, and a conveyor on which the cans are being placed for further operation thereon.

In the preferred embodiment of my invention shown in the drawings, the transfer mechanism as a unit is supported on a pair of pillow blocks 10 and a shaft stand 11 on which is rotatably mounted the hollow drive shaft 12. Concentrically mounted within the shaft 12 is a vacuum tube 13 whereby there are provided a vacuum passage 14 surrounded by an air passage 15 as shown in FIGS. 1 and 2. The forward or left hand ends of the shaft 12 and tube 13 are mounted in a rotary pressure joint 16 through which the vacuum passage 14 communicates with a vacuum creating source 17 and the air passage 15 communicates with a pressurized air source 18. The shaft 12 may be rotated by any suitable source of power, not shown.

Six air cylinders 20 are mounted on a front carrier plate 21 and a rear carrier plate 22, keyed to the shaft 12 to rotate therewith. The carrier plates are circular, the rear carrier 22 being shown detached in FIG. 4,

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where the keyway for mounting the carriers on the shaft 12 is indicated at 23. Each of the carriers 21, 22, is provided with six matching holes 24 and twelve matching smaller holes 25 extending therethrough in horizontal alignment. The air cylinders 20 are provided with end flanges 26 whereby they are connected to the proximate faces of the carriers 21, 22 by bolts 27 which extend through the holes 25 as shown in FIG. 3, with the cylinder ends registering with the holes 24. The bolts 27 may be elongated rods extending across the space between the carriers 21, 22, serving not only to connect the cylinders to the carriers but to reinforce the cylinder-carrier unit.

Also mounted on the shaft 12 at the rear or right hand end of the machine and spaced from the carrier plate 22 is a valve carrier 28, shown detached in FIG. 5. This carrier is circular, cut away on the lines 29 to provide spaces between the six equally spaced apart valve carrying members 30. Each member 30 is provided with four holes 31 and two larger holes 32. The holes 31 accommodate bolts which mount six "Bellows Electroaire" valves 33 on the forward face of the carrier 28. The holes 32 accommodate air tubes 34, 35, which extend through the holes from the air valves to the cylinder interiors at opposite ends of the cylinders 20. As shown in FIGS. 1 and 2, the air tube 34 communicates with the air valve 33 and the rearward end of a cylinder 20, and the air tube 35 communicates with the air valve 33 and the forward end of the same cylinder. Six of each of said tubes 34, 35, are required to provide air passages between each of the six valves 33 and opposite ends of each of the cylinders 20 for a purpose to be explained.

Six holes 36 in the valve carrier 28 accommodate the air tubes 35 (FIG. 1). The tubes 35 pass rearwardly, that is to the right, from the air valves 33 through the holes 32 and then are bent to extend forwardly, to the left, to pass through the holes 36 in the valve carrier 28, across the space to the cylinder carrier and through the holes 37 in cylinder carrier 22, to the forward ends of the cylinders. An air tube 38 conveys air from the air passage 15 in shaft 12 to the air valve 33, and an exhaust air tube 39 conveys air from the valve to the passage 15, as shown in FIG. 2.

A hollow piston rod 40 is mounted for reciprocatory movement in each cylinder 20 with ends extending beyond the cylinder end walls. Each rod is provided on its free forward end with a suction cup 41. The opposite rearward end of the rod 40 is connected to a vacuum tube 42 connected at its other end to a vacuum valve 43 known as a "Skinner 3-Way" valve. Six of the vacuum valves 43 are mounted on the rearward face of the cylinder carrier plate 22 by bolts which extend through holes 44 in said plate. The plate is provided with six drilled and counterbored holes 45 to receive the ends of the valves 43. The valves 43 are connected by tubes 46 to the vacuum passage 14 in shaft 12. Since the rods 40 have reciprocatory movement in the cylinders 20, the vacuum tubes 42 between the rods and the vacuum valves are sufficiently long to accommodate the rods 40 in their extended and retracted positions, the excess length (when rods are retracted) being bent and located in the spaces formed by cutting away the valve carrier 28 on the lines 29. The rods 40 have mounted thereon pistons or rings 47 (FIG. 2) within the cylinders 20.

Before explaining the operation of the cup-carrying rods 40 and the functions of the air and vacuum passages and the valves located therein, heretofore described, reference will be made briefly to the electrical switches and indexing means whereby the valves 33 and 43 are controlled. Mounted on the forward or left hand portion of the hollow drive shaft 12 are switch carriers 50, 51, 52,

which rotate with the shaft 12 so that the micro-switches carried thereby are actuated by tripping mechanism (not shown in detail) supported on the stand 11 or other stationary support. The switches are electrically connected to the air and vacuum valves by wiring (not shown) which extends from the switches along the outside of the shaft 12 through holes 53 in carrier 22 to the switches 33, 43. The switch and indexing mechanism may be varied and therefore is not being claimed, per se, herein. Suffice to say that the valves 33 and 43 controlled thereby are actuated as hereinafter explained to reciprocate the rods 40 in the cylinders 20 and to create suction in the cups 41.

The shaft 12 is rotated intermittently, the rotation being interrupted six times during each rotation to provide time for the piston rods 40 of two of the six cylinders to be moved simultaneously, one to extended position and the other to retracted position. The shaft 12 carries with it the switch carriers, the cylinder carriers and cylinders, the vacuum valves 43, and the valve carrier 28 with six air valves 33 mounted thereon. The step by step rotation is such that the shaft 12 is momentarily stationary when the cup 41 on the end of one of the rods 40 is exactly opposite one end of a can or tube 60 on a mandrel 61 of a rotatable frame 62, and the cup 41 on the end of another rod 40 is exactly opposite a pin 63 on the conveyor chain 64 to which the can or tube is to be transferred. In FIG. 7, the mandrels 61 are shown as mounted on a frame 62 which is being rotated in a clockwise direction by shaft 65, and the pins 63 are on a conveyor driven by a sprocket moved clockwise by shaft 66, while the shaft 12 of my transfer mechanism is rotated counter-clockwise.

In FIG. 6, the successive positions of a piston rod 40 and suction cup 41 have been indicated by use of designations: E meaning that the rod is in extended position, S that suction is being applied to the cup 41, WS that suction has been withdrawn, and R that the rod has been retracted. The positions indicated in FIG. 6 constitute one example, but it will be understood that the positions may be varied as required by the relative locations of the can delivering mandrels 61 and the receiving pins 63.

In the particular embodiment shown, in the number 1 position the extended rod and cup have been moved by rotation of the shaft 12 to register endwise with a can 60 on mandrel 61, suction has been created, the can 60 has been engaged by the suction cup, followed by retraction of the rod. From the number 2 position, still retracted and with suction applied, the can is carried by the cup as the shaft 12 rotates to the number 3 position, where the can carrying cup registers endwise with a pin 63. Then the retracted rod is extended so that the can is placed on the pin and suction is withdrawn to release the can from the cup. Further rotation of the shaft 12 moves the extended rod with idle cup first to position 4, then to position 5, then to position 6, whereupon the cycle is repeated. It will be understood that the reciprocatory movements of the rods take place during the intervals when the rotation of the shaft 12 is interrupted.

In the example illustrated and described, the transfer of the can 60 is accomplished in positions 1 and 3, but the relative positions of the can delivering machine, the can receiving machine and the transfer mechanism may be such that the transfer is accomplished in positions 1 and 4, or 2 and 5, or other positions of the cups and rods. The rotation of the shaft 12 is interrupted six times during each revolution. During each revolution of the shaft 12, six cans are transferred from one machine to another. The number of objects transferred during one revolution of the drive shaft 12 may vary, depending on the number of cylinders and suction cup rods employed in the particular embodiment.

The moving of the rod 40 in each cylinder 20 to extended position is produced by pumping air under pressure through passage 15 of shaft 12, tube 38, air valve

33, tube 34 to the rearward end of cylinder 20 where the air pressure exerted against piston 47 causes the rod 40 and cup 41 to move to the left, thereby forcing air out of the forward end of the cylinder through the air tube 35, valve 33, and tube 39 back to passage 15. To retract the rod 40, the air valve 33 is actuated to permit air under pressure to pass through the tube 35 in reverse direction to the forward end of cylinder 20, with exhaust through the tube 38 to the passage 15.

Suction is created in each cup 41 by drawing air through the rod 40, vacuum tube 42, valve 43, vacuum tube 46 and vacuum passage 14. When the valve 43 is closed, no suction is created and the cups are idle. As previously stated, the valves 33 and 43 are controlled by indexing means and the electrical switches on carriers 50, 51, 52. The controls are such that during the time when one piston rod and cup are moved from extended position with cup suctionally engaging a can on the delivering machine, to retracted position, another piston rod and cup are moved from retracted position with cup suctionally held, to extended position to place the can on the receiving machine, whereupon suction is withdrawn. Thus each cup functions during each revolution of the shaft 12 to remove a can from the delivering machine and to place that can on the receiving machine.

From the description of the construction and operation of parts, it will be understood that this transfer mechanism is extremely speedy in operation, due to the fact that only one reciprocation of the cup carrying rod is required for transfer of a can or other article. In prior art machines, the article grasping means is reciprocated to and from the delivering machine to engage the article and is reciprocated again to and from the receiving machine to place the article thereon. In my mechanism, the transfer from the delivering machine to the article receiving machine is achieved by one reciprocation of the cup carrying rod, namely, retraction of the rod after the article has been engaged by the extended cup, and extension of the rod to place the article on the receiving machine.

In describing the invention, reference has been made to a particular example embodying the same, but I wish it to be understood that the invention is not limited to the construction shown in the drawing and that various changes may be made in the construction and general arrangement of parts without departing from the invention.

I claim:

1. Transfer mechanism comprising a rotated hollow shaft, separate concentric pressurized air and vacuum passageways one located within the other in the shaft, a source of pressurized air communicating with the air passageway, means for creating vacuum in the vacuum passageway, a cylinder carrier mounted on the shaft to rotate therewith extending radially from the shaft, a plurality of air cylinders axially parallel to the shaft mounted on the carrier, a hollow piston rod slidably mounted in each cylinder extending beyond opposite ends of the cylinder, a piston fixed on each rod within the cylinder, a suction cup on the forward end of each piston rod communicating with the hollow interior of the rod, an air valve carrier mounted on the shaft and rotatable therewith, a plurality of air valves fixed on the carrier, air tubes connecting the air passageway in the shaft to each air valve, air tubes connecting each air valve to one end of a cylinder, other air tubes connecting the other end of each cylinder to an air valve and each air valve to the air passageway of the shaft, a vacuum valve carrier mounted on the shaft to rotate therewith, and vacuum tubes connecting the vacuum passageway in the shaft to each vacuum valve and each vacuum valve to a piston rod in communication with the interior of the rod, the air tubes alternately admitting pressurized air to a cylinder at opposite sides of the piston to alternately extend and retract the piston rod relatively to its cylinder and move the suction cup into and out of contact with an article to

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be transferred, all of said air tubes and vacuum tubes being carried in annular paths about the axial center of the shaft when the shaft is rotated.

2. Transfer mechanism comprising a rotated hollow shaft, separate concentric pressurized air and vacuum passageways one located within the other in the shaft, a source of pressurized air communicating with the air passageway, means for creating vacuum in the vacuum passageway, a cylinder carrier mounted on the shaft to rotate therewith extending radially from the shaft, a plurality of air cylinders axially parallel to the shaft mounted on the carrier, a hollow piston rod slidably mounted in each cylinder extending beyond opposite ends of the cylinder, a piston fixed on each rod within the cylinder, a suction cup on the forward end of each piston rod communicating with the hollow interior of the rod, valve controlled air tubes connecting the pressurized air passageway of the shaft to opposite ends of each cylinder at opposite sides of the piston therein alternately admitting pressurized air from the shaft to opposite ends of the cylinder to reciprocate the piston rod, a valve controlled vacuum tube connecting the vacuum passageway of the shaft to the rear end of each hollow piston rod in communication with the interior thereof, a first group of valves mounted on the cylinder carrier, a valve carrier fixed on the shaft to rotate therewith and spaced longitudinally of the shaft from the cylinder carrier, and a second group of valves mounted on the valve carrier, each of the valves of one of said groups being connected to an air tube and each of the valves of the other of said groups being connected to a vacuum tube.

3. Transfer mechanism comprising a rotated hollow shaft, separate concentric pressurized air and vacuum passageways one located within the other in the shaft, a source of pressurized air communicating with the air passageway, means for creating vacuum in the vacuum passageway, a cylinder carrier mounted on the shaft to rotate therewith extending radially from the shaft, a plurality of air cylinders axially parallel to the shaft mounted on the carrier, a hollow piston rod slidably mounted in each cylinder extending beyond opposite ends of the cylinder, a piston fixed on each rod within the cylinder, a suction cup on the forward end of each piston rod communicating with the hollow interior of the rod, valve controlled air tubes connecting the pressurized air passageway of the shaft to opposite ends of each cylinder at opposite sides of the piston therein alternately admitting pressurized air from the shaft to opposite ends of the cylinder to reciprocate the piston rod, and a valve controlled vacuum tube connecting the vacuum passageway of the shaft to the rear end of each hollow piston rod in communication with the interior thereof, the cylinder carrier comprising a pair of plates spaced apart longitudinally of the shaft and provided with axially registering apertures, the air cylinders being located between said plates and mounted at opposite ends on the proximate faces of said plates, the ends of the hollow piston rods extending in opposite directions through registering apertures in the carrier plates.

4. Transfer mechanism comprising a rotated hollow shaft, separate concentric pressurized air and vacuum passageways one located within the other in the shaft, a source of pressurized air communicating with the air passageway, means for creating vacuum in the vacuum passageway, a cylinder carrier mounted on the shaft to rotate therewith extending radially from the shaft, a plurality of air cylinders axially parallel to the shaft mounted on the carrier, a hollow piston rod slidably

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mounted in each cylinder extending beyond opposite ends of the cylinder, a piston fixed on each rod within the cylinder, a suction cup on the forward end of each piston rod communicating with the hollow interior of the rod, valve controlled air tubes connecting the pressurized air passageway of the shaft to opposite ends of each cylinder at opposite sides of the piston therein alternately admitting pressurized air from the shaft to opposite ends of the cylinder to reciprocate the piston rod, and a valve controlled vacuum tube connecting the vacuum passageway of the shaft to the rear end of each hollow piston rod in communication with the interior thereof, the cylinder carrier comprising a pair of plates spaced apart longitudinally of the shaft and provided with axially registering apertures located adjacent the peripheral edges of the plates, the air cylinders being located between said plates and having end flanges fixed on the proximate faces of the plates and surrounding said apertures, the ends of the hollow piston rods extending in opposite directions from the cylinders through registering apertures in the carrier plates, and the vacuum tube valves being mounted on one of said carrier plates radially inwardly of said piston rods opposite the face of the plate to which the cylinders are connected.

5. Transfer mechanism comprising a rotated hollow shaft, separate concentric pressurized air and vacuum passageways one located within the other in the shaft, a source of pressurized air communicating with the air passageway, means for creating vacuum in the vacuum passageway, a cylinder carrier mounted on the shaft to rotate therewith extending radially from the shaft, a plurality of air cylinders axially parallel to the shaft mounted on the carrier, a hollow piston rod slidably mounted in each cylinder extending beyond opposite ends of the cylinder, a piston fixed on each rod within the cylinder, a suction cup on the forward end of each piston rod communicating with the hollow interior of the rod, valve controlled air tubes connecting the pressurized air passageway of the shaft to opposite ends of each cylinder at opposite sides of the piston therein alternately admitting pressurized air from the shaft to opposite ends of the cylinder to reciprocate the piston rod, a valve controlled vacuum tube connecting the vacuum passageway of the shaft to the rear end of each hollow piston rod in communication with the interior thereof, the cylinder carrier comprising a pair of plates spaced apart longitudinally of the shaft and provided with axially registering apertures, the air cylinders being located between said plates and mounted at opposite ends on the proximate faces of said plates, the ends of the hollow piston rods extending in opposite directions through registering apertures in the carrier plates, and an air valve carrier plate mounted on the shaft to rotate therewith and spaced longitudinally of the shaft from the cylinder carrier plates, said air valve carrier plate having a plurality of valve carrying members spaced from each other annularly, the air tubes which connect the air valves to opposite ends of the cylinders passing between said valve carrying members toward the cylinders.

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