

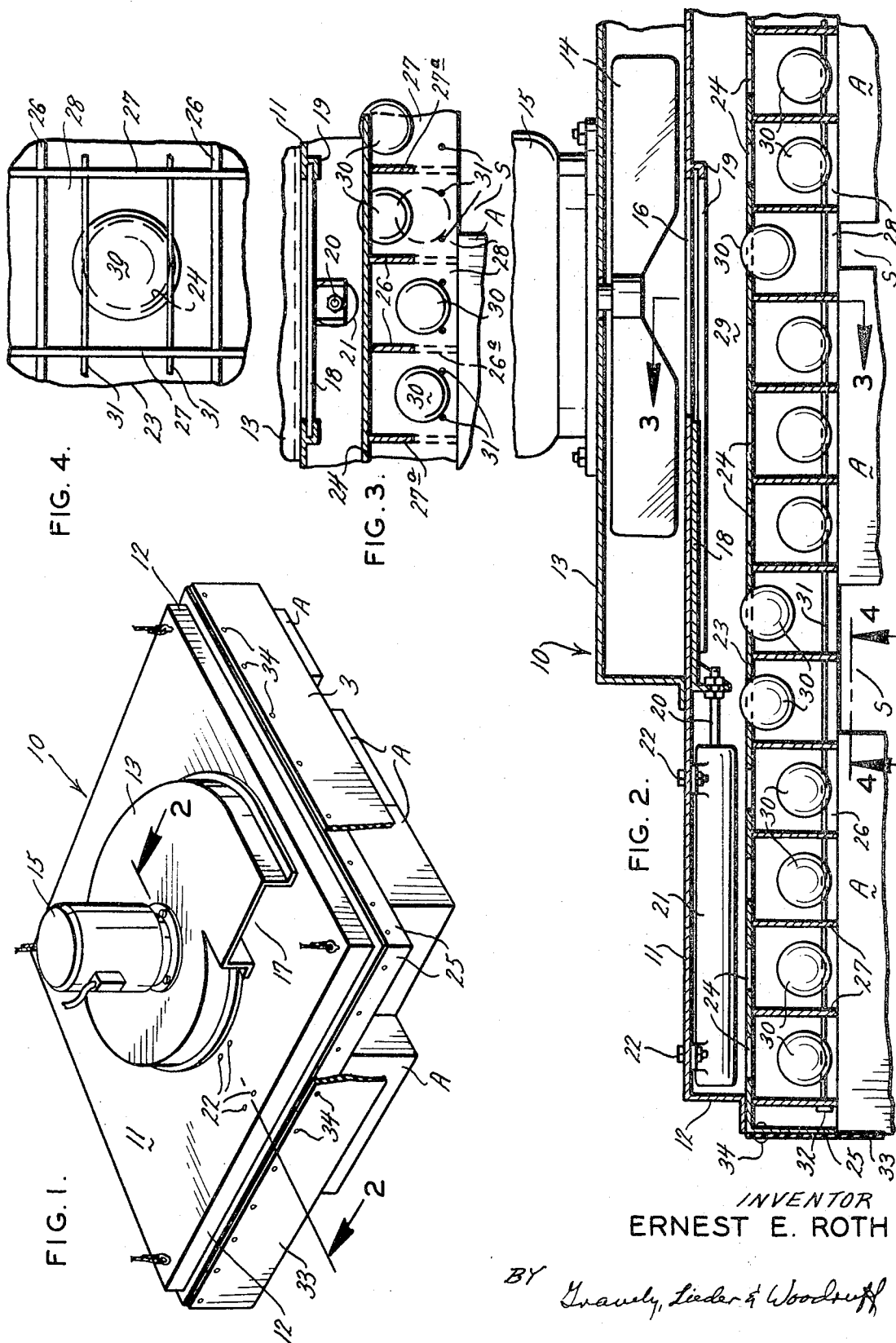
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SUCTION HEAD FOR ARTICLE HANDLING APPARATUS

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SUCTION HEAD FOR ARTICLE HANDLING APPARATUS

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6 Claims

ABSTRACT OF THE DISCLOSURE

Article handling apparatus embodied in a suction head which incorporates a plurality of valved suction chambers connected on one side into a plenum chamber to which the suction of a blower is connected and open on the other side to engage one or more articles requiring transportation or movement. The valve for each chamber is a light weight ball element free to move within the chamber in rapid response to flow of air for closing the chamber to such flow for conserving the suction effect when an article is not opposite one or more chambers.

This invention relates to improvements in article handling apparatus and is particularly concerned with a novel suction head assembly with valve means which regulates the application of suction to areas within the head where articles are not located to avoid loss of the suction effect.

It is known to use suction or vacuum for lifting or moving articles, and it is also known to provide a plurality of suction chambers with means to control the suction effect so as to cut off chambers not registered with the articles and avoid loss of the suction effect. However, those known types of suction lifting or moving means are expensive to construct and maintain and do not possess the necessary freedom from inertia effects to be certain of action under all conditions of operation.

It is, therefore, an important object of this invention to provide a unique suction head in which the valve means for the various chambers have low inertia characteristics.

It is also an important object of this invention to provide a suction head having a bank of valved ports distributed over an area large enough to accommodate a plurality of articles, and to provide very sensitive valve means that will function positively whether the suction head is level or canted.

Another important object of this invention is to provide a suction head which will automatically prevent the loss of suction effect in areas where no article is situated.

A further object of this invention is to provide valve means for a suction head that will automatically adjust for moving less than a full complement of articles and thus cause the suction effect to be applied to the articles that are present.

A preferred embodiment of this invention comprises a lifting head having a bank of suction passages distributed over the effective articles engaging area, and individual valve elements for each passage which have low inertia characteristics so as to be rapidly responsive to the flow of air through the passages for closing any passages not effectively registered with one or more articles. The valve elements thereby assure the application of the suction effect to articles that are present without substantial loss of effectiveness.

Other objects of this invention will be exemplified in the various parts and components of the preferred embodiment, and reference will be made to the several views of the accompanying drawings, wherein:

FIG. 1 is a perspective view of a suction head assembly for article handling apparatus, a portion of the structure being broken away;

FIG. 2 is an enlarged and fragmentary sectional view taken along line 2—2 in FIG. 1;

FIG. 3 is a fragmentary sectional view taken along line 3—3 in FIG. 2; and

FIG. 4 is a fragmentary view taken along line 4—4 in FIG. 2, looking up from underneath the suction head to show a typical assembly detail.

The suction head 10 shown in FIG. 1 may be incorporated in apparatus of the character shown in the application of Ernest E. Roth and Henry E. Tanner, filed Mar. 10, 1966, bearing Ser. No. 533,571 and entitled Pallet Loading and Unloading Apparatus and now U.S. Pat. No. 3,387,718. The essential features of the suction head 10 include a rigid open bottom box structure having a top wall 11 and depending marginal flanges 12 which together constitute a shallow plenum space opening downwardly. The top wall 11 carries the volute casing 13 for a blower rotor 14 operably driven by a suitable drive motor 15. The casing is provided with a suction inlet 16 (FIG. 2) in the wall 11 and with an exhaust outlet 17 (FIG. 1). A suitable control valve 18 is slidably mounted in a guide frame 19 carried at the underside of the wall 11 so as to direct the valve 18 to open or close the suction inlet port 16. The valve 18 is operated by the piston rod 20 of a suitable motor cylinder 21 attached to the wall 11 (FIG. 2) by means 22. Although not shown herein, the motor 21 may be operated in the manner set forth in the above identified application Ser. No. 533,571.

As can be best seen in FIG. 2 the underside of the shallow box is provided with a wall or plate 23 in which are formed a plurality of ports 24 distributed over the area of the partition within the depending flange 12. The plate 23 is formed with depending flanges 25 on all margins, and a series of partitions 26 and 27 are secured to the plate 23 and its flanges 25. The partitions 26 are slotted at 26a (FIG. 3) so as to fit into slots 27a of partitions 27, thereby making up a bank of air flow passages 28 with each thereof having a port 24 opening to the plenum chamber 29 formed within the shallow box above the perforated plate 23. In the assembly shown the passages 28 are substantially square in plan view (FIG. 4) and they are arranged in right angular rows lengthwise and widthwise of the suction head 10. The view of FIG. 2 shows that the passages 28 open to the ambient space in a common plane constituting an outer surface which, due to the length of the passages 28, is spaced from the plate 23 which latter plate constitutes an inner surface. Thus, the bottom wall has some thickness to provide for the valved passages 28.

Each passage 28 contains a light weight ball valve element 30, and the valve elements are retained within the passages by cage means or wires 31 strung through the partitions 27 and secured at the ends by head elements 32 (FIG. 2). The cage means 31 are arranged in spaced pairs for each passage 28 (FIGS. 3 and 4) such that the valve elements 30 cannot fall out. A preferred valve element 30 may be a low inertia ball having a sensitive response to the flow of air through the passages 28 to ports 24. An equivalent valve may consist of a ball similar to a Ping Pong ball.

The suction head 10, as shown in FIGS. 1 and 2, is provided with depending flexible side curtain 33 on each side, the curtain being secured by means 34 to the depending flanges 25. The curtain 33 prevents the intake of foreign objects and dirt that may be present in the air surrounding the head 10, and it also assists in retaining the articles A in alignment with each other and within the head 10.

As may be seen in FIGS. 2 and 3, with the valve slide 18 open the suction effect of the blower rotor 14 creates a vacuum or low pressure in the plenum chamber 29 relative to the ambient area below the head 10. When articles

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A are registered with certain of the passages 28, the valve elements 30 remain on the cage means 31, but where there is a space S between articles, the air flow causes the valve elements 30 to rise and close off the ports 24. The two right hand valve elements 30 of FIG. 3 are shown in port closed position.

A feature of the suction head 10 is that it can be canted or tipped without the ball valve elements 30 losing effectiveness. This is possible as the cage means 31 will not block off the underside of any element 30, thereby allowing the air to flow unimpeded against the element 30 and cause it to close the port 24. Whether level or canted, the suction head 10 is effective to engage a full complement or a few spaced articles and lift the same without substantial loss of vacuum in the plenum chamber 29.

It should now be evident to those skilled in this art in what manner the described embodiment of a suction head is intended to function. It will, of course be understood also that equivalent components may be employed and it is the intent to include all such components within the scope of the appended claims.

What is claimed is:

1. A suction head for article handling apparatus comprising a downwardly opening shallow box structure defined by top and depending side walls, a plate mounted over the downwardly open side of said box structure and formed with a plurality of spaced ports opening between the ambient space and the space within said box structure, a plurality of wall elements carried by said plate at the ambient side thereof and arranged in intersecting relationship to define a plurality of individual air flow passages with each passage communicating with a port in said plate said wall elements being positionable adjacent articles to be handled so that some at least of said air flow passages are obstructed by the articles, a low inertia valve element in each air flow passage to be freely movable between a first position uncovering the adjacent port for air flow and a second position closing the adjacent port in said plate to air flow, valve cage means in each passage, and suction producing means connected to said box structure opposite said plate to communicate through said space with all of said air flow passages and being operative to cause a flow of air through the air flow passages not obstructed by an article sufficient to actuate the valve elements in such unobstructed passages to said second position, said valve elements in said article obstructed passages remaining in said first positions whereby said suction producing means is effective to handle the articles.

2. The suction head of claim 1 wherein said valve elements are balls, and said cage means are carried by certain of said wall elements.

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3. The suction head of claim 1 wherein said plate and wall elements are substantially rigid and said wall elements have edges defining a plane of engagement with the articles to be handled.

4. The suction head of claim 3 wherein a depending flexible curtain is carried by said box structure to extend below said wall elements and exclude foreign objects from entering the air flow passages.

5. The suction head of claim 2 wherein a control valve is operable in the connection of said suction producing means to said box structure, and motor means is operably connected to said control valve.

6. A suction head for moving articles from place to place by creating a differential pressure across the articles, said suction head including a box structure having an interior space enclosed by a top wall, depending side walls and a bottom wall spaced from said top wall, said bottom wall having an inner surface adjacent the interior space formed with a plurality of ports and an exterior surface spaced from said inner surface and extending in a common plane coextensive with said inner surface, said exterior surface engaging the articles to be moved, said bottom wall having a plurality of air flow passages opening outwardly of the plane of said exterior surface and extending inwardly to communicate with said ports in said inner surface, each passage communicating with a port and all of said passages opening to the ambient space at said common plane which constitutes said outer surface of said bottom wall spaced from said inner surface, a valve element loosely fitted in each of said passages, means retaining each valve element in its passage for movement between a first position adjacent said exterior surface of said bottom wall and spaced from said air flow port and a second position adjacent said inner surface closing said air flow port, and suction producing means connected to said suction head to evacuate the interior space of said box structure and cause said valve elements normally to move to said second positions to obstruct air flow communication between the ambient space and said interior space and the placement of said outer surface of said bottom wall on articles to be moved causing obstruction of air flow to said passages whereby said valve elements retain said first positions.

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