United States Patent

[11] **3,582,144**

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[54] **VALVE FOR AIR CONVEYOR**
3 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **301/31,** 302/29
[51] **Int. Cl.** **B65g 53/04**
[50] **Field of Search** 302/29, 31

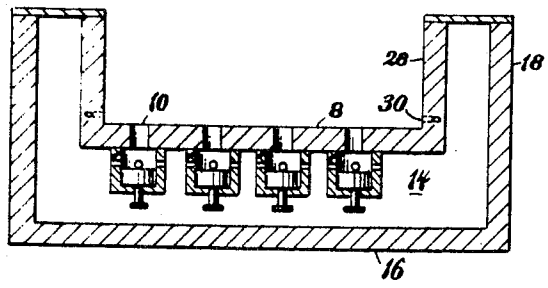
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Primary Examiner—Andres H. Nielsen
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ABSTRACT: An air current-type conveyor by which solid objects are carried on a current of air moving longitudinally over the upper side of an apertured membrane. The air is supplied to a chamber on the underside of the membrane and is permitted to traverse the apertures in the membrane only when a load being carried on the upper side thereof requires air for its lifting.



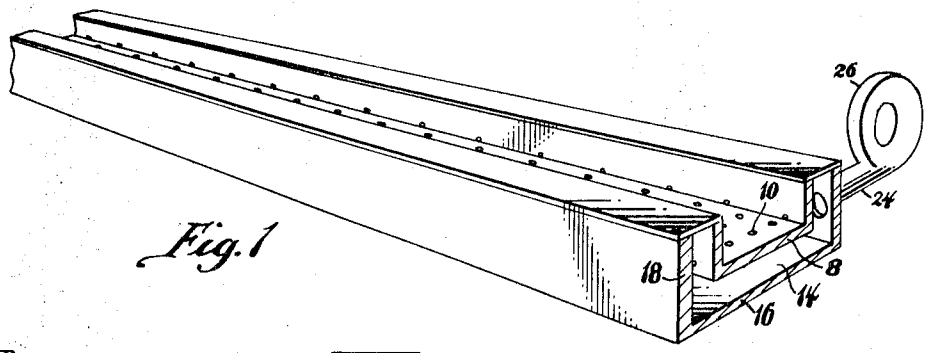


Fig. 1

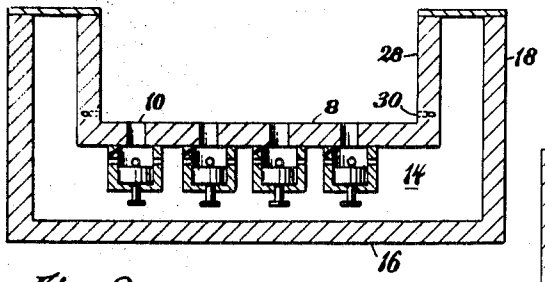


Fig. 2

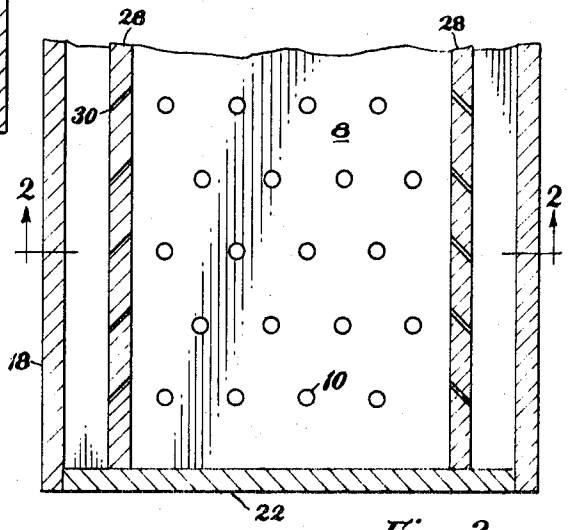


Fig. 3

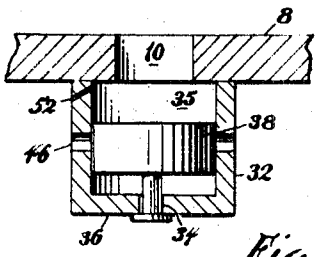


Fig. 4

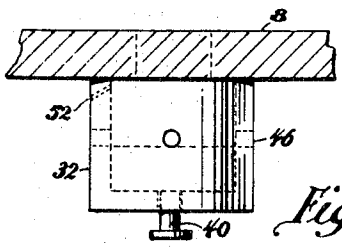


Fig. 5

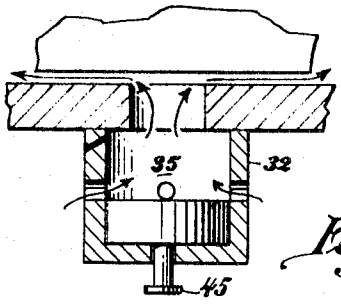


Fig. 6

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VALVE FOR AIR CONVEYOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an air valve which controls the flow of air in an air type conveyor by which loads carried thereby are lifted slightly and moved longitudinally along the surface of the conveyor by a continuously moving layer of air. The stream of air supporting the load on the conveyor traverses apertures in a membrane, the flow through the apertures of said membrane being controlled solely by the automatic air valves defined herein.

2. Description of Prior Art

Although air conveyors such as those shown in U.S. Pats. No. 2,805,898 and No. 3,180,688 have been accepted for some time as being an effective form of conveyor for certain types of solid articles such as flat-sided cartons or boxes, their use has never been extensive because the excessive costs involved in providing a continuous supply of compressed air to the conveyor table for lifting and motivating the articles being conveyed far outweigh the advantages obtained therefrom.

SUMMARY OF THE INVENTION

This invention therefore provides an arrangement for conserving air by supplying a unique valving means for an air-type conveyor which terminates the supply of air thereto when a load is not being carried upon the conveyor and pressurized air is not needed thereby as a lifting agent for the load.

A BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a schematic perspective drawing of apparatus utilizing my invention,

FIG. **2** is a view of the valve in cross section,

FIG. **3** is a plan view of the apertured membrane comprising the air conveyor,

FIGS. **4**, **5**, and **6** show various stages in the operation of the valve for controlling the flow of compressed air in accordance with my invention.

Referring now to the drawings there is shown in FIG. **1** an air current conveyor having a substantially horizontal conveyor membrane or plate **8** with a multiplicity of vertical holes **10** therethrough for the supply of compressed air to the upper side of the conveyor from a source of supply connected to a chamber on the lower side thereof.

The conveyor plate **8** preferably comprises the top wall of a plenum chamber **14** having a bottom wall **16**, sidewalls **18** and end walls **22**. Compressed air is supplied to the plenum chamber **14** through an air supply duct **24** connected to a source such as blower **26**. The conveyor plate **8** is open to the atmosphere throughout its length for the placement of objects on its upper surface whereby they may be transported longitudinally from one end of the conveyor to the other.

Sidewalls **28** along the upper side of conveyor plate **8** are provided to form an upward facing channel that contains the objects being transported upon said plate. The sidewalls also have holes **30** therein pointed in the general direction of one end thereof to exhaust air therethrough onto the objects on the table and so move them along the conveyor with the moving bed of air. Since the airflow through openings **30** on opposite sides of the conveyor are substantially equal, articles being transported will seek the center of the conveyor.

Each opening **10** of the conveyor plate **8** is provided with a valving means which according to this invention includes a housing **32** for the valve whose upper edge is secured to the bottom of the plate surrounding each opening. The housing has an opening **34** in the bottom end **36** thereof forming a bore with a smaller cross-sectional area than that of chamber **35** inside housing **32**. Thus the bottom **36** of the housing provides a shoulder on which the piston valve **38** may seat intermediate differentially sized piston-type actuators.

Valve **38** within the housing **32** is of the reciprocable piston type having a stem **40** slidably fitting bore **34** with sufficient annular space therebetween to permit stem **40** to reciprocate

freely but to prevent excess airflow through the annular space. Moreover head **45** on the lower end of stem **40** is arranged to sealingly abut the face of bottom **36** to further restrict the flow of fluid through said annular space. Therefore when the upward force of high pressure air acting against the small area of head **45** exceeds the downward force of the lower pressure air acting against the larger area of piston valve **38**, the head **45** moves upward and seats against the bottom **36** so as to prevent airflow through the annular space between the bore and the stem.

A series of air ports **46** are located above the top surface of the piston **38** when it is seated upon the end plate **36** whereby compressed air of chamber **14** may readily flow through ports **46** from the lower to the upper sides of the valve and then through ports **10** to the upper side of plate **8** where the articles being conveyed are located. A bleed port **52** in the upper wall of housing **32** provides means by which the high pressure compressed air may slowly escape to the upper side of the piston valve and exhaust to the conveyor above the hole **10**. Excessive pressure above the large area of piston **38** then moves it down to uncover ports **46** to the free flow of air from chamber **14**. This high pressure air from chamber **14** freely passes to the upper side of plate **8** and acts against the upper surface of adjacent valves **38** so they in turn may freely supply pressurized lifting air to the conveyor.

In operation a load comprising a plurality of suitable articles is placed on the upper surface of the apertured conveyor membrane **8**. When compressed air is supplied to the plenum chamber **14** it bleeds through the ports **52** to the cylinder on the upper side of piston **38**. When a port **10** is covered by an article the apertured membrane **8**, the air pressure acting upon the the plate **8** the pressure builds up, the differential of force created by the downward force of compressed air acting upon the larger area of piston **44** as compared to the upward force acting upon stem **40** forces the piston down and opens the ports **46** to the flow of air from chamber **14**. Upon opening ports **46** the compressed air of plenum chamber **14** flows to the upper side of apertured plate **8** and supports the articles thereon. The articles are then moved longitudinally along the conveyor by the force of the compressed air exhausting through the inclined side ports **56**. When a load no longer rests upon the apertured membrane **8**, the air pressure acting upon the upper surface of piston **44** is reduced because air in cylinder **35** vents unimpeded to the atmosphere. Thus the force of the compressed air within the plenum chamber acting upon the smaller surface area of head **45** exceeds that of the lower atmospheric pressure acting upon the larger head of piston **44**, and accordingly the piston rises to close off the openings **46** to the flow of air. Compressed air from chamber **14** continues to exhaust through inclined side ports **56** and the head ports **52** but the quantity of air thus lost is small in comparison to the total compressed air requirements.

While a preferred embodiment of my invention has been shown and described herein various modifications and substitutions may be made without departing from the intent of the present invention. It is to be understood therefore that the details of the conveyor including the size and position of the pressure responsive valves and even the degree to which the air is pressurized has been described by way of illustration only, and the limits of the invention are to be determined only by the scope of the appended claims.

I claim:

1. An air conveyor including a substantially horizontal bottom plate having a plurality of perforations therein, an air chamber on the underside of said plate, means for supplying a quantity of pressurized air to said chamber, valving means controlling airflow through said perforations comprising a housing with an apertured end plate surrounding the underside of said perforations, a reciprocable piston in each housing having a stem traversing the aperture in the end plate to subject the end face thereof to the pressurized air of said air chamber, an aperture in said housing above the piston adapted to permit pressurized airflow therethrough when the force of

air on the top of said piston exceeds the force of air on the bottom face of said stem and moves the piston downward, and a bleed port in said housing vertically spaced above the aperture in said housing wall adapted to permit pressurized air to bleed continuously from said chamber on the underside of the apertured plate to the chamber on the upperside of said piston.

2. An air conveyor including a horizontal bottom plate having a plurality of spaced perforations therein, sidewalls extending longitudinally along said bottom plate to form an upwardly facing channel, openings in said sidewalls inclined similarly toward one end of said conveyor to form propulsion passageways, means for supplying compressed air to each of said passageways, a chamber for pressurized air secured to the underside of said plate, means for supplying a quantity of pressurized air to said chamber, valve means controlling airflow through the perforations of said plate comprising a cylindrical housing secured to the underside of each perforation, an end plate having a concentric aperture therein enclosing the bottom of said cylindrical housing, a reciprocable piston valve in each housing having a stem traversing the aperture in said end plate, apertures in the wall of said cylindrical housing spaced from said end plate a distance greater than the thickness of said piston valve whereby the apertures will be open when the force of air on top of said piston exceeds the force on the bottom face of said stem forcing the piston to an extreme downward position, and a bleed port in the cylindrical housing vertically spaced above the apertures in said housing wall adapted to permit pressurized air to bleed continuously from said chamber on the underside of the apertured plate to the chamber on the upperside of said piston.

3. An air conveyor as defined in claim 2, having stop means that permit movement of said piston valve a distance somewhat greater than the distance of said apertures above the lowermost position of said piston.