United States Patent [19]

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[11] **3,741,409**

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[54] **TRANSFER APPARATUS FOR ARTICLES WITH A VERTICAL PASSAGE**

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[22] Filed: **Dec. 1, 1971**

[21] Appl. No.: **203,721**

[52] **U.S. Cl.** ..... **214/1 BC**, 214/38 CA, 214/1 BD, 294/93

[51] **Int. Cl.** **B66c 1/66**

[58] **Field of Search** ..... 214/658, 1 BC, 1 B, 214/1 BB, 1 BD, 147 T; 294/93, 86.24, 86 R, 99 R, 63 A

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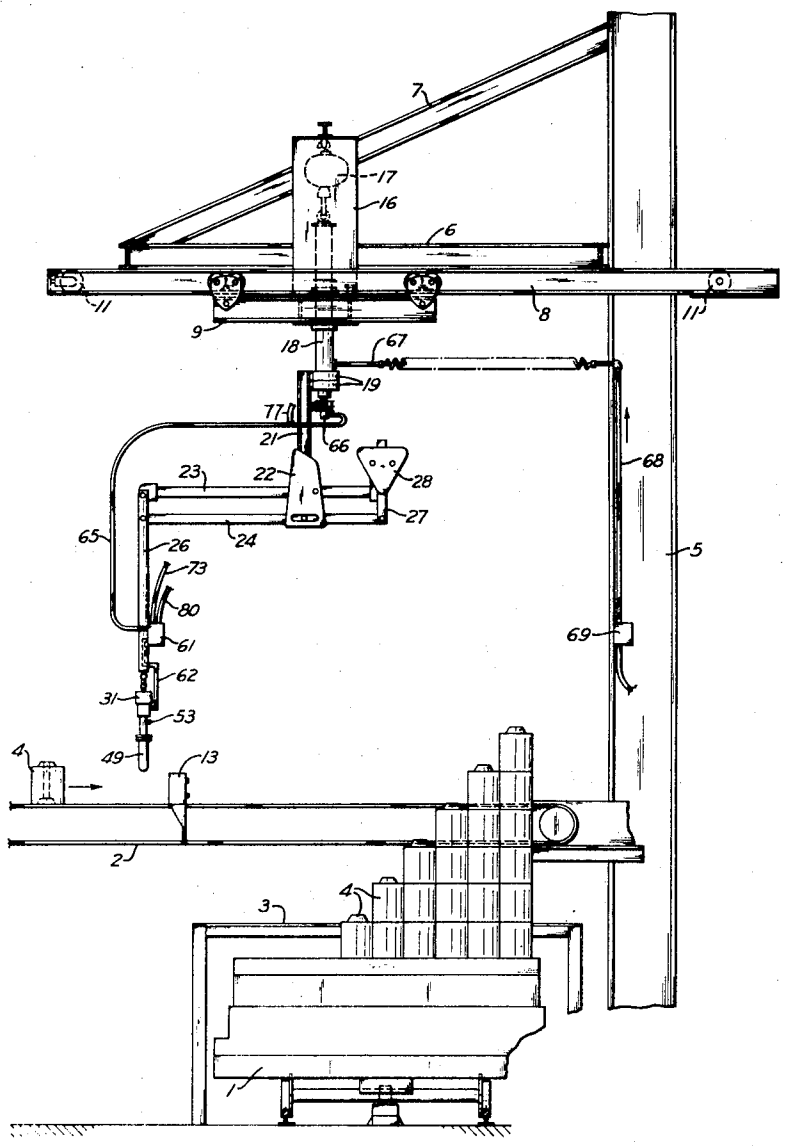
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[57] **ABSTRACT**

An inflator head provided with an opening through it is supported for vertical and lateral movement. Secured to the head around its opening is the open upper end of a resilient bag that extends downwardly from the head for insertion in an article having a vertical opening in it. There are means connected with the head opening for delivering air under pressure to the bag to inflate it and for releasing the air pressure from the bag. Means are also provided for raising the head-supporting means so that after the bag has been inflated in an article to grip the wall of the opening therein the article can be picked up by the bag and transferred to another location.

10 Claims, 5 Drawing Figures



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SHEET 1 OF 5

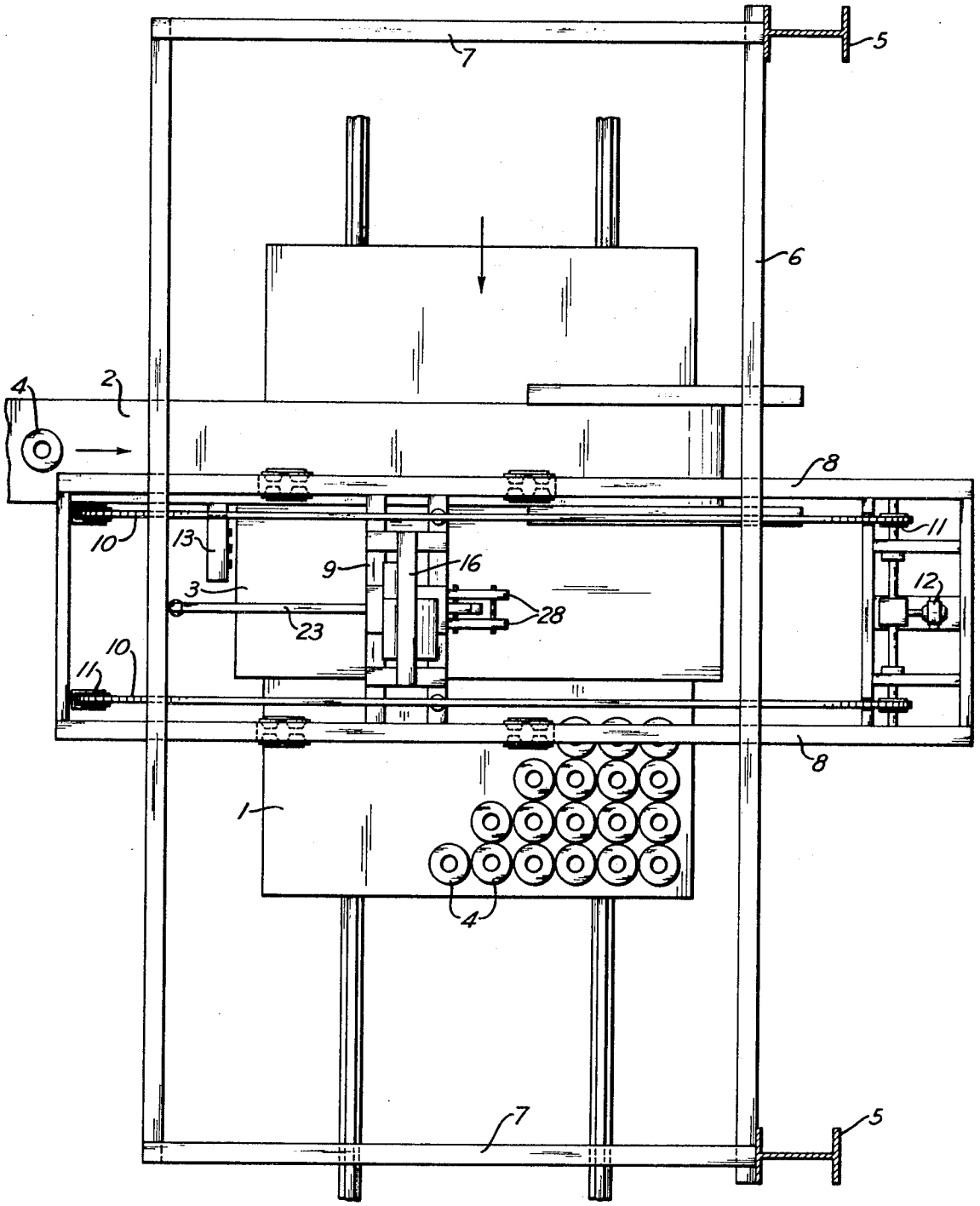


Fig. 1

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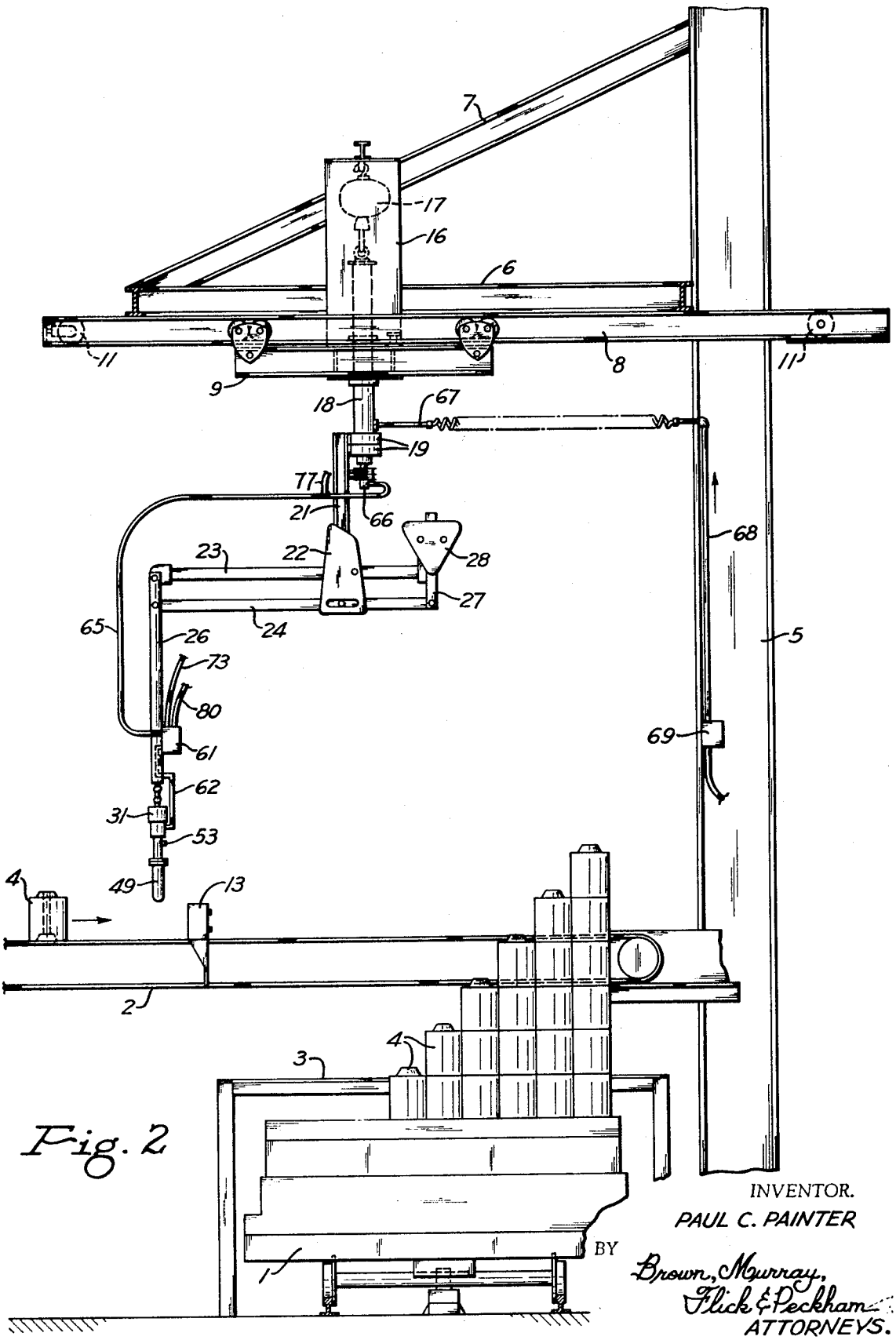


Fig. 2

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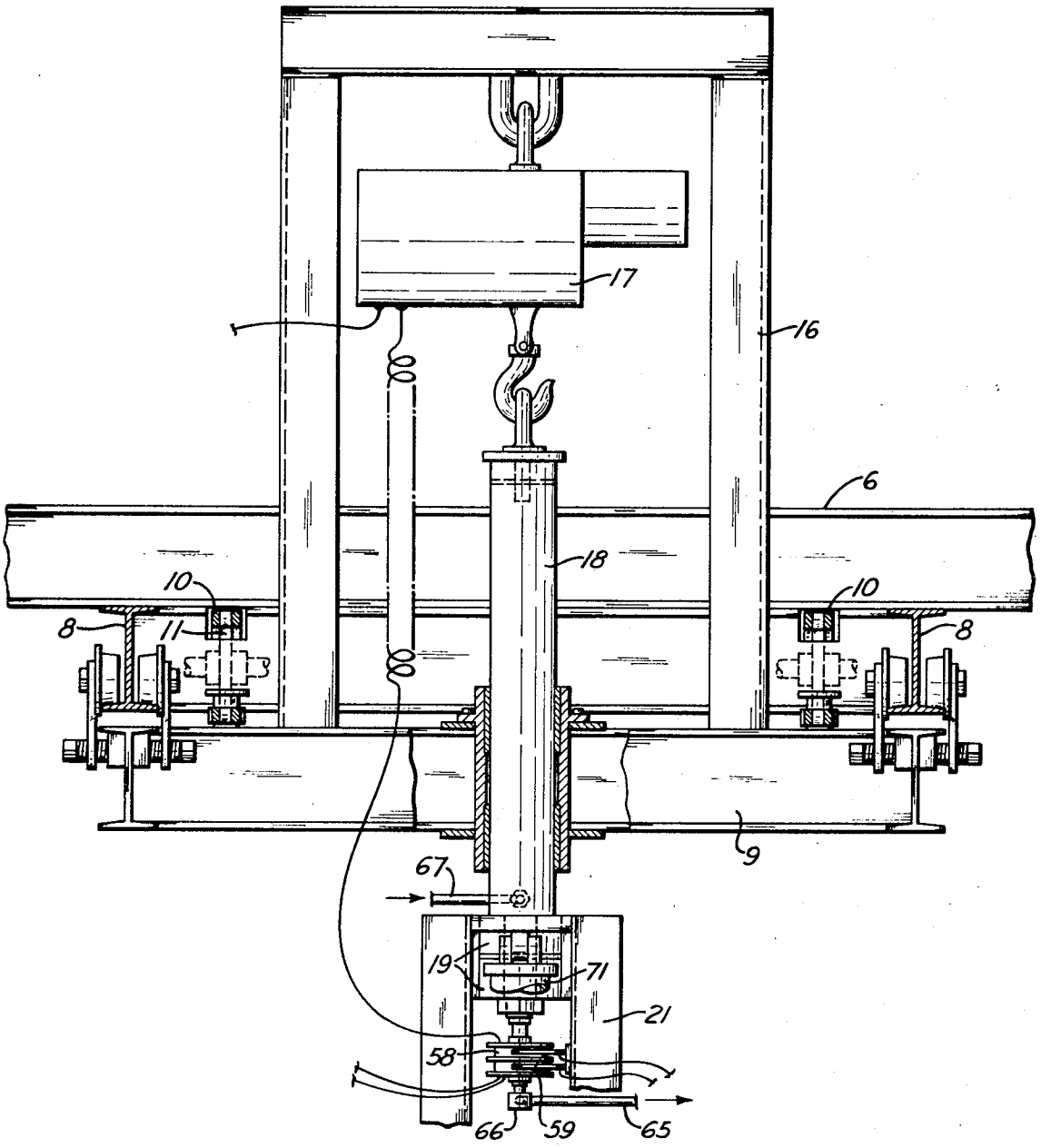
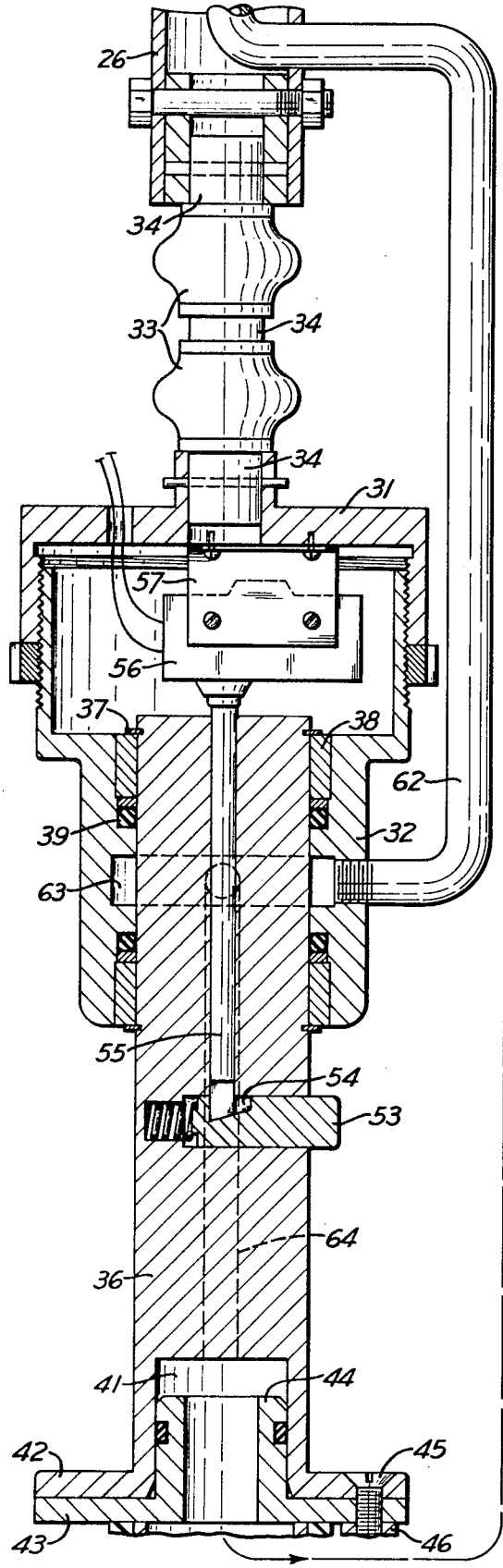


Fig. 3

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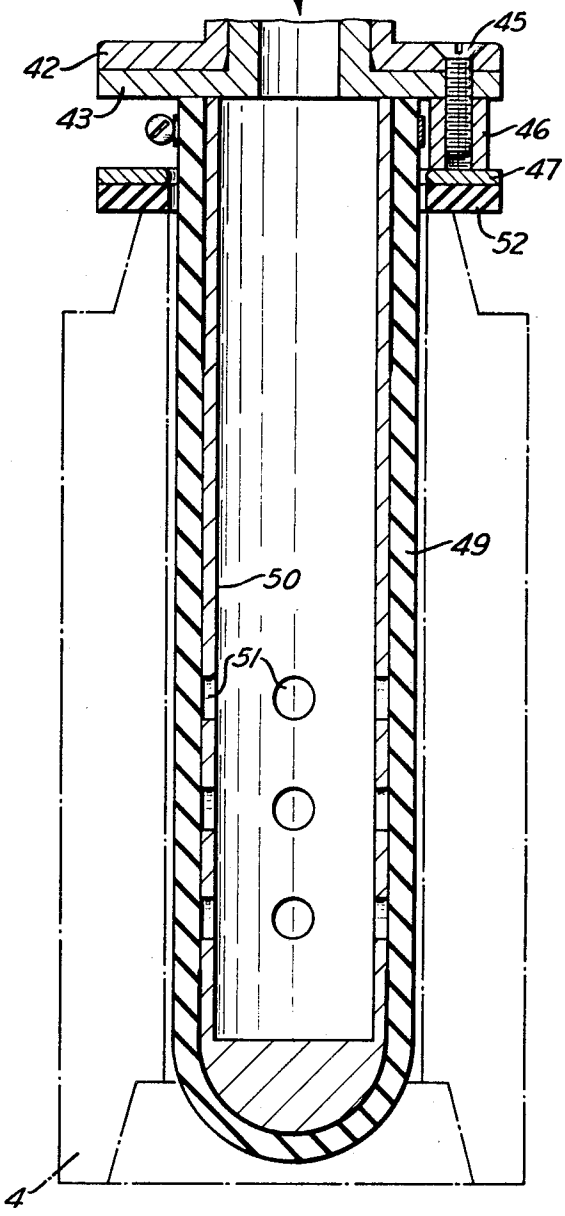


Fig. 4

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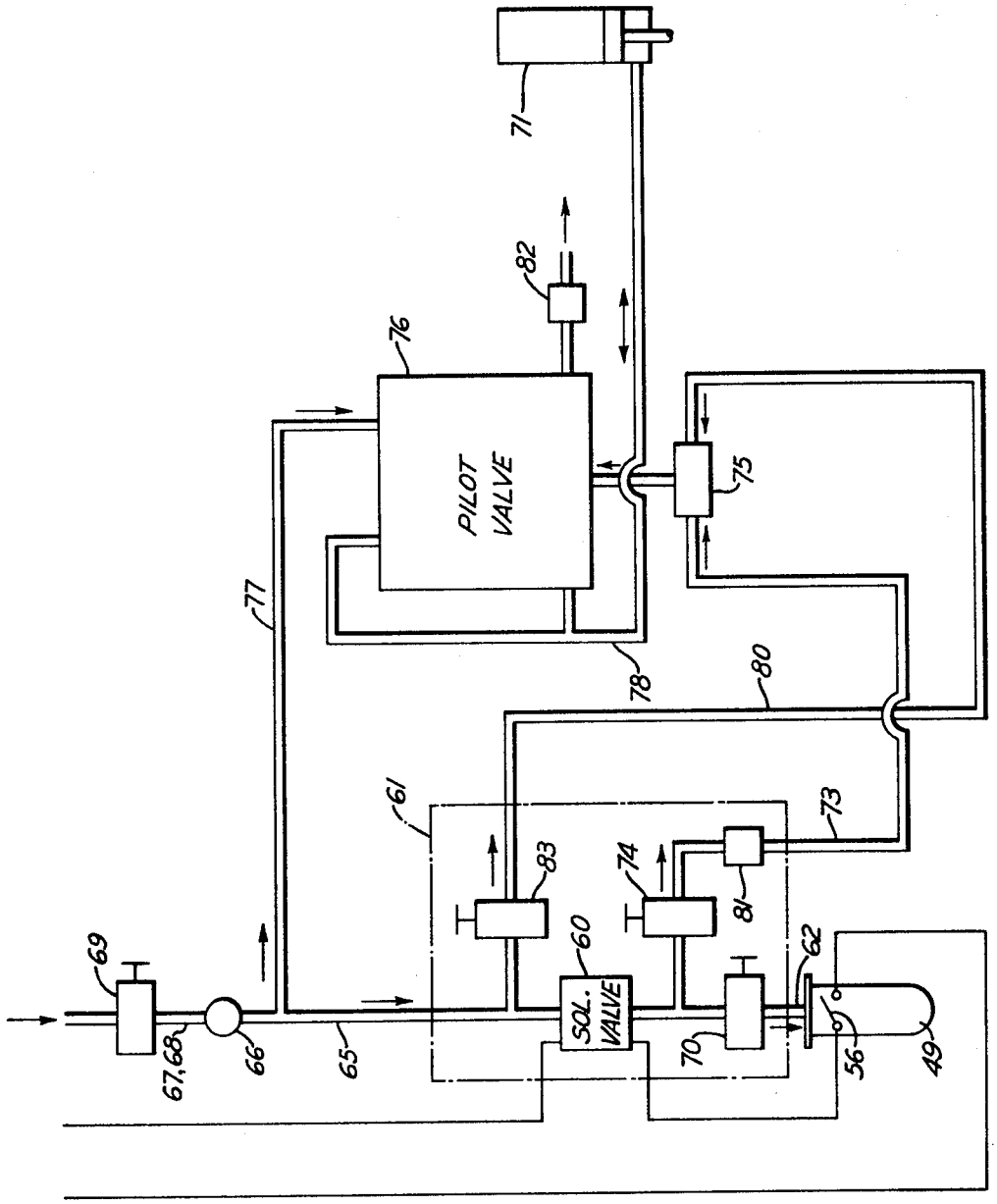


Fig. 5

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TRANSFER APPARATUS FOR ARTICLES WITH A VERTICAL PASSAGE

In the making of refractory sleeves for the stopper rods of ladles for molten steel, the practice has been to transfer these articles from one location to another, such as to and from a drier or kiln car, by manual labor. Since some of the articles are very heavy, the manual exertion required has been very great, and the number of pieces that a man can handle per hour has been rather limited, with the work usually confined to young men with great physical stamina. Also, the products frequently are damaged by workmen tossing and catching them, or by hand and finger marks and indentations in undried articles or by distortion, chipping, rounding off of edges and injury to the joints due to the manual handling of these articles.

It is among the objects of this invention to provide apparatus which is easy to use for quickly transferring hollow articles from one location to another with extremely little effort, which can be adapted for handling articles of various sizes and weights without requiring a prolonged shut-down period, which is capable of handling a plurality of objects simultaneously, which increases productivity, which eliminates product damage, which is easily controlled by one hand, and which can be operated by an older man as well as by a young man.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

FIG. 1 is a plan view;

FIG. 2 is a side view;

FIG. 3 is an enlarged fragmentary end view;

FIG. 4 is a further enlarged vertical section of a detail; and

FIG. 5 is a pneumatic and electric circuit diagram.

Referring to FIGS. 1 and 2 of the drawings, a kiln car 1 is shown in front of a tunnel kiln (not shown). In its empty state the car is positioned beside an endless conveyor belt 2 or below one that extends across the car as shown. Between the belt and the kiln a working platform 3 is supported a short distance above the car, with the front end of the car projecting from it. The platform is some distance below the level of the top of the conveyor belt. The conveyor is for carrying ceramic articles to be stacked on the kiln car so that they can be moved into the kiln and fired. The articles illustrated in the drawing are refractory sleeves 4 for steel ladle stopper rods. Some of these sleeves may weigh as much as 80 pounds. The articles could also be refractory pouring nozzles for steel ladles, or be other articles provided with vertical openings or passages. Before this invention, the articles were transferred by hand to the kiln car from a conveyor or other car.

It is a feature of this invention that the sleeves can be quickly transferred from the conveyor to the kiln car with extremely little manual effort. Accordingly, at one side of the kiln car a pair of steel columns 5 are connected by one side of a horizontal frame 6, the opposite side of which is supported by inclined braces 7 connected at their upper ends to the columns. Supported by this frame is a pair of parallel tracks 8 that extend over the working platform. These tracks support a carriage 9 that can be moved back and forth along them by chains 10 passing around sprockets 11 rotatably mounted at the opposite ends of the tracks. The sprockets at the column end of the tracks are driven by a motor 12 operated from a control panel 13 supported by one side of the conveyor at the working platform. From this panel a suitable device also is operated for indexing the kiln car ahead as it is being loaded.

As shown in FIGS. 2 and 3, the carriage 9 includes an upwardly extending central frame 16, from which a chain hoist 17 is suspended. This hoist, also controlled from panel 13, supports a non-rotatable post 18 that the hoist can raise and lower in the carriage as required. Rotatably supported on the lower end of the post are bearings 19 attached to the upper end of a frame 21 that supports a bracket 22 shown in FIG. 2. Pivotally mounted in the bracket is a parallel linkage system that includes parallel upper and lower arms 23 and 24 extending away from opposite sides of the bracket. The front ends of the arms are pivotally connected to the upper end portion of a leg 26 that extends downwardly. The rear ends of the arms are pivotally connected by a link 27 that supports a pair of counterweights 28 to balance the leg.

The lower end of leg 26 is connected by a double universal or flexible joint to a housing 31 having a downwardly extending cylindrical flange 32, shown in FIG. 4. The flexible joint is formed from a pair of resilient couplings 33 connecting short pipes 34. Rotatably mounted in housing flange 32 is a cylindrical hand grip swivel memeber 36 that is retained in the flange by a retaining ring 37 extending into an annular groove in the upper end of the swivel member and overlying a bushing 38 mounted in the upper end of the flange. Sealing rings 39 also encircle the swivel member inside the flange. The lower end of the swivel member is provided with an upwardly extending socket 41, the lower end of which is encircled by a flange 42. Engaging the bottom of this flange is the head 43 of an inflator, the head having a central opening and a neck 44 extending up into the socket of the swivel member. The flange and head are held together by bolts 45 screwed down into nuts 46 welded to the top of a metal ring 47.

The open upper end of a resilient bag 49 of rubber or similar material is secured to the bottom of the inflator head around its central opening. This is preferably done by first welding the upper end of a hollow ocre 50 to the bottom of the head and then bonding the upper portion of the bag to the outer surface of the core. For best results, the bottom of the core is solid and convex and the lower portion of the bag is bonded to it. Between the upper and lower bonded portions of the bag the side wall of the core is provided with openings 51 for supplying air to the inside of the bag so that it will inflate or expand. The length and diameter of the uninflated bag is such that is can readily be inserted in the vertical passage through any one of the refractory sleeves 4 for which the bag is designed. To prevent the upper ends of the sleeves from being damaged when the bag is inserted, a ring 52 of rubber or other cushioning material is bonded to the bottom of ring 47 for engaging the upper ends of the sleeves.

To insert the inflator in one of the sleeves, an operator standing on the working platform 3 grasps swivel member 36 in one hand and moves it sideways until the inflator is directly over the passage through the sleeve. This can be done because the parallel linkage system can tilt and swing around post 18 supporting it, and the flexible joint 33, 34 will allow some lateral movement of the inflator relative to the supporting leg 26. The inflator then is lowered into the sleeve until the cushioning ring 52 rests on top of it. The bag then is inflated

to cause it to press against the side of the sleeve passage tightly enough to hold the bag and sleeve together when the inflator is lifted. If the sleeves are short in relation to the length of the inflator and are stacked two high on the conveyor, a pair of the sleeves can be picked up together. In such a case, the central portion of the bag should be secured to the core to prevent it from expanding and possibly breaking the adjoining ends of the two sleeves.

Inflation is accomplished by pressing a laterally projecting button **53** that is slidably mounted in swivel member **36.** As shown in FIG. **4,** the top of this button is provided with a recess **54** having a downwardly and inwardly inclined bottom, on which rests the inclined lower end of a rod **55** that extends up through an axial bore in the swivel member and a short distance above it. The upper end of the rod engages the actuator of an electric switch **56** supported by a bracket **57** in housing **31.** The wires from this switch are connected with slip rings **58** carried by the lower end of post **18** and engaged by sliding contacts **59** projecting from frame **21.** The contacts are wired to a suitable electrical source. Closing of the switch opens a solenoid valve **60** (FIG. **5**) mounted in a control box **61** fastened to the side of leg **26.** The valve outlet is connected by a flexible air line **62** that conducts air under pressure down through the leg and then out and down to a port in the side of housing flange **32.** This port opens into an annular passage **63** around the inside of the flange, and the passage communicates with the upper ends of other passages **64** that extend down through the swivel member into its socket **41.** As shown in FIG. **5,** the inlet of the solenoid valve is connected by a flexible hose **65** and a swivel joint **66** with a passage that extends up through the lower portion of the post to an air line **67** that leads to a pipe **68** connected to a suitable source of air under pressure.

Before the air reaches the solenoid valve, it may have to pass through a stabilizing pressure reducer **69** and a further pressure reducer **70** in line **62** inside control box **61** between the valve and the inflator. This second reducer is adjusted to limit the pressure in the inflator to a safe value for the inflator and the particular object being lifted. The same hand the operator uses to grip the swivel member is also used to press button **53** in order to admit the air under pressure to the inflator bag so that it will be inflated against the surrounding refractory sleeve. The end portions of the bag bonded to the core limit expansion of the bag to the central portion of the sleeve where it is strongest. Immediately after inflation, air also is delivered to the lower end of a cylinder **71** (FIGS. **3** and **5**) mounted in frame **21** and having a piston connected with the parallel arms in order to swing their front ends upwardly to lift the sleeve from the conveyor until it is balanced by the counterweights. The oprator then can swing the swivel member and the refractory sleeve around to a desired position above the kiln car, whereupon he can pull the swivel member downwardly with little effort until the sleeve rests on the car. The button is then released, which causes the lower end of the cylinder to be connected with exhaust and the inflator bag to deflate. The counterweights then will be able to lift the inflator out of the sleeve so that the operator can swing the inflator back to pick up the next sleeve.

As shown in FIG. **5,** in order to deliver air under pressure to the lower end of cylinder **71** immediately after the bag has been inflated, the air line **62** between the solenoid valve and the lower pressure reducer **70** is connected by a load line **73** and a pressure regulator **74** to a valve **75,** such as a shuttle valve, that is then shifted by the air pressure to admit the air to a pilot valve **76** in which the pressure shifts the pilot valve to connect a supply line **77** between main line **65** and the pilot valve with a line **78** between the pilot valve and the bottom of the cylinder. The pilot valve is a purchased sealed unit, the internal construction of which is not known to me. The shuttle valve is also connected in a no-load line **80** connected to the main air line **65** in the control box. The shuttle valve is not actuated the moment the button is pressed, because that might cause the inflator to be lifted out of the sleeve before it can grip it. A slight delay is inherent in the system because of the longer air line distance from the main line **65** to the cylinder than to the inflator. Also, the rate at which the cylinder can raise the inflator is controlled by a needle valve **81** between regulator **74** and the shuttle valve. This also helps ensure that the inflator will be expanded before it starts to rise.

In case the air pressure should fail in the bottom of the cylinder, sudden descent of the inflator and sleeve would be prevented by a descent control valve **82** connected to the exhaust from the pilot valve. The back pressure built up in the pilot valve by valve **82** when button **53** is released shifts the pilot valve so that air can flow through no-load line **80** and the shuttle valve into the pilot valve and out through line **78** to the cylinder. A pressure regulator **83** in line **80** limits the air pressure to stabilize the balancer under no-load conditions. Adjustment of this regulator is necessary when changing weights of inflators.

It will be seen that with this transfer apparatus an operator can engage and pick up a refractory sleeve or the like by merely pushing a button, and he then can easily swing the sleeve over to the kiln car and deposit it on the car. The inflator does the gripping for him, and cylinder **71** and its piston do the lifting, thereby greatly reducing the time and effort formerly required for manually transferring the sleeves from one location to another. The carriage **9** and hoist **17** permit the sleeves to be deposited throughout a large area and stacked to a considerable height. Indexing of the kiln car allows the operator to reduce the travel distance of the sleeves from the conveyor to the car to a minimum. Since no space is required for a man's hands between the different stacks of sleeves, because the inflator grips the inside of the sleeves, the sleeves can be placed side by side in engagement with one another. This makes the group of sleeves on a car very stable, as they support one another against lateral movement.

Inflators of different diameters and lengths for different products can be quickly attached to or disconnected from the swivel member. For heavier or lighter products, the amount of pressure supplied to the inflator can be changed by adjusting pressure regulator **70.**

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. Transfer apparatus for articles having a vertical passage therein, comprising overhead supporting means, suspension means hung from said supporting means and rotatable around a vertical axis, laterally extending arm means pivoted on a horizontal axis to said suspension means, a leg extending downwardly from one end of said arm means, means pivoting the upper end of the leg to the arm means on a horizontal axis, pneumatically operated means carried by said suspension means and connected with said arm means for tilting said end of said arm means up to raise the leg, a hand grip swivel member beneath said leg manually rotatable on its vertical axis, flexible joint means connected to the lower end of the leg and supporting said swivel member, an inflator head connected with the lower end of said swivel member and provided with an opening therethrough, a resilient bag with an open upper end secured to said head around said opening and extending downwardly therefrom for insertion in one of said articles, a manual control member carried by said swivel member, means controlled by said control member for supplying air under pressure to said bag and to said pneumatically operated means, and means for delaying said supplying of air pressure to said pneumatically operated means until the bag has been inflated, whereby a workman beneath said arm means and gripping said swivel member with one hand can control with that hand inflation of the bag and its vertical and lateral movements and can swing the swivel member laterally in a circle.

2. Transfer apparatus according to claim 1, in which said arm means extends laterally from opposite sides of said suspension means, the apparatus including a counterweight on the end of said arm means opposite said one end.

3. Transfer apparatus according to claim 1, including adjustable means for delivering air under pressure to said pneumatically operated means to balance said arm means while under no-load conditions.

4. Transfer apparatus according to claim 1, including

a first conduit connected with said head opening, and a second conduit for delivering sufficient pressure to said pneumatically operated means to raise said end of said arm means, said delaying means comprising pilot valve means normally closing said second conduit, and means controlled by said control member for operating said pilot valve means to open the second conduit after the bag has been inflated.

5. Transfer apparatus according to claim 1, in which said delaying means include a pressure reducer.

6. Transfer apparatus according to claim 4, in which said second conduit is under continuous air pressure.

7. Transfer apparatus according to claim 4, in which said means controlled by said control member include a third conduit for delivering air under pressure to said pilot valve means to operate it, and a pressure reducer in the third conduit.

8. Transfer apparatus according to claim 4, in which said means controlled by said control member includes a shuttle valve controlling said pilot valve means, means for delivering air to said shuttle valve to shift it in one direction, and means operative when said control member is released to reverse the shuttle valve.

9. Transfer apparatus according to claim 4, including a first conduit connected with said head opening, and a second conduit for delivering sufficient pressure to said pneumatically operated means to raise said end of said arm means, said delaying means comprising pilot valve means normally closing said second conduit, a third conduit for delivering air under pressure to said pilot valve means to operate it, and a pressure reducer in the third conduit, air under pressure being delivered to said third conduit when said control member is actuated.

10. Transfer apparatus according to claim 9, including adjustable means for delivering air under pressure to said pneumatically operated means to balance said arm means while under no-load conditions.

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