Sept. 6, 1960 W. E. WILSON ET AL 2,951,513

LEAK-CHECK VALVE

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Fig. 1.

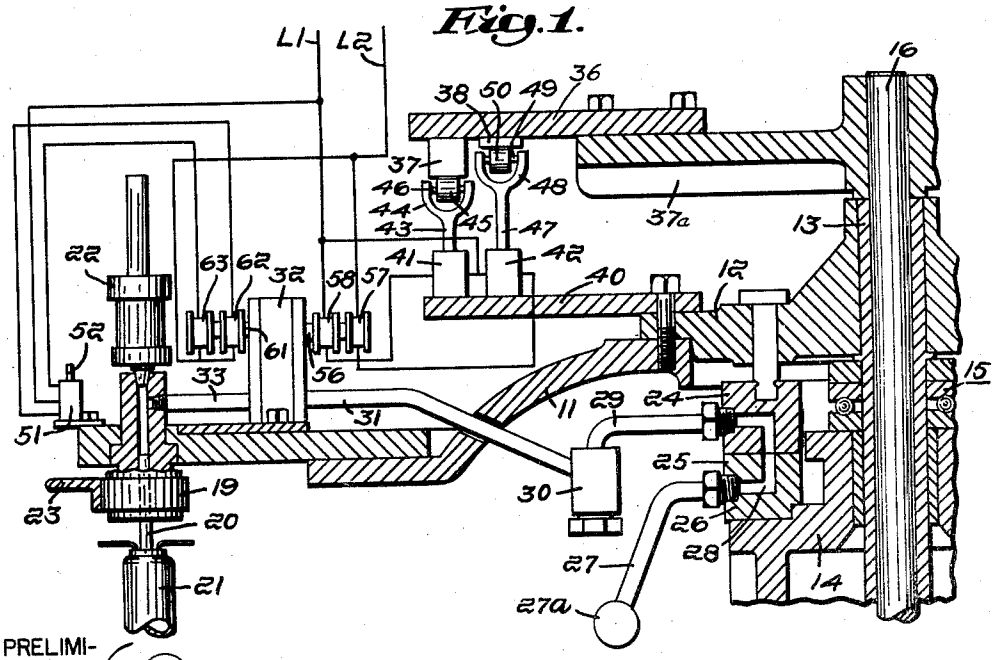
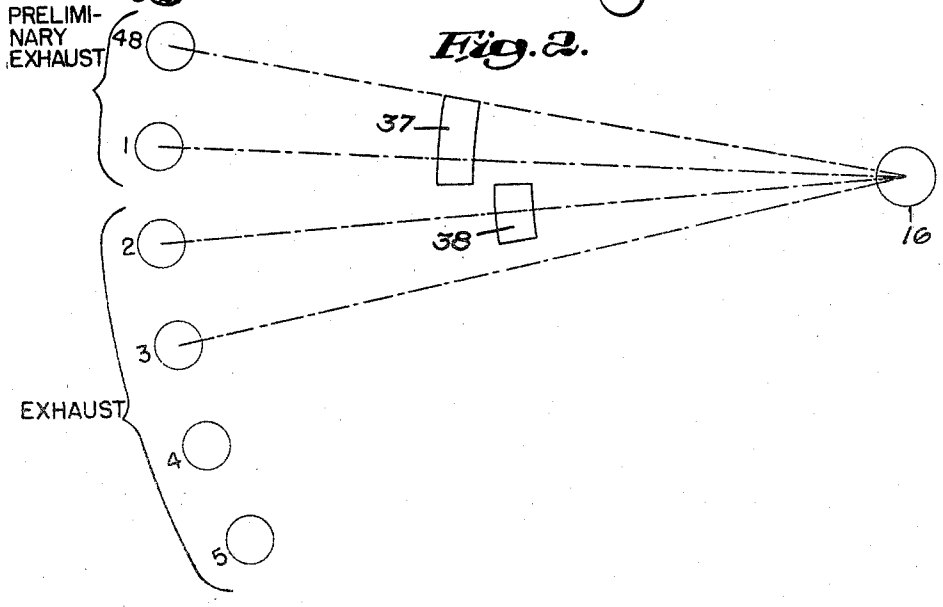


Fig. 2.



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Fig. 3.

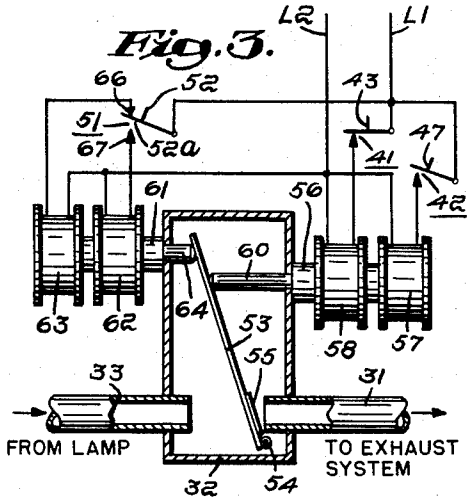


Fig. 4.

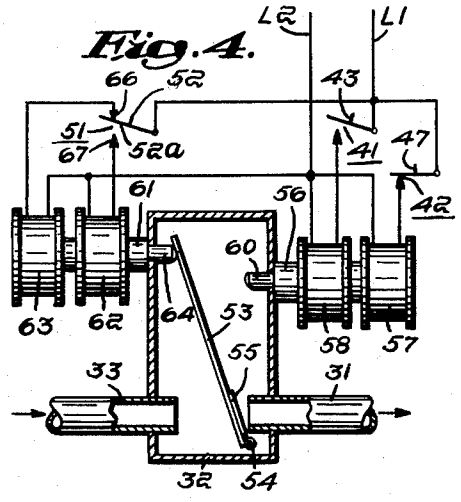


Fig. 5.

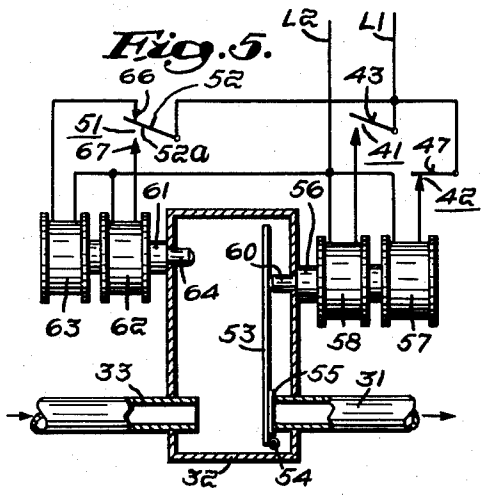


Fig. 6.

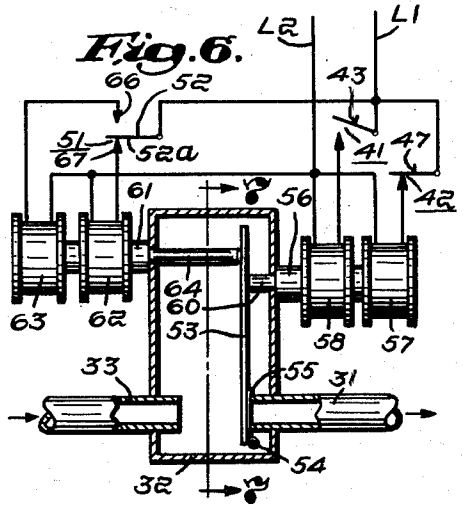
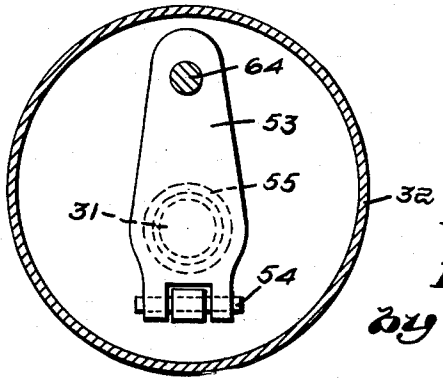


Fig. 8.



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2,951,513

LEAK-CHECK VALVE

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6 Claims. (Cl. 141—65)

The present invention relates to automatic machines for exhausting electrical devices, such as fluorescent lamps, and relates more particularly to an improved leak-check valve for such a machine.

Machines for the exhausting of fluorescent lamps are well known and in common use. Such a machine is disclosed in U.S. Patent No. 2,533,712, issued December 12, 1950, to J. M. Campbell. In such a machine, when a plurality of fluorescent lamps to be exhausted are connected to a common exhaust manifold, sudden implosions or leaks in one lamp may cause the phosphor coating in the other lamps on the same exhaust manifold to be destroyed, and the admitted ambient air may contaminate the other lamps, as well as the pump of the exhaust manifold, thereby ruining the other lamps and requiring considerable time to restore the system to normal operation.

Heretofore it has been known to employ a leak-check valve of the type shown in U.S. Patent No. 2,672,266, issued March 16, 1954, to J. R. Morin et al. to isolate the leaky fluorescent lamp. This leak-check valve, as shown in this patent, uses a metallic ball in the chamber provided in the exhaust line of the vacuum system, which ball is subject to the disadvantage that it tends to reduce the pumping speed of the system. In addition, during the reseating of such ball in its normal position on the shelf by a magnet, difficulty is sometimes encountered (due to collected contaminants on the seat which faces the inrushing deleterious material) in unseating the ball from the seat. Further the initial surge of air pumped from the lamp during preliminary exhaust occasionally undesirably seats the ball in the seat thus closing the leak-check valve.

It is also customary to provide such exhaust machines with pinch clamps (of the type shown in U.S. Patent No. 2,247,513, issued July 1, 1941, to A. J. Marshaus) for enabling an operator, at will, to manually close off the pumping system when an empty exhaust port arrives at an exhaust station. Although automatic pinch-clamp closing mechanism of the type shown in U.S. Patent No. 2,254,905, issued September 2, 1941, to D. Mullan are available, such closing mechanisms are bulky, complicated and expensive to maintain. Further the pinch-clamp rubbers (after long periods in the closed position) tend to remain constricted or closed. In addition, after repeated operation the pinch-clamp rubbers lose their resiliency and crack, thus requiring frequent replacement.

It is the general object of the present invention to avoid and overcome the foregoing and other difficulties of and objections to prior art practices by the provision of an effective leak-check valve for an automatic exhaust machine, which improved leak-check valve effectively shuts off the leaky electrical device from the remainder of the exhaust system to which it is connected.

Another object of the present invention is to prevent a leaky and contaminated electrical device from affecting and contaminating other devices being exhausted.

A further object of the present invention is to provide

a leak-check valve between a lamp being exhausted and an exhaust line, which valve can be closed and opened either automatically or manually, at the will by the operator to serve as a pinch clamp.

An additional object of the present invention is the elimination of conventional pinch-clamp rubbers and pinch-clamp closing mechanisms on exhaust machines.

The aforesaid objects of the invention, and other objects which will become apparent as the description proceeds, are achieved by providing a leak-check valve in the exhaust line between a lamp to be exhausted and the exhaust manifold to which that lamp and other lamps to be exhausted are connected. The valve contains a pivoted vane which is exposed to the air entering the valve from a leaking or broken lamp, and is deflected by such air to seal off the exhaust line connecting the valve to the exhaust manifold. Since the initial surge of air pumped from a normal lamp would actuate the vane to seal off the exhaust line, the vane is held back during the preliminary pumping stage, and released after the preliminary pumping stage so that it can be actuated only by leaking air. This valve having the pivoted vane automatically actuated by leaking air to close off an exhaust line, is provided with additional emergency means for enabling an operator to manually cause the pivoted vane to close off the exhaust line, the valve thus serving additionally as a pinch clamp.

Although the principles of the present invention are broadly applicable to machines for exhausting electrical devices, the present invention is particularly adapted for use in conjunction with machines for exhausting fluorescent lamps, and hence it has been so illustrated and will be so described.

For a better understanding of the present invention reference should be had to the accompanying drawings, wherein like numerals of reference indicate similar parts throughout the several views and wherein:

Fig. 1 is a fragmentary, vertical-sectional view of an exhaust machine embodying the leak-check valve of the present invention.

Fig. 2 is a diagrammatic plan view showing the arcuate relation of the cams in Fig. 1 to the work stations of the exhaust machine;

Fig. 3 is a vertical-sectional view of the leak-check valve of Fig. 1, showing its vane held against closing during the preliminary pumping stage of the lamp exhaust, and also showing diagrammatically the electrical controls for the leak-check valve;

Fig. 4 is a view similar to Fig. 3 but showing the vane at an exhaust pumping station and free to close;

Fig. 5 is a view similar to Fig. 4 but showing the vane deflected by the air from a leaking lamp to close off the outlet line from the valve.

Fig. 6 is a view similar to Fig. 5 but showing the vane in closed position when operated as a pinch clamp, and

Fig. 7 is a vertical-sectional view along the line 7—7 of Fig. 6 in the direction of the arrows.

With specific reference to the form of the present invention illustrated in the drawings and referring particularly to Fig. 1, a conventional exhaust machine of the type shown in the above-mentioned U.S. Patent No. 2,533,712, is shown having a turret **11** provided with a hub **12** attached to a vertically extending hollow shaft **13** which is driven by a conventional indexing mechanism (not shown) by of the type shown in U.S. Patent No. 2,569,852, issued October 2, 1951, to J. H. Green. The hub **12** is rotatable on a frame **14** of the exhaust machine by means of a ball bearing **15** and the hollow shaft **13** rotates on a stationary pedestal **16** extending through the shaft **13** above the hub **12**.

The turret **11** carries forty-eight conventional heads **19** (only one of which is shown in Fig. 1) of the type

shown in the above-mentioned U.S. Patent No. 2,533,712 and into each of which extends an exhaust tube **20** of a fluorescent lamp **21** to be exhausted. Each head **19** may carry a conventional mercury doser **22**. In order to operate each head **19** to grip or release an exhaust tube **20**, a conventional hand lever **23** may be used.

Attached to the hub **12** is a rotatable upper section **24** of a conventional rotary valve **25** (of the type shown in U.S. Patent No. 2,113,798, issued April 12, 1938, to D. Mullan), which valve has a lower section **26** attached to the frame **14**. An exhaust line **27** connected to a conventional exhaust manifold **27***a* (and thence to a pumping system, not shown) connects the exhaust manifold **27***a* to passage **28** in the valve **25**. When such valve **25** is open, as shown in Fig. 1, this passage **28** is connected in turn to the lamp **21** through a line **29**, a conventional trap **30**, an outlet line **31** from a leak-check valve **32** of the present invention and from the latter through an inlet line **33** extending to the head **19**. Each exhaust manifold **27***a* has, for example, four heads **19** connected thereto.

To provide cam-mounting means on the frame **14** (Fig. 1), a horizontally extending plate **36** is attached to a flanged member **37***a* which in turn is affixed to the pedestal **16**, and extends over the inner portion of the turret **11**. The plate **36** has attached to its under surface, as viewed in Fig. 1, cams **37** and **38** formed in circular arcs with their centers at the axis of the pedestal **16** (Fig. 2) which is the center of rotation of the turret **11**. These cams **37** and **38** are utilized to automatically close a first "operating" circuit and a first "retracting" circuit respectively, which circuits are operable to prevent and then allow closing of the leak-check valve **32** respectively during the preliminary stages of the exhaust of a lamp **21**, as hereinafter explained in detail.

A circular plate **40**, which extends under the plate **36** and is mounted on the turret **11**, is utilized to mount an "operating"-circuit switch **41** and a "retracting"-circuit switch **42** (which form a part of the above-mentioned first "operating"-circuit and first "retracting"-circuit respectively) for rotation with the hub **12** and along the cams **37** and **38** respectively. These switches **41** and **42** are mounted on the upper surface of the plate **40**, as viewed in Fig. 1, there being separate switches **41** and **42** for each leak-check valve **32**.

The "operating"-circuit switch **41** has a switch-closing lever **43** provided with a bifurcated upper portion **44** carrying a shaft **45** on which is mounted a rotary cam follower **46** for engagement with the cam **37**. The "retracting"-circuit switch **42** has a similar switch-closing lever **47**, the bifurcated upper portion **48** of which carries a shaft **49** for a rotary cam follower **50** for the cam **38**.

As shown in Fig. 1 a manually operated double-throw emergency switch **51**, which forms a part of an emergency "operating"-circuit and an emergency "retracting"-circuit (when the valve **32** is used as a pinch clamp), is mounted on the outer edge of the turret **11** opposite each head **19**. This normally open emergency switch **51** has a manually-operated switch closing and opening arm **52** for operating the blade **52***a* (Figs. 3–6) of the switch **51**.

Leak-check valve

Each leak-check valve **32** (Figs. 1 and 3–7) has a hollow, cylindrical body, into the lower end of which extend the adjacent ends of the opposed outlet line **31** and the inlet line **33**. A vane **53** (Figs. 3–7) is pivoted at **54** to the valve body below and adjacent the outlet line **31**. This vane **53** has (on its side facing the outlet line **31**) a sealing-off pad **55** of resilient material, such as rubber, which is adapted to contact and close off the inner end of the outlet line **31** when the vane **53** is deflected to closed position as shown in Figs. 5 and 6.

Operating means

The operating means for the first "operating"-circuit and the first "retracting"-circuit (Figs. 1 and 3–6) are mounted on a sleeve **56** extending from the right-hand side of the valve **32** (Figs. 3–6) above the outlet line **31**, which support electromagnets **57** and **58** positioned about such sleeve **56**. A plunger **60** actuated by the electromagnets **57** and **58** reciprocates within the sleeve **56** and through the wall adjacent the upper end of the leak-check valve **32** in alignment with the longitudinal axis of the vane **53**. Another sleeve **61** (associated with the operating means for the emergency "operating"-circuit and the emergency "retracting"-circuit) extends from the opposite side of the leak-check valve **32**, and has mounted therearound electromagnets **62** and **63**. A plunger **64** actuated by these electromagnets **62** and **63**, reciprocates within the sleeve **61** and through the opposite wall of the leak-check valve and also in alignment with the longitudinal axis of the vane **53**.

The above-mentioned "operating"-circuit switch **41** connects the electromagnet **58** with electric supply lines **L1** and **L2** to form the first "operating"-circuit. When this "operating"-circuit switch **41** is closed by the cam **37**, the electromagnet **58** is energized and moves the plunger **60** through the wall of the leak-check valve **32**, from the position shown by Fig. 4 to that shown by Fig. 3, to thus engage the vane **53** and hold the latter in the open position (Fig. 3) during the preliminary exhaust of the lamp **21** at stations "48" and "1" (Fig. 2). The first "retracting"-circuit comprises the "retracting"-circuit switch **42** which connects the electromagnet **57** to the supply lines **L1** and **L2**. When this switch **41** is opened to deenergize electromagnet **58** and switch **42** is closed, the electromagnet **57** is energized thus causing retraction of the plunger **60** away from the vane **53** from the position shown in Fig. 3 to that shown by Fig. 4 and preparing the leak-check valve **32** for closure by the occurrence of a leaking lamp **21** at the exhaust stations, such as stations "2," "3" etc. (Fig. 2).

As shown in Figs. 3–6, the manually operable emergency switch **51** has an upper switch contact **66**, and a lower switch contact **67**. The switch **51** (when its movable blade **52***a* is momentarily in contact with its upper contact **66**) connects the electromagnet **63** to the supply lines **L1** and **L2**, thereby closing the emergency "retracting"-circuit (after the valve has been used as pinch clamp) and energizing the electromagnet **63**. This momentary energization of the electromagnet **63** causes the retraction of the plunger **64** from the pinch-clamp position shown in Fig. 6 to that shown in Fig. 5. When the operating blade **52***a* momentarily engages the lower contact **67**, the switch **51** connects the electromagnet **62** to the supply lines **L1** and **L2**, thus closing the emergency "operating"-circuit with resultant momentary energization of the electromagnet **62** and thereby causing movement of the plunger **64** outwardly from the position shown in Fig. 5 to the pinch-clamp position shown in Fig. 6, to position the sealing-off pad **55** against the outlet line **31**. After the emergency "operating"-circuit is opened the vacuum in the outlet line **31** holds the pad **55** against the open end of the line, with the valve **32** being thus "closed."

The above-mentioned cam **37** is located as shown by Fig. 2, to cause the "operating"-circuit switch **41** to be closed just before a head **19** and the lamp **21** carried thereby reach the first preliminary exhaust station, station "48," of the exhaust machine, and to cause the "operating"-circuit switch **41** to be opened when the lamp **21** leaves the last preliminary exhaust station, such as station "1." The cam **38** is located, as shown by Fig. 2 (adjacent station "2"), to cause the "retracting"-circuit switch **42** to be closed when the head **19** and the lamp **21** are at station "2" and to cause the "retracting"-circuit switch **42** to be open thereafter during the exhaust of the lamp **21**.

Even though it is believed that the operation of the leak-check valve will be apparent from the foregoing

description, a brief review of the operation thereof will now be made.

Operation

In operation, when a lamp **21** carried by a head **19** is indexed by the turret **11** to the initial preliminary exhaust station, station "48" (Fig. 2), the cam follower **46** of the "operating"-circuit switch **41** (Fig. 1) engages the cam **37**, and closes the switch **41** and the first "operating"-circuit. At this time the cam follower **50** of the "retracting"-circuit switch **42** is off the cam **38** so that the switch **42** and the first "retracting"-circuit is open. The closure of the first "operating"-circuit causes the electromagnet **58** to be energized with resultant movement of the plunger **60** inwardly from the position shown in Fig. 4 to the position shown in Fig. 3, thus deflecting the vane **53** away from the inner end of the outlet line **31** so as to prevent the initial surge of air from the lamp **21** (caused by its now being exhausted) from deflecting the sealing-off pad **55** on the vane **53** against the inner end of the outlet line **31** and undesirably closing off the exhaust manifold **27***a* from the lamp **21**.

When the lamp **21** leaves the second preliminary pumping station, station "1" (Fig. 2), the cam follower **46** rides off the cam **37** and opens the switch **41** and the first "operating"-circuit thus deenergizing the electromagnet **58**. At the same time, the cam follower **50** engages the cam **38**, closing the "retracting"-circuit switch **42** and the first "retracting"-circuit, thus energizing the electromagnet **57**, which retracts the plunger **60** to the position shown in Fig. 4. However, the vane **53** remains in the position shown in Fig. 4 during continued exhausting of the lamp **26** since the suction force of the vacuum is not sufficient to cause rotation of the vane **53** about its pivot **54** and hence communication is continually established through the valve **32** from inlet line **33** to outlet line **31**.

If a leak however occurs in the lamp **21** after it has left the last-mentioned exhaust station, station "2," the vane **53** will be deflected to the position shown in Fig. 5 by the inrushing air through the leak so that the valve sealing-off pad **55** closes off the inner end of the outline **31** where it is retained by the suction of the vacuum even after the leaking lamp has been removed and until the vane **53** is returned to its normal exhaust position, as shown in Fig. 4, by movement of plunger **60** to the position shown in Fig. 3. Use of the leak-check valve **32** eliminates conventional pinch clamps and automatic pinch-clamp closing mechanisms.

During the normal operation of the exhaust machine, the plunger **64** is held by the vane **53** in its retracted position (Figs. 3–5) (where it does not interfere with the above-mentioned deflection of the vane **53**) by the above-mentioned inward movement of the plunger **60** during the preliminary exhaust stage. If the operator of the machine desires to close off a particular head **19** from the exhaust manifold **27***a* for any reason, such as the failure of the switch **42**, he depresses the plunger **52** of the emergency switch **51** (Fig. 1) to cause the operating blade **52***a* of the emergency switch **51** (Figs. 3–6) to engage the lower contact **67** with resultant closure of the emergency "operating"-circuit. Closure of the emergency "operating"-circuit energizes the electromagnet **62**, thereby causing the plunger **64** to be moved forwardly against the vane **53** to deflect the vane and position the sealing-off pad **55** against the inner end of the outlet line **31** and close off the latter. Thus, the operator in an emergency can use the leak-check valve **32** as a pinch clamp for closing off the lamp **21** from the pumping system at will.

Since the sealing-off pad **55** on the vane **53** is attached to the side of the vane which is opposite the inlet line **33** connected to the lamp **21**, contamination by impurities from a leaky lamp **21** is eliminated.

It will be recognized by those skilled in the art that the objects of the present invention have been achieved

by the provision of an improved leak-check valve for an automatic exhaust machine. This improved leak-check valve effectively shuts off a leaky and contaminated lamp from the remainder of the exhaust system to which it is connected and prevents such lamp from contaminating other lamps being exhausted. In addition, the valve can be opened and closed at will in an emergency by the operator to serve as a pinch clamp.

While in accordance with the patent statutes one best known embodiment of the invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

We claim:

1. In combination for a machine for exhausting fluid from an envelope and having a plurality of stations including an exhaust station together with means for moving said envelope to be exhausted from one station to another and an exhaust line for exhausting fluid from said envelope, a valve between said envelope and line, said valve having an inlet connected to said envelope and having an outlet connected to said line, said valve having outlet-closing means responsive to flow of fluid from said envelope through said valve to said line for closing said outlet, a first operating means actuated by said envelope moving means when said envelope is at said exhaust station for preventing said outlet-closing means from closing said outlet, and a second operating means actuated by said envelope moving means when said envelope is moved from said exhaust station to said other station for disabling said first operating means.

2. In combination for a machine for exhausting air from an envelope and having a plurality of stations including an exhaust station together with means for moving said envelope to be exhausted from one station to another and an exhaust line for exhausting air from said envelope, a valve between said line and envelope, said valve having an inlet connected to said envelope and having an outlet connected to said line, said valve having a pivoted vane adapted to be deflected by the flow of air from said envelope through said valve to said line to close said outlet, and operating means for said valve comprising electromagnetic means for preventing said vane from closing said outlet, and means actuated by said envelope moving means for energizing said electromagnetic means when said envelope is at said exhaust station, and for deenergizing said electromagnetic means when said envelope is moved from said exhaust station to said other station.

3. In combination for a machine for exhausting air from an envelope and having a plurality of stations including an exhaust station together with means for moving said envelope to be exhausted from one station to another and an exhaust line for exhausting air from said envelope, a valve between said envelope and line, said valve having an inlet connected to said envelope and an outlet connected to said line, said valve having a pivoted vane adapted to be deflected by the flow of air from said envelope through said valve to said line to close said outlet, and operating means for said valve comprising a first electromagnetic means for preventing said vane from closing said outlet, means actuated by said envelope moving means for energizing said first electromagnetic means when said envelope is at said exhaust station, and for deenergizing said first electromagnetic means when said envelope is moved from said exhaust station to said other station, a second electromagnetic means for causing said vane to close said outlet, and means including a manually operated switch for energizing and deenergizing said last mentioned second electromagnetic means.

4. In combination for a machine for exhausting air from an envelope and having a plurality of stations including an exhaust station together with means for moving said envelope to be exhausted from one station to another and an exhaust line for exhausting air from said

envelope, a valve between said line and envelope, said valve having an inlet connected to said envelope and having an outlet connected to said line, said valve having a pivoted vane adapted to be deflected by the flow of air from said envelope through said valve to said line to close said outlet, and operating means for said valve comprising a plunger adapted to move said vane away from said outlet, a first electromagnet for causing said plunger to move said vane away from said outlet, a second electromagnet for retracting said plunger from contact with said vane, means including a first switch closed by movement of said envelope moving means for energizing said first electromagnet when said envelope is at said exhaust station, said switch being opened by movement of said envelope moving means when said envelope moves from said exhaust station to said other station, and means including a second switch closed by movement of said envelope moving means for energizing said second electromagnet when said envelope is moved from said exhaust station to said other station, said second switch being opened by movement of said envelope moving means when said envelope is at said exhaust station.

5. In combination for a machine for exhausting air from an envelope and having a plurality of stations including an exhaust station together with means for moving said envelope to be exhausted from one station to another and an exhaust line for exhausting air from said envelope, a valve between said line and envelope, said valve having an inlet connected to said envelope and having an outlet connected to said line, said valve having a pivoted vane adapted to be deflected by the flow of air from said envelope through said valve to said line to close said outlet, and operating means for said valve comprising a plunger adapted to move said vane away from said outlet, a first electromagnet for causing said plunger to move said vane away from said outlet, a second electromagnet for retracting said plunger from contact with said vane, means including a first switch closed by movement of said envelope moving means for energizing said first electromagnet when said envelope arrives at said exhaust station, said switch being opened by said envelope moving means when said envelope moves from said exhaust station to said other station, means including a second switch closed by movement of said envelope moving means for energizing said second electromagnet when said envelope is moved from said exhaust station to said other station, said second switch being opened by movement of said envelope moving means when said envelope is at said exhaust station, a second plunger adapted to move said vane to close said outlet, a third electromagnet for causing said second plunger to deflect said vane against said outlet, a fourth electromagnet for retracting said second plunger from contact with said vane, and means including a manually operable double-throw switch for energizing said third electromagnet or for energizing said fourth electromagnet.

6. In combination a valve having an air inlet and an air outlet, a pivoted vane having a valve seat facing said outlet, said vane being adapted to be deflected by air entering said inlet to cause said seat to close said outlet, and operating means for said valve comprising a plunger for deflecting said vane and seat away from said outlet, a first electromagnet for causing said plunger to deflect said vane and seat away from said outlet, a second electromagnet for retracting said plunger from contact with said vane, means including switching means for energizing said first electromagnet or for energizing said second electromagnet, a second plunger for deflecting said vane to cause said seat to close said outlet, a third electromagnet for causing said second plunger to deflect said vane to cause said seat to close said outlet, a fourth electromagnet for retracting said second plunger from contact with said vane, and means including switching means for energizing said third electromagnet or for energizing said fourth electromagnet.

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