Dec. 9, 1958 R. H. ABPLANALP 2,863,316

VALVE TESTER FOR AEROSOL DISPENSING UNITS

Filed Jan. 21, 1955

6 Sheets-Sheet 1

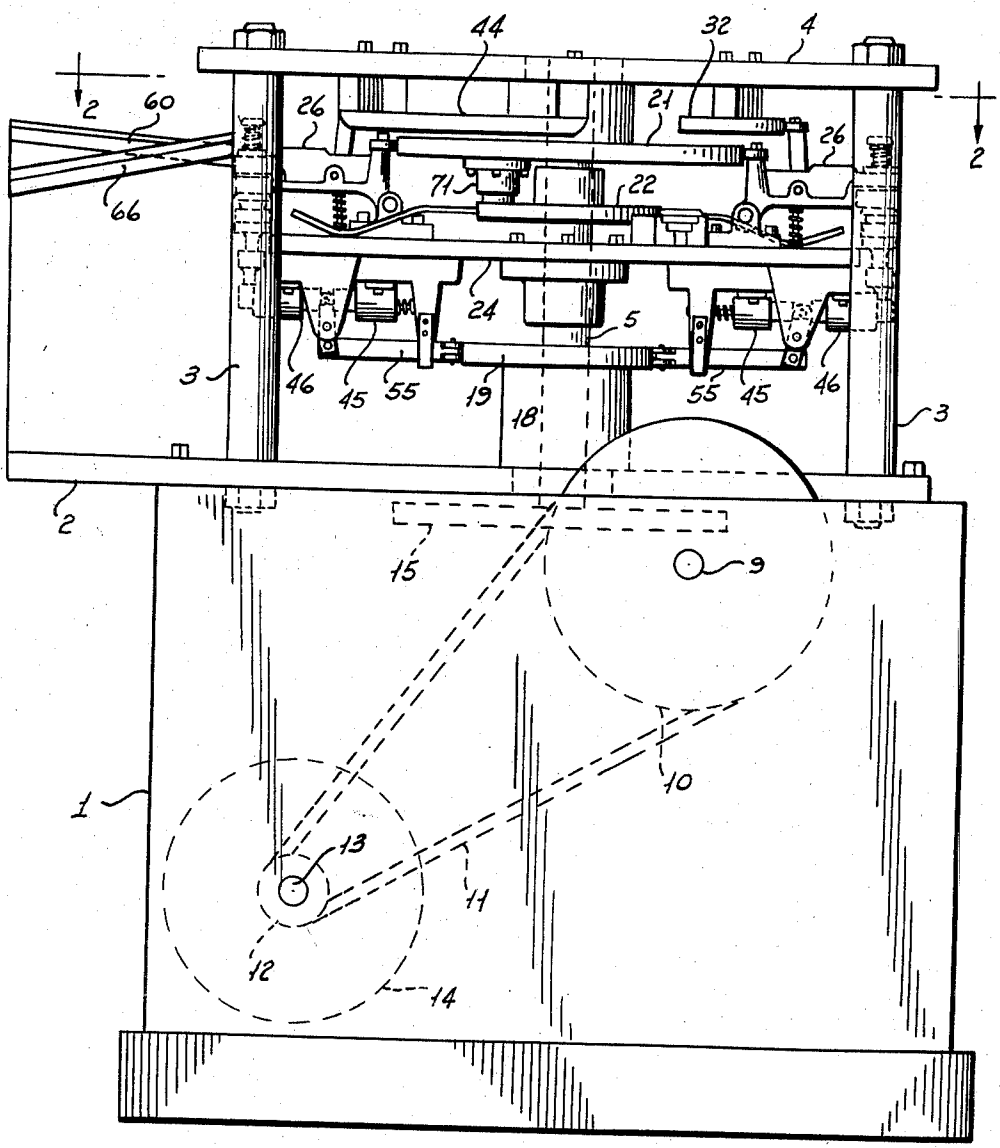


Fig. 1

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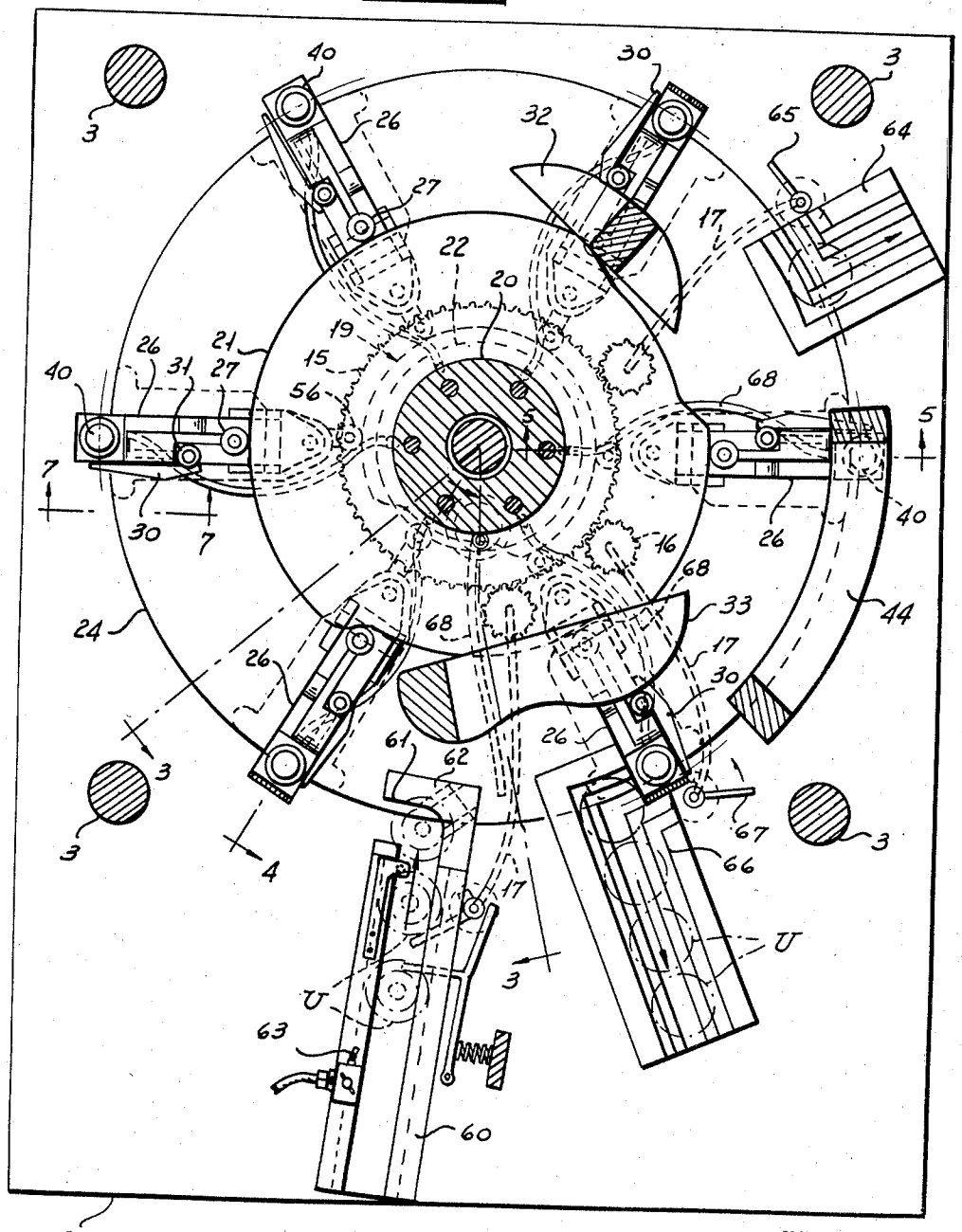
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VALVE TESTER FOR AEROSOL DISPENSING UNITS

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6 Sheets-Sheet 2

Fig 2



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Dec. 9, 1958 R. H. ABPLANALP 2,863,316

VALVE TESTER FOR AEROSOL DISPENSING UNITS

Filed Jan. 21, 1955 6 Sheets-Sheet 3

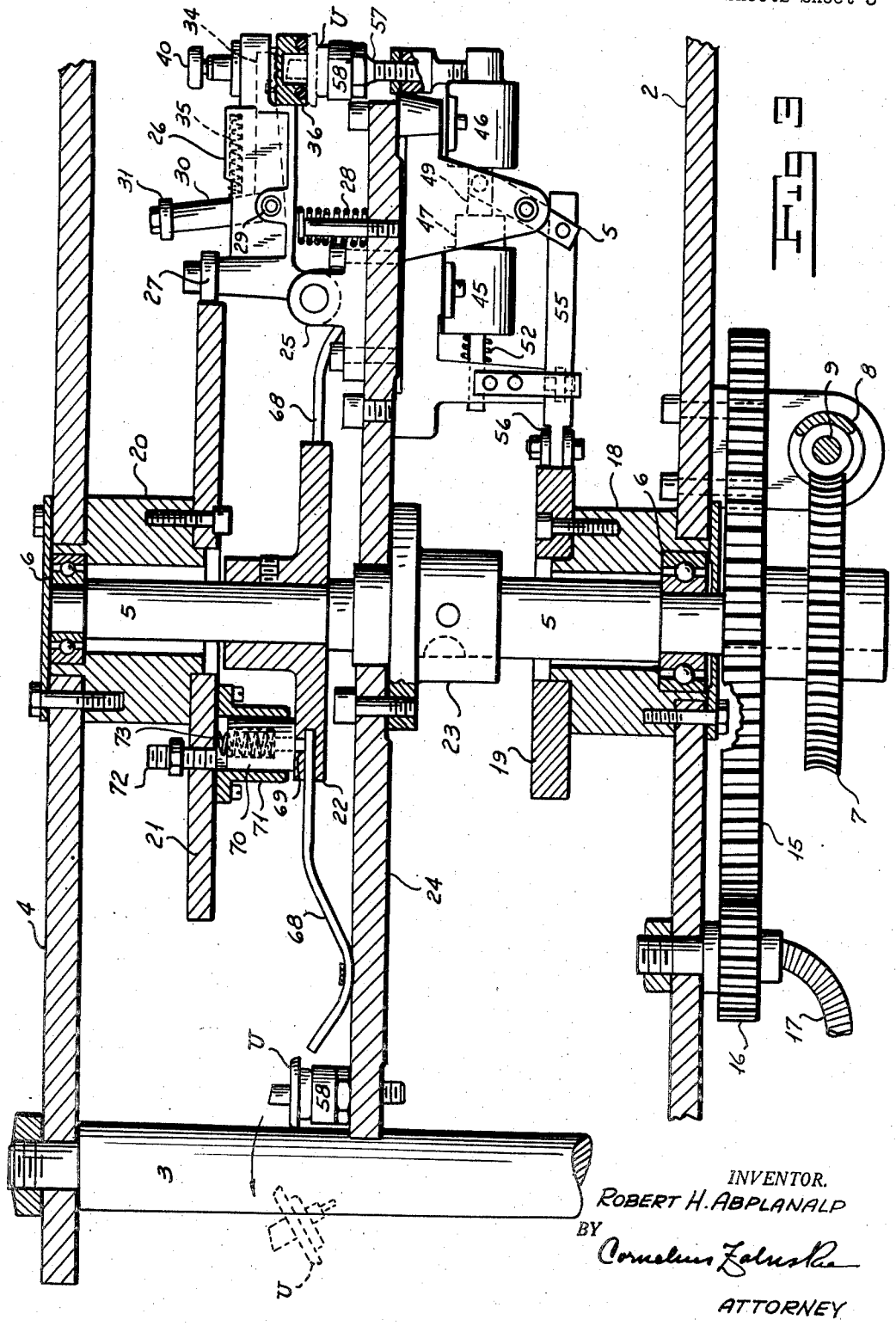


FIG. 3

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VALVE TESTER FOR AEROSOL DISPENSING UNITS

Filed Jan. 21, 1955

6 Sheets-Sheet 4

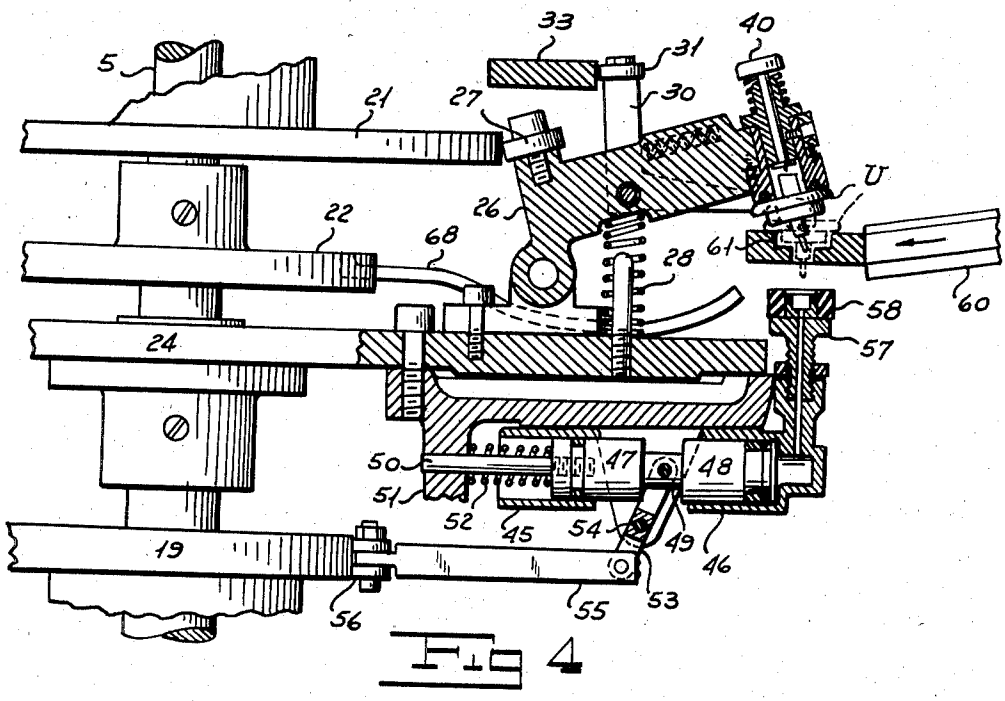


FIG 4

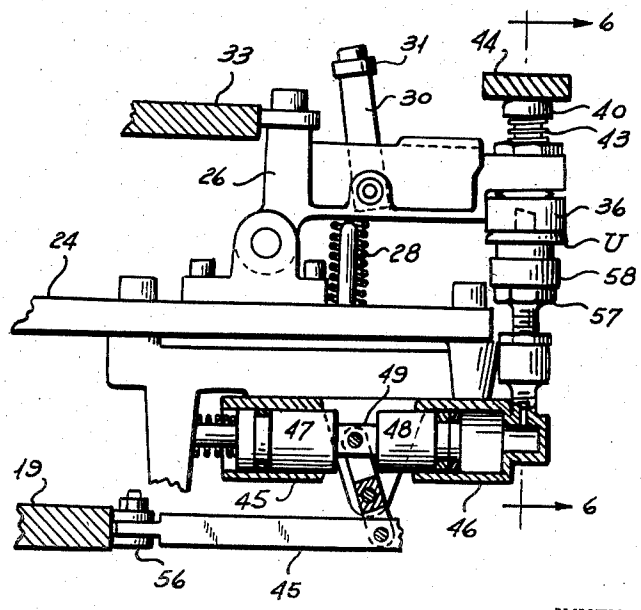


FIG 5

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Dec. 9, 1958 R. H. ABPLANALP 2,863,316

VALVE TESTER FOR AEROSOL DISPENSING UNITS

Filed Jan. 21, 1955 6 Sheets-Sheet 5

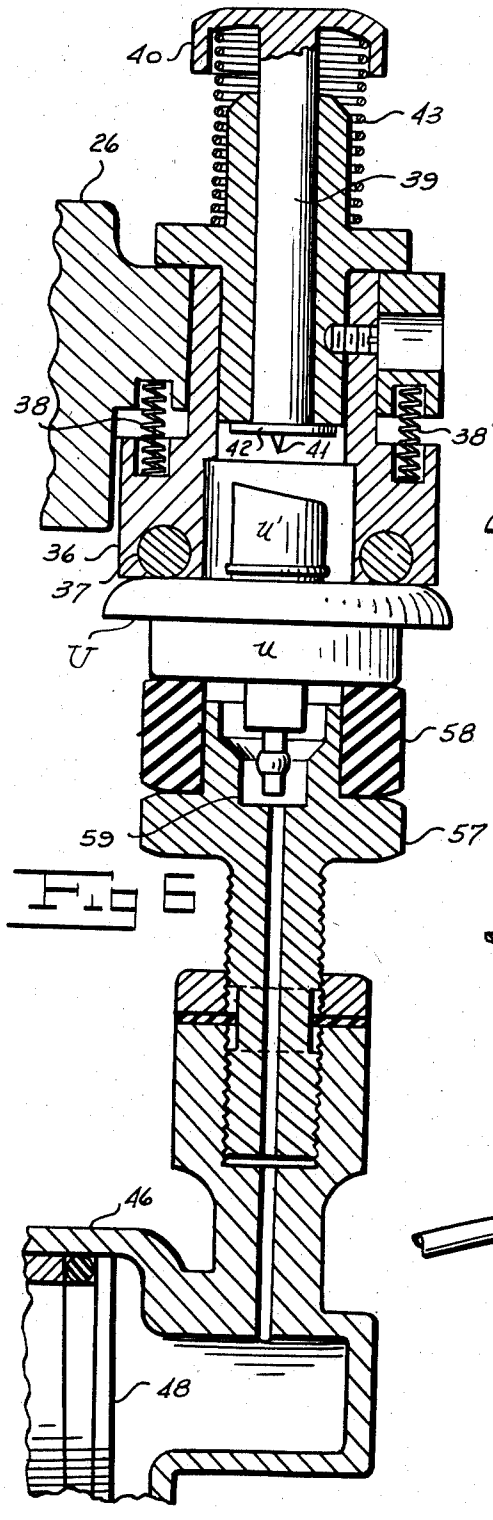


FIG 6

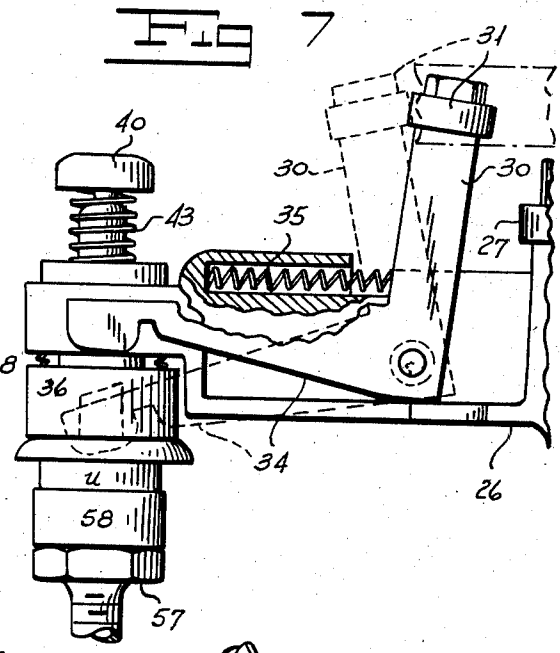


FIG 7

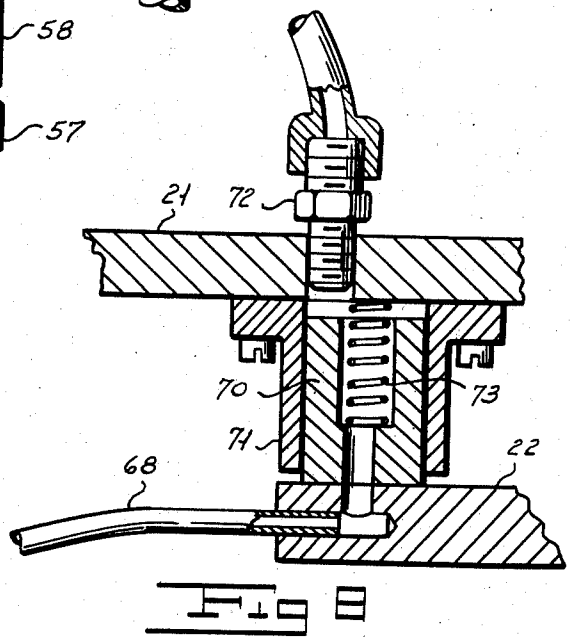


FIG 8

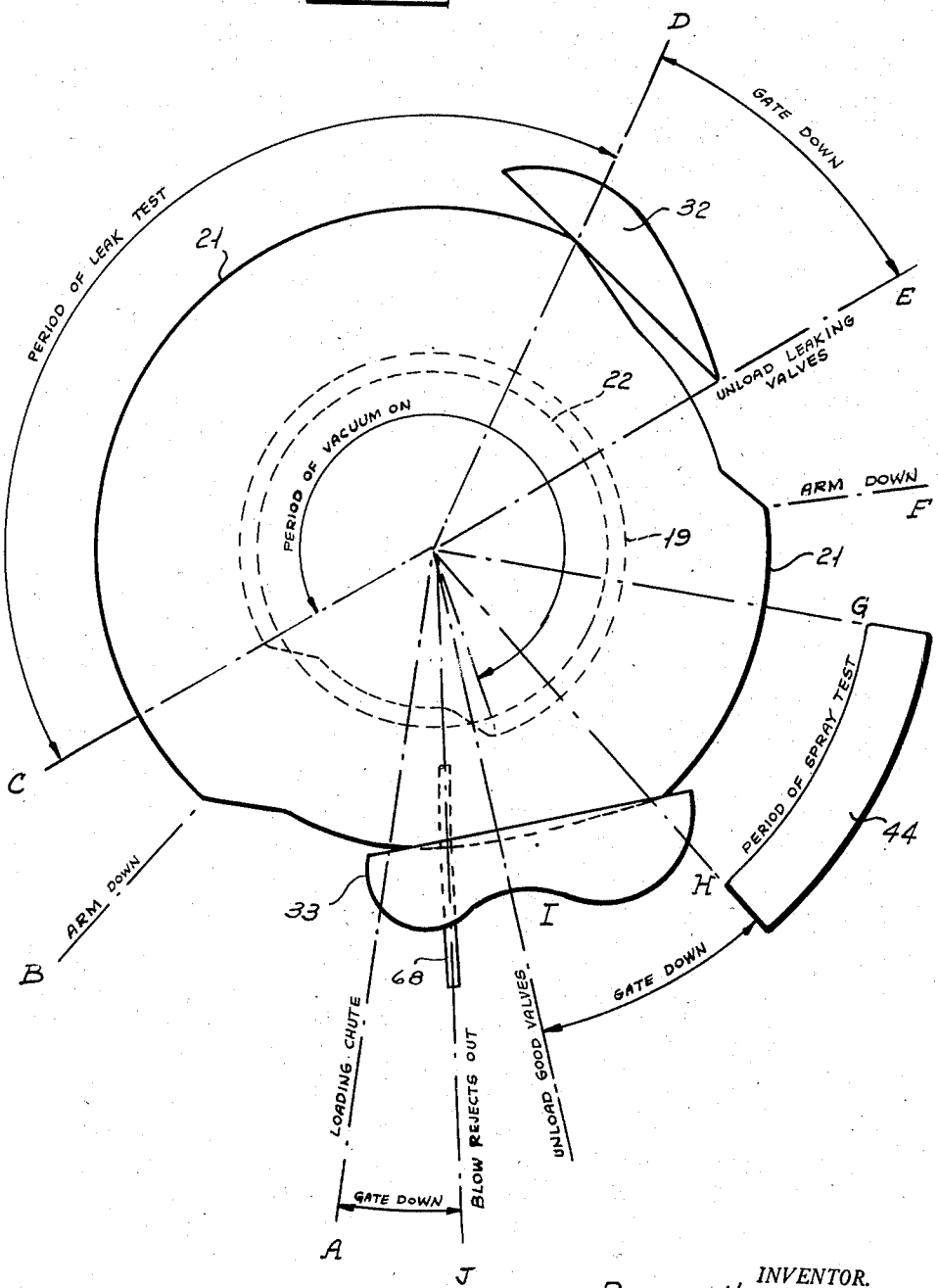
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Dec. 9, 1958 R. H. ABPLANALP 2,863,316

VALVE TESTER FOR AEROSOL DISPENSING UNITS

Filed Jan. 21, 1955 6 Sheets-Sheet 6

FIG 9



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United States Patent Office 2,863,316 Patented Dec. 9, 1958

2,863,316

VALVE TESTER FOR AEROSOL DISPENSING UNITS

Robert H. Abplanalp, Bronx, N. Y., assignor, by direct and mesne assignments, of one-half to John J. Baessler, Yonkers, N. Y.

Application January 21, 1955, Serial No. 483,194

14 Claims. (Cl. 73—45)

This invention is a machine for testing aerosol dispensing valves after they are manufactured and before they are applied to aerosol containers, so that the manufacturer may be sure that the valve is leak-proof and operative, and thereby overcome the necessity of discarding defective aerosol filled packages.

In the aerosol dispensing field, the valves which normally hold the packed material under pressure in the container and which are manually operable to permit of discharge of such material from time to time, are generally built into a unit which comprises a mounting cup by means of which the valve mechanism may be readily mounted on a container to form a hermetic seal therewith. This cup supports a valve housing interiorly of which valve mechanism is positioned, with the valve stem extending through the top of the valve housing and carrying a manually operable push button whereby the valve may be unseated when desired to dispense the pressurized material. These parts will hereinafter be collectively referred to as a valve unit. One illustrative form of such a unit is disclosed in my Patent No. 2,631,814, issued March 17, 1953.

The usefulness of such a valve unit depends fundamentally upon its ability to maintain a tight seal against the pressure in the container and to permit the operation of the valve mechanism to discharge the material from the container when desired. The parts entering into the valve mechanism are relatively small and in practice there is the ever present tendency of these valves to leak. If a leaky valve unit is inadvertently mounted on a container and the container filled, the resulting product is defective and must be discarded. It therefore becomes highly important to the manufacturer to equip containers with units which are thoroughly capable of carrying out their intended functions and the object of the present invention is to provide a machine whereby assembled units may be tested before mounting them on a container to be sure that they will so function.

Speaking generally, the machine of this invention is so constituted that valve units fed thereto are delivered to a suction head at a loading station and, as the head travels along a predetermined path, suction is applied to the unit while the unit travels along such path in concert with a magnet traveling along the same general path but in axially spaced relation to the unit. If the valve mechanism is leak-proof, the suction applied to such unit overcomes the attractive force of the magnet, but if the valve is leaky, the magnetic attraction overcomes the suction and places the unit under control of the magnet, so that, as the parts travel along said path, the defective unit is magnetically brought into cooperative relation with an ejector which automatically ejects that unit from the machine into the discard. If the valve is leak-proof, it continues to travel along the aforesaid path and in due course comes into cooperative relation with means for automatically opening the valve to break the suction, and if the passages through

the valve mechanism are clogged or are otherwise improperly functioning, suction will retain control with the result that an ejector mechanism further along the path of travel will eject the defective unit to the discard. On the other hand, if the valve is properly functioning, the suction will be broken and the magnet will take control and move the fully operative unit to a discharge station where the unit is discharged for attachment to an aerosol container.

The present invention embodies various novel features which will hereinafter become apparent from the drawings and from the following specification and appended claims.

The accompanying drawings illustrate one practical embodiment of the invention, but the construction therein shown is to be understood as illustrative, only, and not as defining the limits of the invention.

Fig. 1 is a side elevation of a machine embodying the present invention.

Fig. 2 is a plan section on the line 2—2 of Fig. 1.

Fig. 3 is a radial section on the broken line 3—3 of Fig. 2, showing the relation of the parts when a magnet carrying arm and suction head couple are at the loading station of the machine.

Fig. 4 is a radial section in the plane of the radial line 4 in Fig. 2.

Fig. 5 is a section on the line 5—5 of Fig. 2 showing certain parts in section and certain parts in elevation.

Fig. 6 is an enlarged fragmental section taken on a plane including the line 6—6 of Fig. 5, but at right angles to the plane of Fig. 5. In Fig. 6 the cam 44 shown in Fig. 4 is omitted and the part 40 is elevated.

Fig. 7 is a side section on the line 7—7 of Fig. 2.

Fig. 8 is an enlarged fragmental view of a portion of the mechanism shown in Fig. 3, with the parts in section on the line 4—4.

Fig. 9 is a diagram graphically showing one complete cycle of operation of the machine.

Referring to the drawings, 1 designates a suitable base surmounted by a table 2 and, mounted above the table on pillars 3 in a position spaced above the table, is rigidly supported a top plate 4. A vertical shaft 5 is supported in bearings 6 at its upper end and near its lower end for rotation and the lower end of said shaft carries a worm gear 7 adapted to be driven from a worm 8 mounted on a shaft 9 within the base. This shaft 9 carries a pulley 10 driven by a belt 11 from a pulley 12 fixed on an armature shaft 13 of a motor 14 (Fig. 1). Mounted on the shaft below the table 2 and above the worm gear 7 (Fig. 3), is a master gear 15 and with this master gear meshes a plurality of satellite pinions 16, each of which is adapted to drive a flexible shaft 17 which operates discharge members hereinafter described.

Rigidly fixed to the upper surface of the table 2 is a cam supporting block 18 to which is secured a fixed suction cam 19, while a similar supporting block 20 is rigidly secured to and depends from the top plate 4. To the lower face of this supporting block 20 is secured a fixed pick-up cam 21. Directly below this pick-up cam and secured for rotation with the shaft is a blow-off flange 22 and directly below this flange and keyed to the shaft is a hub 23 of a rotary arm carrying disk 24. When the shaft is rotated, the arm carrying disk 24 and the blow-off flange rotate with the shaft while the cams 19 and 21 remain stationary.

Mounted at annularly spaced apart distances on the rotary arm carrying disk are a plurality of brackets 25 to which are pivoted a like number of radially disposed arms 26. Any number of these arms may be provided although for the purpose of illustration, I have shown six spaced at equal distances about the disk 24 and projecting

in an outward radial direction. Each of these arms carries a cam follower roller 27 adapted to follow the periphery of the pick-up cam 21 and said follower is maintained in contact with said cam by a compression spring 28 (Figs. 3, 4 and 5).

At the back face of each of said arms a gate is pivoted on a pivot 29. This gate is in the form of a bell crank lever 30, the upstanding arm of which carries a cam follower roller 31 adapted to cooperate in succession with two gate cams 32 and 33 which are supported on and suspended below the top plate 4, as shown best in Figs. 1, 2 and 9. Each bell crank lever 30 has an outwardly radially extending arm 34 which, through cooperation of the follower 31 and cams 32 and 33, may be swung downwardly into the downwardly inclined dotted line position of Fig. 7, and when released by the cams will swing into the substantially horizontal position shown in full lines in this figure under the action of a spring 35.

Mounted on a vertical axis near the outer end of each arm is a magnet holder 36 with a permanent magnet 37 (shown best in Fig. 6) embedded in its lower face. Such a magnet holder is supported on each arm 26 so as to permit of limited vertical movement relative to the arm and it is normally held in its lowered position by a compression spring 38. The magnet holder is in effect tubular and extending therethrough is a stem 39 of a valve depressor provided at its upper end with a head 40 and at its lower end with a button contacting finger 41 directly above which the stem is provided with a flange 42. A spring 43 interposed between the head 40 and the magnet holder normally serves to elevate the finger 41 while permitting the valve depressor to be moved downwardly when the head 42 rides under and into contact with the under surface of a suction breaking cam 44 (Figs. 1, 2, 5 and 9).

Rigidly mounted on the rotary arm carrying disk 24 immediately below each of the pivoted radial arms 26 is a suction device comprising tandem cylinders 45 and 46. In these cylinders are arranged pistons 47 and 48, respectively, which are connected by a rigid shank 49. These cylinders and pistons are coaxial with one another and the piston 47 has an inwardly extending stem 50 which passes through a lug 51 on the device and a spring 52 is interposed between said lug and the piston 47 and normally tends to move both pistons in an outward radial direction. A lever 53 of the first kind is mounted intermediate its ends on a pivot 54 with its upper end bifurcated to straddle the shank 49, while its lower end is pivoted to a connecting rod 55, the inner end of which carries cam follower rollers 56 adapted to follow the periphery of the fixed suction cam 19, all as clearly shown in Figs. 4 and 5. Both of the pistons 47 and 48 are provided with suitable packings, such as O-rings and oilite rings so as to slide smoothly in the respective cylinders and, when drawn in an inward radial direction through the operation of the follower rollers 56 in traversing the cam 19, a partial vacuum will be produced in the outward end of the cylinder 46.

The outer end of the cylinder 46 is closed except for a small duct connection with an upright suction head 57, shown best in Fig. 6. This suction head is coaxial with the magnet holder 36 of the corresponding pivoted arm 26 when said arm is in the lowered position shown in Figs. 1, 3, 4, 5 and 6. The upper end of each suction head 57 carries an annular resilient seat 58 which may conveniently be formed from soft rubber and on this seat a unit U to be tested is adapted to rest. The upper portion of the suction head is recessed as at 59 to receive the depending portion of the unit. Each unit U comprises a cup *u* which is adapted to rest upon the seat 58 and a valve operating push button *u'* which is adapted to be engaged and operated by the finger 41 of the valve depressor 39 when said depressor is forced inwardly by engagement with the under side of the cam 44 as presently explained and as shown in the left hand portion of Fig. 1.

When the twin pistons 47 and 48 are moved to the left in Figs. 3, 4 and 5 of the drawings, the partial vacuum formed in the outer end of the cylinder 46 is communicated as suction to the suction head 59 and is thus adapted to hold a unit U firmly seated on the resilient seat 58, as indicated in Fig. 6, for said seat makes a hermetic seal therewith and pneumatically holds the unit to its seat until the partial vacuum is broken by venting the cylinder.

The shaft 5 which carries the several radial arms and associated adjuncts is rotated at a constant speed from the motor 14 or from any other suitable source of power and the units to be tested are fed through an inclined chute 60 into the upper end of which they may be introduced manually or by any suitable feeder. They pass down this chute in close succession to the lower end and successively come to a seat against an abutment 61 and a chute outlet facing in the direction of rotation of the disk 24, as shown best in Fig. 2. The movement of the units down the chute may be facilitated by applying compressed air behind them as through a compressed air jet 63, shown in Fig. 2. At the rear end of the abutment 61 is positioned a permanent magnet 62 which holds the foremost unit accurately in such position that it can be picked up by the magnet 39 of the next radial arm as the latter passes over it.

As a radial arm 26 approaches the loading station where it is to receive a unit from the chute 60, the cam 33 moves the gate 30 into the dotted line position of Fig. 7, i. e., it lowers the gate, so that the forward unit in the chute is directly in its path. As the arm 26 passes over said unit, the gate forces the unit free from the magnet 62 of the chute and immediately thereafter the magnet 37 of the magnet holder of that particular arm lifts the unit and grips it, so that the unit is carried along with the arm in a clockwise direction, as viewed in Fig. 2. The arm 26 will then be in tilted up position as seen in Fig. 4.

After the arm 26 has left the loading station at the chute and arrives at the radial plane B of Fig. 9, the pick-up cam 21 acts upon the follower 27 of such arm to lower the outer end of the latter and seat the unit upon the resilient seat 58 of the subjacent suction head 57. Immediately thereafter, the fixed suction cam 19 acts upon the followers 56 to move the pistons 47 and 48 from the forward position in which they are shown in Fig. 4, to the retracted position shown in Fig. 5, thereby producing a partial vacuum or suction to hold the unit firmly to said resilient seat 58.

As the disk 24 continues to rotate in a clockwise direction, the said unit is carried along and engaged both above and below as shown in Fig. 5, and in more detail in Fig. 6 and these conditions exist during the period of leak test, i. e., from radial plane C of Fig. 9 to radial plane D of said figure. This allows a sufficient interval of time to properly determine whether or not the valve in the unit is leaky. If it is leaky, atmospheric air will leak through the valve of the unit into the cylinder 46 to vent said cylinder and break the vacuum therein, so that the unit will no longer be suction held to the resilient seat. On the contrary, if the valve is tight and leak-proof, the suction holding operation will continue at least until the unit reaches the radial plane G.

When the unit arrives at the radial plane D of Fig. 9, the follower 27 of the arm which is cooperating with the particular unit described, arrives at a lower phase of the pick-up cam 21 and, as a result, the arm 26 is tilted upwardly by its spring 28 and, if the valve of that unit has been defective and the suction head consequently vented, the unit will be picked up and elevated to the plane of the chute 64 by the magnet 37 of the magnet holder. The gate 34 is thereupon lowered behind the defective unit by the gate cam 32 with the result that, as the disk 24 continues to rotate, the gate will sweep the defective unit into the inlet end of a discharge chute 64 shown in Fig. 2. Immediately thereafter the spring 35 lifts the gate out of the way and a rotary discharge kicker

65 discharges the defective unit from the machine to discard. This rotary kicker 65 is operated by one of the flexible shafts 17 connected to one of the satellite pinions shown in Fig. 3. The discharge of the defective unit will occur at approximately the radial plane E in Fig. 9.

If, however, the unit has passed the leak test, it will remain held by suction on the suction head 57 and will pass the chute 64 at the discharge station for leaky valves for the suction will continue to hold the unit seated on the suction head, while the cam follower 27 traverses the low phase of the pick-up cam indicated between the radial lines D and F of Fig. 9. At line F the pick-up cam 21 will again lower the magnet holder and the parts will reassume the relation shown in Fig. 6 as the rotary disk 24 continues to turn, until the arm reaches the radial line G which marks the forward end of the valve depressing cam 44. At this time the valve depressor head 40 will ride under this cam and the valve depressor will be forced downwardly against the push button u' and will in turn depress that button to open the valve for a spray test. If the valve is operating properly the opening of such valve will immediately vent the suction head and outer cylinder 46 and suction beneath the unit will be broken.

Continuing rotation to the line H in Fig. 9, the follower 27 of said arm will again encounter another low phase of the pick-up cam 21 and the arm will again be tilted up by its spring 28. If the valve is not defective as shown by the breaking of the vacuum, the unit will be lifted by the magnet 37 of said arm as it is tilted up and thus brought into the plane of a discharge chute 66 at the radial plane I of Fig. 9. As it is about to enter said chute, the gate 30 is again lowered by the cam 33, so as to push it into the chute 66 and as it is thus released from the pivoted arm a secondary rotary kicker 67, also operated by a flexible shaft 17 from one of the pinions 16, will discharge it through the chute 66 as a proper unit to be applied to an aerosol container.

On the other hand, if the pressure on the push button has not vented the suction head, due to clogging of one of the passages or for any other defect in the unit, the unit will remain suction held to the suction head and will be carried below the plane of the discharge chute 66 to a point beyond such chute and in advance of the chute 60. As it reaches its intermediate position, indicated at J in Fig. 9, it will be discharged from the machine by a blast of compressed air fed through the tube 68 which leads from the blow-off flange 22, as shown in Fig. 3. This blow-off flange is provided in its upper face with a port registering with the inner end of each tube 68 and, as the flange rotates with the shaft 5, it brings the ports appropriate to the several arms into registration with a tubular graphite plug 70 mounted in a stationary tubular holder 71. To the upper end of this holder air is fed through a nipple 72 from any appropriate source of compressed air. A spring 73 maintains a firm sliding contact between the plug 70 and the upper face of the flange 22, so that compressed air is discharged from the tube 68 in an upwardly inclined direction against the under side of the unit U and blows said unit out of the machine to discard, after the manner indicated in dotted lines in Fig. 3.

I have described the operation of one radial arm and its associated parts. The same identical operation is carried out for each arm and the tests are progressively performed on the units which are fed to said arms in succession. The machine operates in an absolutely automatic manner. It first tests each valve and discards it if it is leaky and then tests each valve for its ability to properly function for the discharge of aerosol material. Good units are delivered from the machine for use while those which are defective are rejected. It is absolutely unfailing in its operation for its operations are positive. The arm carrying disk may rotate at a relatively fair rate of speed, so that the output of the machine does not constitute a bottle-neck in production. The independent

mechanisms and their operations are such that they are not liable to get out of order and very little maintenance is required to keep the machine operating effectually and continuously for protracted periods.

The machine of this invention takes the place of slow and monotonous manual testing of the individual valves which was heretofore necessary and in connection with which the human element of mistake occasioned in the past a considerable percentage of discards of aerosol containers with consequent financial loss. These human factors are entirely eliminated in the present invention, the machine of which is absolutely positive and reliable.

The foregoing detailed description sets forth the invention in its preferred practical forms, but the invention is to be understood as fully commensurate with the appended claims.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A valve tester for aerosol units comprising: means for moving units in succession along a predetermined path, means for applying suction to the valves of said units as they travel to individually test the ability of said valves to hold pneumatic pressure, means positioned along said path to discard units with leaky valves, means further along said path to open the leak-proof valves of the remaining units to individually test the capability of such units to properly control the discharge of aerosol material therethrough, means still further along the path to individually select the good from the defective units and separately remove the units of both kinds from said path of travel.

2. A valve tester according to claim 1, wherein the means for moving the units along said path comprises: a rotatable member having annularly spaced apart suction heads adapted to support and hold the units until the suction head is vented.

3. A valve tester according to claim 2 comprising: a magnet contiguous to each suction head to remove a unit from such suction head after that suction head has been vented.

4. A valve tester for aerosol units comprising: a testing couple mounted to conjointly travel along a predetermined path and embodying a suction head and a magnet arranged in axially spaced apart relation, means for introducing a unit to be tested between them at a loading station, means beyond the loading station to produce a partial vacuum in the suction head to test the ability of the valve of said unit to hold pressure, means for thereafter axially moving the magnet away from the head along with the unit if the valve of said unit is leaky and fails to hold the vacuum in said head, and means for removing a thus defective unit from the magnet and discharging it from said path of travel.

5. A valve tester for aerosol units comprising: a testing couple mounted to conjointly travel along a predetermined path and embodying a suction head and a magnet arranged in axially spaced apart relation, means for introducing a unit to be tested between them at a loading station, means beyond the loading station to produce a partial vacuum in the suction head to test the ability of the valve of said unit to hold pressure, means for thereafter axially moving the magnet away from the head along with the unit if the valve of said unit is leaky and fails to hold the vacuum in said head, and means for removing a thus defective unit from the magnet and discharging it from said path of travel, in combination with means further along the path of travel to open the valve of a unit which has previously held the vacuum to thereupon break said vacuum if said unit is operable to dispense aerosol material, the magnet being thereafter again moved away from the suction head to remove the thus proven effective unit from the suction head, and means further along said path to remove said unit from the magnet and discharge it from said path of travel for commercial use.

6. A valve tester according to claim 5 comprising: means still further along said path of travel to remove therefrom any unit which remains in said path of travel.

7. A valve tester for aerosol units comprising: a disk mounted to rotate on a vertical axis, a plurality of testing couples annularly spaced apart about said disk and each embodying a suction head and a superimposed magnet holder having a magnet, a loading station for feeding units in succession between the members of said couples in succession, a leaky valve discharge station further along the path of rotation of said couples, a valve opening station further along said path, a station further along said path for discharging good units, and a defective unit discharge station still further along said path, in combination with means for producing a partial vacuum in each suction head after it leaves the loading station, and means for lowering the magnets into contact with the units after they leave the loading station and while they are in the proximity of the valve opening station and for lifting said magnets away from the suction heads while said units are in proximity to the discharge and loading stations.

8. A valve tester according to claim 7, wherein the means for producing a partial vacuum in the suction heads comprises a cylinder communicating with each head, a piston in each cylinder, and means for withdrawing the piston to produce such partial vacuum.

9. A valve tester according to claim 8, wherein the means for withdrawing the piston does so once for each complete cycle of rotation of said disk.

10. A valve tester according to claim 9, wherein said means for withdrawing the piston comprises a stationary cam coaxial with the disk with operative connections between said cam and piston for moving the piston in one direction, and a spring for moving it in the opposite direction.

11. A valve tester according to claim 7 comprising means at each of the leaky valve and good unit discharging stations for forcibly removing units supported by the magnets.

12. A valve tester according to claim 11, comprising a gate movable with the disk to positively force the units on the magnet into cooperative relation with said last mentioned means.

13. A valve tester according to claim 11, comprising a stationary cam coaxial with the disk for actuating the gate.

14. A valve tester for aerosol dispensing units comprising: a shaft with means for rotating the same, a rotary arm carrying disk supported on and rotatable with the shaft, a fixed suction cam arranged cross axially of the shaft, a fixed pick-up cam arranged cross axially of the shaft, a plurality of suction devices arranged in arcuately spaced apart relation around the disk with upstanding suction heads surmounted by resilient seats, said suction devices being provided with cam followers coacting with the fixed suction cam to apply suction to the suction heads during a predetermined portion of each complete rotation of the disk, a plurality of arms pivoted on said disk and carrying magnet holders and valve depressors adapted to axially register with said suction heads, each of said arms having a cam follower coacting with the stationary pick-up cam to force the magnet holders into engagement with the units seated upon the corresponding suction heads during predetermined portions of each complete rotation of the disk, springs for tilting the arms upwardly when permitted to do so by the pick-up cam to lift the magnet holders, a magnet carried by each magnet holder and adapted to lift a unit therewith when the arm is up-tilted after the corresponding suction head is vented, means at a loading station to successively feed units between each magnet and suction head, means arcuately spaced along the path of travel of the unit from the loading station to discharge units embodying leaky valves which have vented the suction head, means further along the path of travel of the units for operating the valve depressor to vent properly operable units, means still further along the path of travel of the units to discharge units which have been properly vented through the operation of the valve depressor, and means still further along the path of travel of the units and in advance of the loading station to discharge units which are defective in that they have not permitted the venting of the corresponding suction head during operation of the valve depressor.

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