

July 21, 1931.

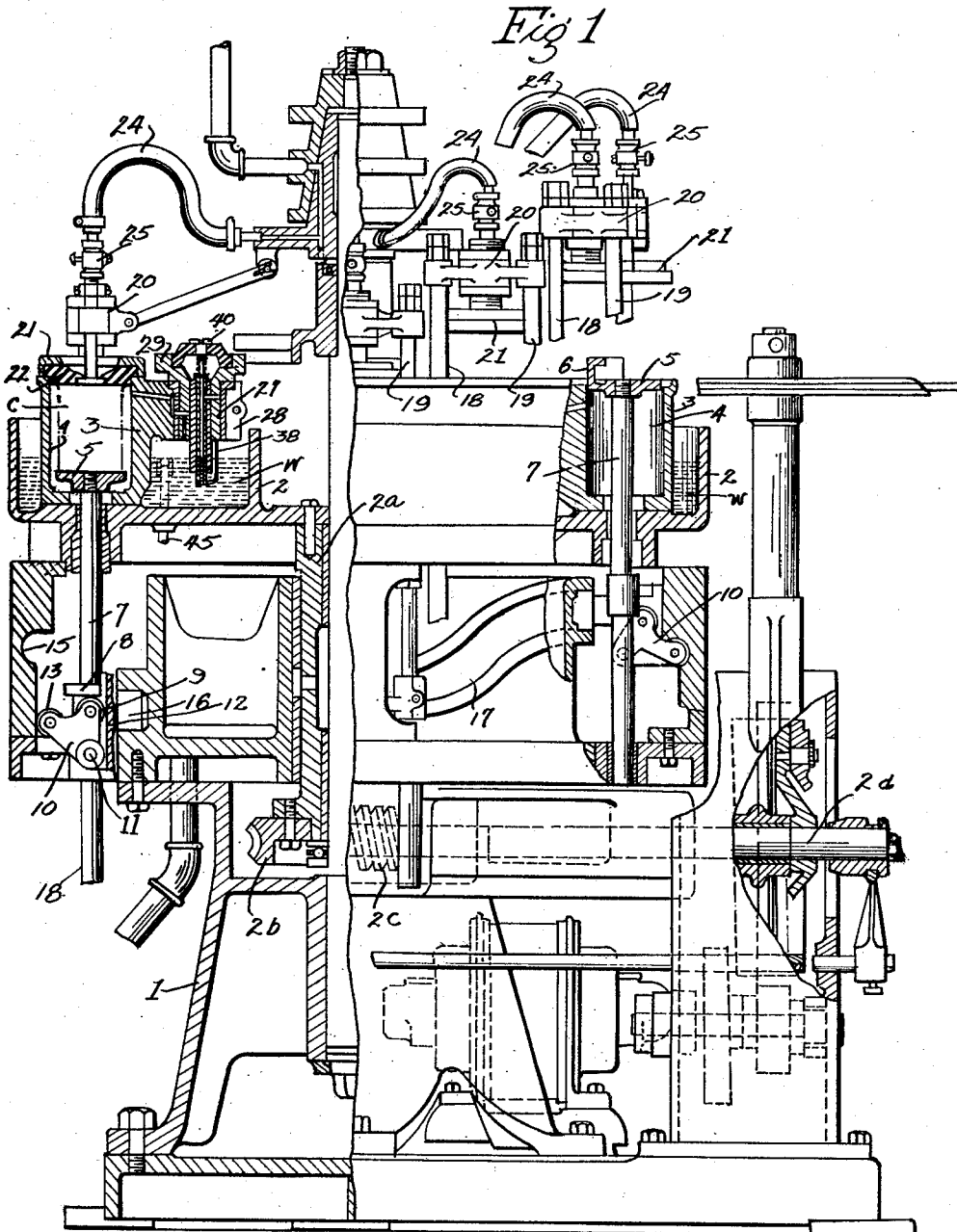
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1,815,523

AUTOMATIC CAN TESTING MACHINE

Filed March 1, 1929

6 Sheets-Sheet 1



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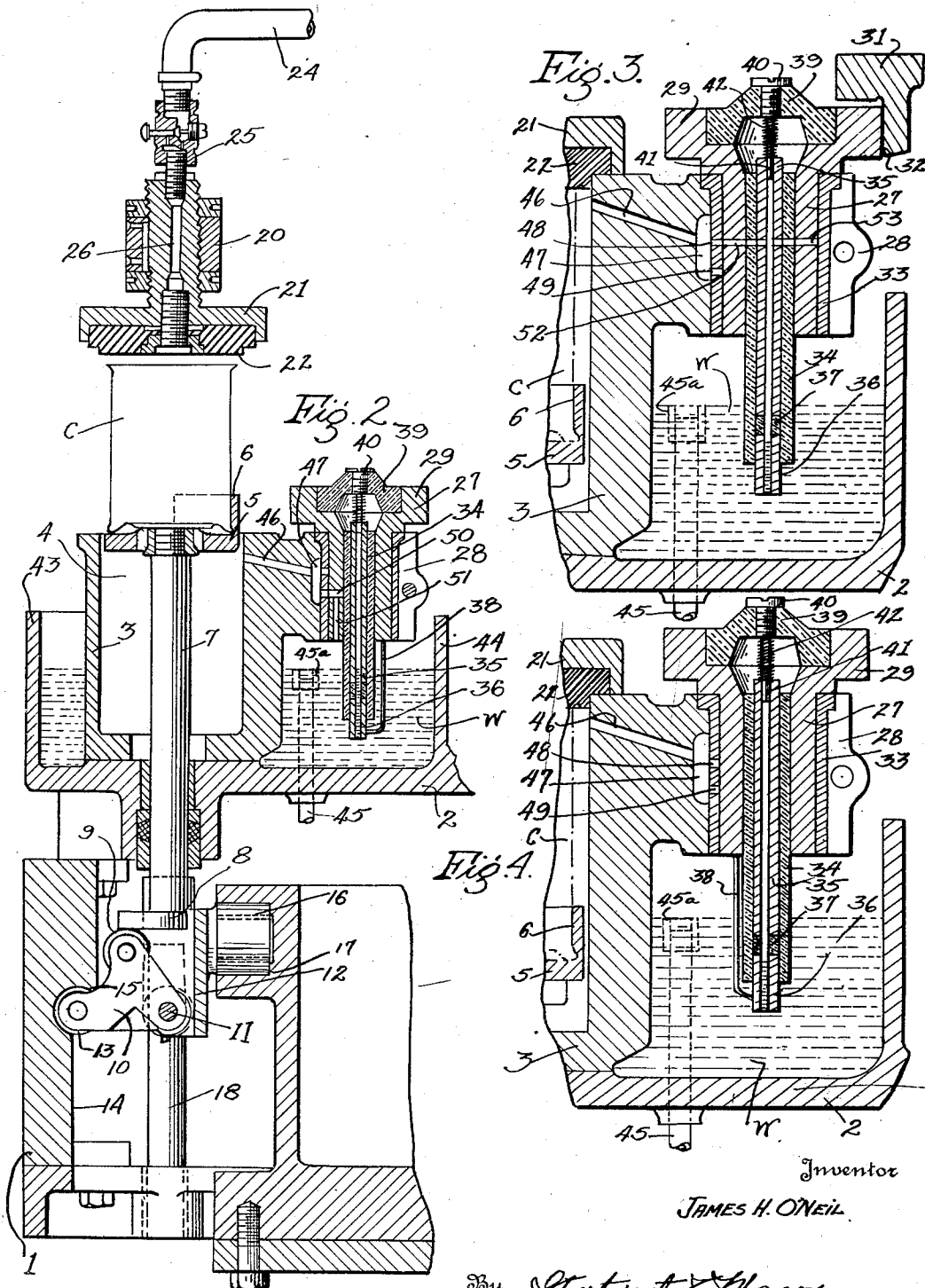
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AUTOMATIC CAN TESTING MACHINE

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6 Sheets-Sheet 2



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AUTOMATIC CAN TESTING MACHINE

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6 Sheets-Sheet 3

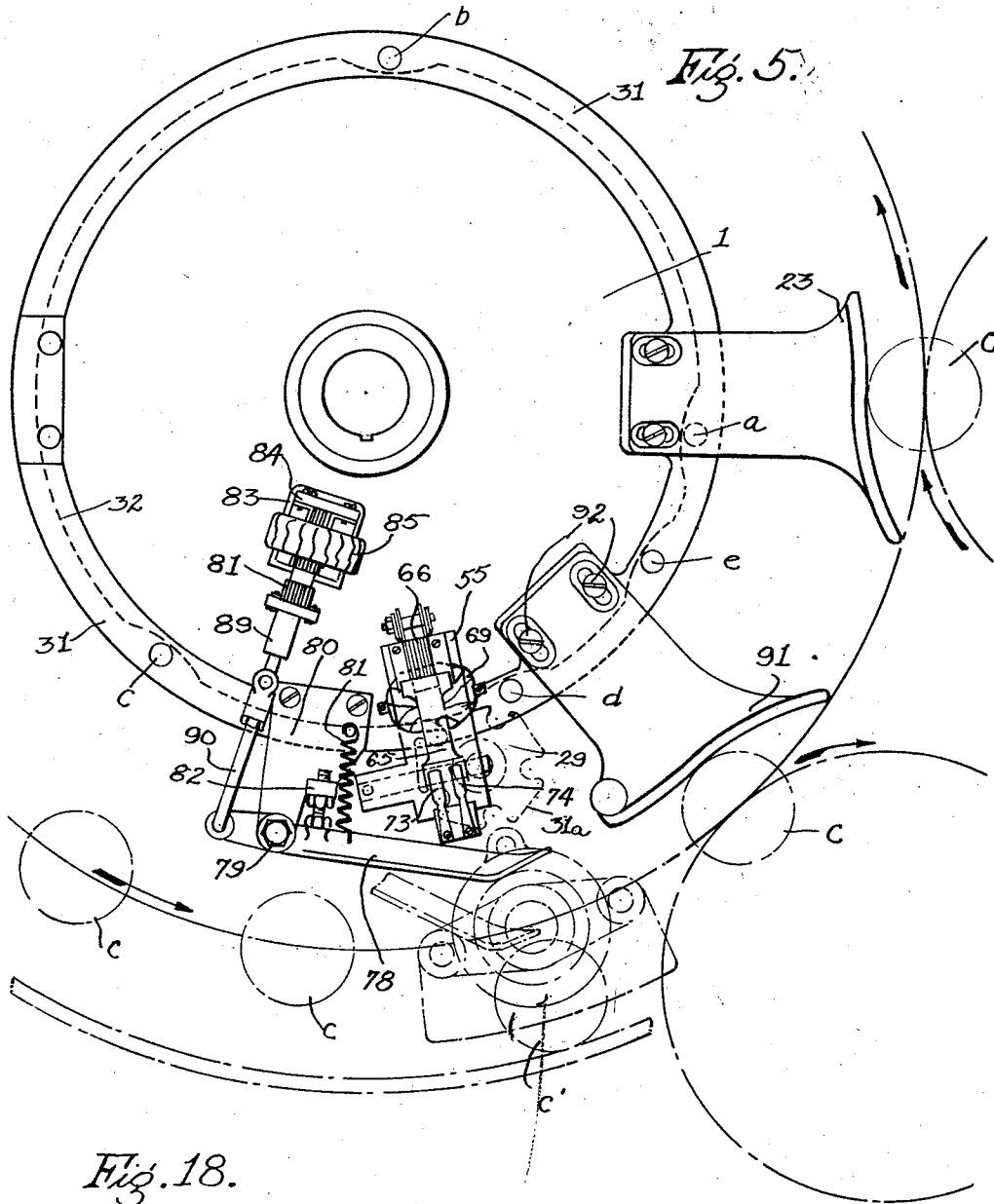
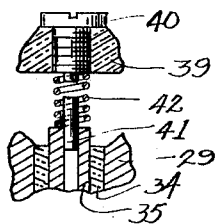


Fig. 18.



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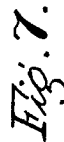
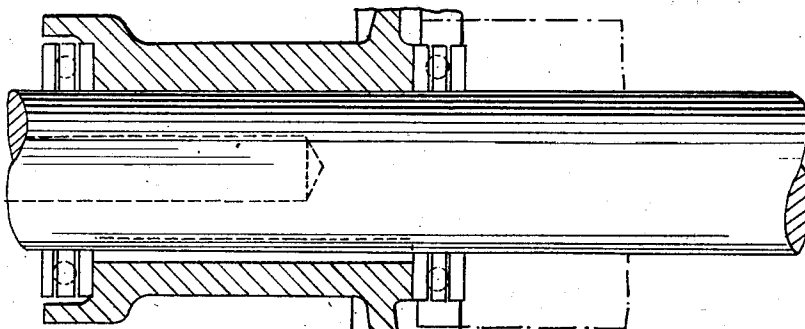
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AUTOMATIC CAN TESTING MACHINE

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AUTOMATIC CAN TESTING MACHINE

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6 Sheets-Sheet 5

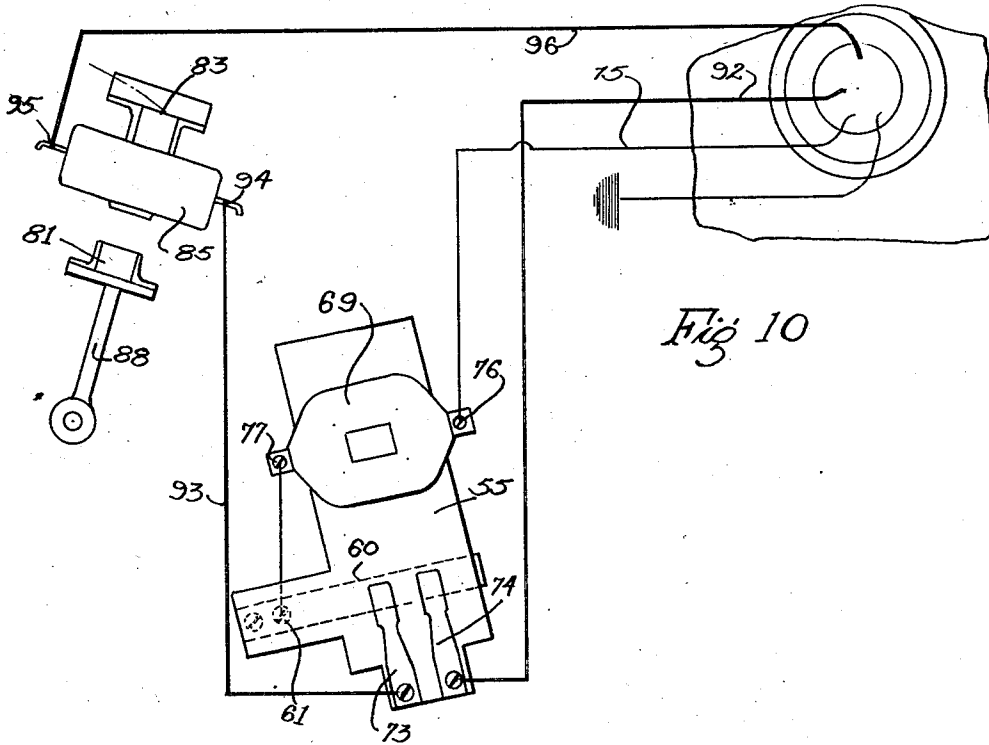


Fig. 10

Fig. 9.

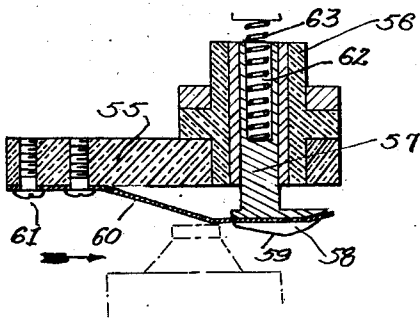
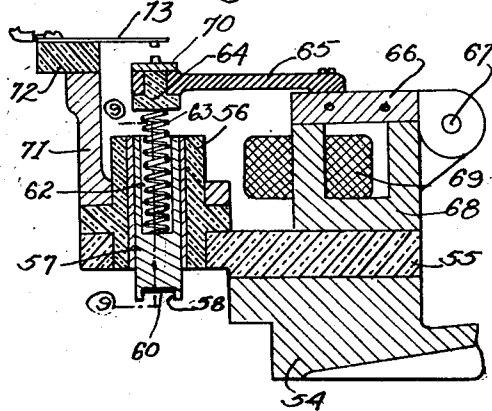


Fig. 8.



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AUTOMATIC CAN TESTING MACHINE

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6 Sheets-Sheet 6

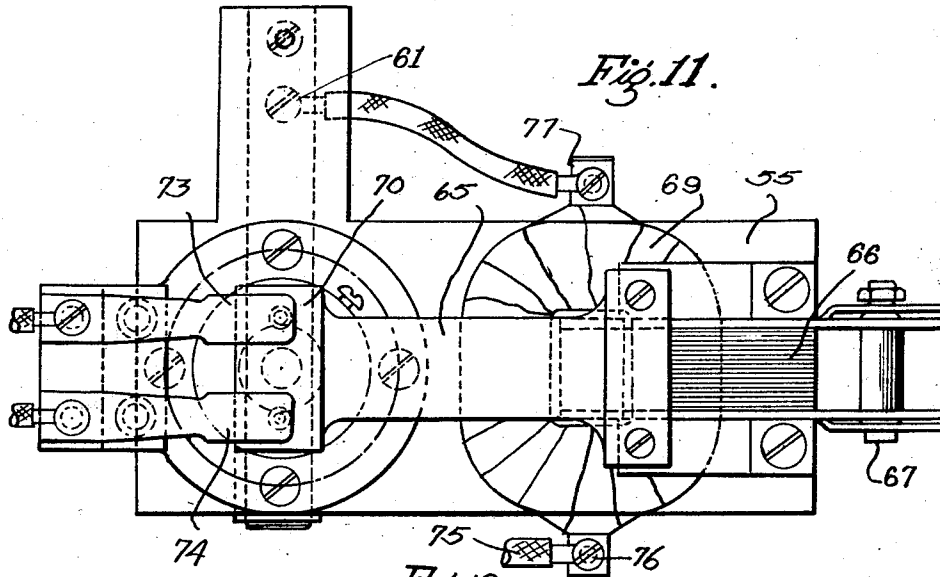


Fig. 12.

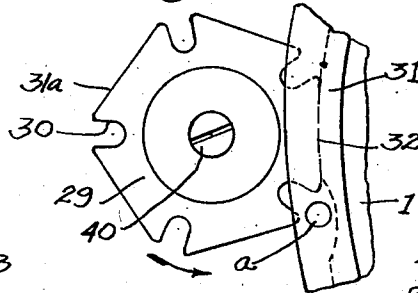


Fig. 13.

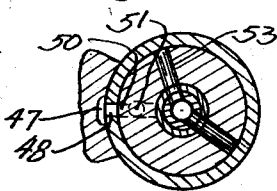


Fig. 14.

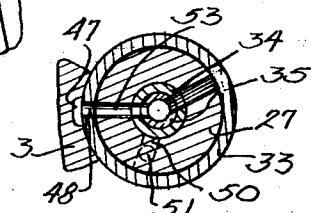


Fig. 17.

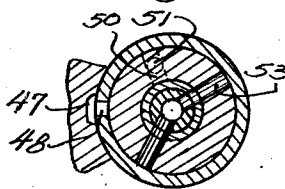


Fig. 15.

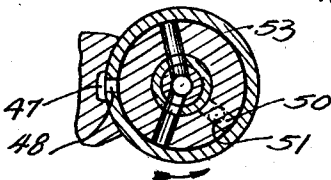
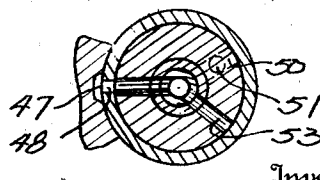


Fig. 16.



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UNITED STATES PATENT OFFICE

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AUTOMATIC CAN TESTING MACHINE

Application filed March 1, 1929. Serial No. 343,722.

The invention relates to new and useful improvements in automatic can testing machines for separating imperfect or leaky cans from perfect cans.

5 An object of the invention is to provide a machine of the above character wherein the can to be tested is caused to form a wall between a chamber having a pressure differing from atmospheric and a chamber closed at
10 atmospheric pressure which controls a can ejecting means whereby a leak in the can will change the pressure on the ejector controlling chamber and effect an ejection of the leaky can.

15 A further object of the invention is to provide a machine of the above type wherein the control for the ejecting means includes a water column is shifted by the variation in the pressure on the chamber surrounding
20 the can.

A further object of the invention is to provide a machine of the above type wherein the ejecting means is electrically controlled and the water column forms a part
25 of the control circuit for the ejecting means so as to cause the operation of the same and the ejection of a can in case of a leak.

A further object of the invention is to provide a machine of the above type which
30 is continuously operating and receives the cans in succession, independently tests each can and ejects the perfect cans from one position in the rotation of the machine and the imperfect cans from another position in the
35 rotation of the machine.

These and other objects will in part be obvious and will in part be hereinafter more fully disclosed.

In the drawings which show by way of
40 illustration one embodiment of the invention:—

Fig. 1 is a side view partly in vertical section and partly in side elevation showing a portion of a machine embodying the im-
45 provements.

Fig. 2 is a vertical section through the machine at one of the testing units.

Fig. 3 is an enlarged vertical sectional view through a portion of the testing unit
50 and showing the control device positioned

so that the water column is subjected to the pressure in the chamber surrounding the can being tested.

Fig. 4 is a view similar to Fig. 3 but showing the control device as turned one step
55 so as to close the connection between the chamber and the water column and hold said water column in its shifted position.

Fig. 5 is a view showing more or less diagrammatically in plan the ejecting means
60 for a leaky can and the means for shifting the control device.

Fig. 6 is a vertical sectional view showing more or less diagrammatically the ejecting means and the can passing the same.
65

Fig. 7 is a detail in section showing the means for shifting the control device.

Fig. 8 is a detail in vertical section showing the trip mechanism for initiating the operation of the knockout device in case of a
70 leaky can.

Fig. 9 is a sectional view on the line 9—9 of Fig. 8.

Fig. 10 is a diagrammatic view showing the circuits for the knockout device and the control means therefor.
75

Fig. 11 is a plan view of the control means which initiates the operation of the knockout device.

Fig. 12 is a detail in plan showing the control device and the means for shifting the position of the same.
80

Fig. 13 is a diagrammatic view showing the position of the control valve when the can is being placed in the chamber and the chamber closed ready for the testing of the can.
85

Fig. 14 is a similar view but showing the control valve turned one step and the water column connected to the closed chamber surrounding the can.
90

Fig. 15 is a similar view but showing the control valve turned through another step and the connection between the water column and the chamber surrounding the same cut off and the water column held in its shifted
95 position.

Fig. 16 is a similar view showing the valve turned through another step which is an idle movement.

Fig. 17 is a similar view but showing the 100

valve turned through another step wherein the passage leading to the inner side of the water column is connected to the atmosphere so that it may be restored to normal position ready for the next testing operation.

Fig. 18 is a detail view in section showing a portion of the circuit forming devices in the valve.

In the application filed July 12, 1927, jointly, by James H. O'Neil and George Flook, Serial Number 205,255, there is shown and described a machine for testing cans wherein the can is enclosed in a chamber filled with a non-compressible fluid. This fluid is subject to the change in pressure by a leak in the can and the change in the pressure on the fluid shifts a water column which controls an electric circuit for ejecting the leaky can.

The present invention is directed to an improvement in the structure embodied in this machine and shown in the aforesaid application. The machine of the present invention does not use a non-compressible liquid such as water for surrounding the can. It is a dry tester. The can is caused to form a wall between two chambers, one of which is placed under a pressure differing from atmospheric, while the other is subsequently closed at atmospheric pressure and connected to a water column balanced by atmospheric pressure and forming an electrical control circuit for an ejecting means. A leak in the can changes the pressure of the control chamber, shifts the water column and effects an ejection of the can.

The machine illustrated, as one embodiment of the invention, includes a rotating turret having a plurality of testing units. The turret rotates continuously and as these units pass the feeding-in station, a can is placed in the testing unit. These testing units are all similar in construction. Each unit includes a chamber into which the can is lowered and after the can is completely housed within the chamber the chamber is closed. The same means which closes the chamber also operates to close the can so that there are two independent chambers formed, one within and the other without the can. As the unit moves along in its path of travel the can is subjected to air pressure. The outer chamber has a passage leading therefrom to a control valve in which there is a water column, one end of which is subjected continuously to atmospheric pressure. The other end of the water column is connected to the chamber surrounding the can. In case there is a leak in the can the pressure on the outer chamber is varied and the water column is shifted.

The valve containing the water column is shifted step by step during the traveling of the testing unit and after the can has been subjected to air pressure for a certain length of time the control valve is shifted so that if

the water column is shifted by a change in the pressure due to a leak, it will be trapped or held in its shifted position. This permits the testing chamber to be opened and the can removed therefrom and positioned so that it may be ejected from the machine. At the proper time this shifted water column controls an electric circuit so as to cause the can which leaks to be ejected from the machine; and on the other hand if the can is perfect the water column likewise causes the ejecting means for the leaky cans to remain inoperative and the can passes by and is ejected by an independent means which takes all of the perfect cans from the machine.

Referring more in detail to the drawings, the machine embodying the improvements includes a supporting frame 1 on which is mounted a rotating turret 2 carrying the testing units. This turret 2 is mounted on a sleeve 2a which in turn is mounted for free rotation in the main frame 1 of the machine. Near the lower end of the sleeve 2a is a worm wheel 2b which is driven by a worm gear 2c carried by the main shaft 2d.

Each testing unit consists of a casing 3 forming a chamber 4. The casing 3 is formed as a part of the turret 2 and rotates therewith. Located in this chamber 4 is a can support 5 having a projecting segment flange 6 at one edge thereof for centering the can on the support. This support is carried by a rod 7 which extends through a suitable packed bushing at the bottom of the turret and at the lower end of the rod there is a head 8 having a lower flat face bearing on a roller 9 carried by a rock lever 10 which is pivoted at 11 to a cross head 12. This rock lever 10 carries a roller 13 which runs along the wall 14 of the frame 1. There is a recess 15 formed in this wall, which receives the roller 13. The cross head 12 is moved up and down by means of a roller 16 which travels in a cam raceway 17 formed in a portion of the main frame 1. The cross head is provided with spaced rods 18 and 19. These rods are attached to a cross bar 20 at their upper ends and the closing head 21 is mounted thereon. This closing head is provided with an elastic pad 22. The can to be tested is indicated at C in the drawings. When the testing unit passes the feeding in station which is indicated diagrammatically in Fig. 5 the can is forced onto the traveling turret and is guided by a guide member 23 onto the support 5 for the can.

After the can is placed on the support 5 the support is lowered into the chamber 4 and the can thus placed in the chamber. This is accomplished by the downward movement of the cross head 12 due to the roller 16 traveling along the cam raceway 17. On the first part of the downward movement of the cross head the roller 13 passes out of

the recess 15 onto the wall 14 of the frame and this gives a slight movement to the rock lever 10. This movement of the rock lever 10 causes the roller 9 to raise the head 8, thus lifting the support 5 so as to cause the can to make tight sealing contact with the elastic pad 22.

After the can is seated against this pad, then the support and the closing head 21 move down together. The elastic pad will engage the casing forming the chamber 4 at its open end and close the same as indicated in Figs. 3 and 4.

A pipe 24 leads to a suitable air pressure means and air is directed through a valve 25 and the passage 26 to the can. This valve is controlled by a cam on the frame so that the valve is not open until the can is closed by the engagement of the pad with the can.

After the can is closed and the chamber formed therein, then it is subjected to the air pressure from the pipe 24. At one side of the casing 3 there is a control valve provided with a water column. This control valve includes a sleeve 27 mounted for rotation in a projecting portion 28 of the casing 3. At the upper end of this sleeve there is a head 29 which is provided with radial slots 30 (see Fig. 12). There are five radial slots shown in the head in this figure. The faces of the head between the radial slots are curved about the axis of the rotating turret as a center, as indicated at 31a. There are five control pins, *a*, *b*, *c*, *d* and *e*, as shown in Fig. 5. These control pins are carried by a stationary member 31 carried by the frame of the machine.

In Fig. 7, the pin *a* is shown as projecting beneath this member 31. The frame immediately beneath the member 31 is curved about the axis of the turret as a center. This forms a control surface 32 for this valve head. As shown in Fig. 12 when the testing unit passes one of these pins it enters the radial slot and will turn the head one step. After the head has been turned a step then the curved part between the radial slots engages the curved control surface 32 which holds the valve in its set position.

The valve sleeve 27 is mounted to rotate in a bushing 33. This sleeve 27 is made of some suitable metal. Within the sleeve 27 is a sleeve of insulating material 34 and again within this sleeve of insulating material is an inner metal sleeve 35 at the upper portion of the sleeve 34. This sleeve 35 extends throughout a greater portion of the length of the sleeve 34. At the lower end of the sleeve 34 is a second metal sleeve 36. The two sleeves 35 and 36 are spaced from each other and in this space is a sleeve of insulating material 37. A rod 38 connects this lower sleeve 36 with the outer sleeve 27 and

establishes a circuit between the lower sleeve and the outer sleeve 27.

The central part of the head 29 is formed with a recess in which is a disc of insulating material 39. A screw 40 is threaded into this disc 39 and carries a stud 41^a. The sleeve 35 carries a rod 41 which fits snugly in and closes the same. A coil spring 42 surrounds this rod 41 and stud 41^a and makes electrical connection between the sleeve and screw (see Fig. 18).

The rotating turret 2 is provided with an outer integral wall 43 and an inner annular vertical wall 44. The testing units are attached to the turret between these vertical walls. Between the vertical walls is a chamber which is kept filled with water to a predetermined level. The turret is provided with an overflow pipe 45 which determines the level of the water in this chamber. The water is indicated at *W* in the drawings. At the upper end of this pipe 45 there is an adjustable sleeve 45^a. By adjusting this sleeve the water level may be readily varied.

The casing 3 is provided with a passage 46 which connects with the chamber 4 at its inner end and at its outer end terminates in a vertically extended recess 47. The bushing 33 is provided with an opening 48 and also an opening 49. The sleeve 27 has a radial opening 50 which at times is in alignment with the opening 49. There is also a vertical opening or passage 51 which leads into the opening 50 at the lower end of the sleeve.

When the parts are positioned as shown in Fig. 2 the chamber 4 is connected through the passage 46, the recess 47, the opening 49 and the passages 50 and 51 to the atmosphere. This is the position of the valve when the support 5 is lowered into the chamber and the chamber closed. This insures that when the chamber is closed the air within the chamber shall be at atmospheric pressure. Just as soon as the chamber is closed then the valve head engages one of the pins and it is rotated one step which cuts off the connection between the chamber 4 and the atmosphere through the passage 46. There is a radial passage 52 which extends all the way through the sleeves 27, 34 and 35 and connects with the central passage in the inner sleeve 35. When this passage 52 is in alignment with the passage 48 then there is a direct connection between the chamber 4 and this central passage in the inner sleeve 35. There is also another radial passage 53 in the valve which likewise extends from the outer surface of the valve to the central passage in the sleeve 35 and this in time passes the port 48.

From the above it will be apparent that there is associated with the valve a water column. The lower end of the sleeve 34 extends beneath the level of the water and

when the central passage or chamber in the sleeve 35 is open to the atmosphere the level of the water in this central passage will seek the same level as the water in the bath into which the lower end of the sleeve extends. The surface of the bath is exposed to the atmosphere so that there is a water column in this passage, the inner end of which is connected to the atmosphere through the chamber 4 and the other end of which is connected through the water bath to the atmosphere.

The level of the water in the bath is slightly above the upper end of the sleeve 37 of insulating material, and, therefore, the water column in the central passage as indicated in Fig. 2 extends above this sleeve 37 and the water column serves as an electric circuit for connecting the sleeves 35 and 36. It will be readily be seen that if this water column is depressed to the position shown in Fig. 3 the circuit will be broken. Means is provided for ejecting the cans. There is a mechanical means for ejecting the perfect cans at a certain point in the rotation of the turret. There is also an electrically operated ejecting means for ejecting imperfect or leaky cans. This electrically operated ejecting means is controlled by this circuit of which the water column forms a part.

When the pin *a* operates on the head 29 the valve is turned to the position indicated in Fig. 2. At this time the passage 50 is in alignment with the passage 49. While the unit is traveling from the position where the head 29 engages the pin *a* to the position where the head engages the pin *b* the can is lowered into the chamber 4 and the chamber closed by the head 21. When this chamber is closed it is still open to the atmosphere through the passage 46, and therefore, the air trapped in this chamber 4 and surrounding the can *C* is at atmospheric pressure. As the head 29 passes the pin *b* the valve will be rotated one step and this closes the passage leading to the atmosphere through the opening 49 and brings the passage 52 into alignment with the opening 48.

The central passage in the valve is now connected with the passage 46 and the inner upper end of the water column is subjected to the pressure of the air in the chamber surrounding the can. The can is connected to the pipe 24 and is subjected to air pressure from within. This air pressure on the chamber formed within the can does not in any way affect the air pressure on the chamber surrounding the can provided the can is perfect and does not leak. If, however, there is a leak in the seam of the can at any point then the air under pressure within the can escapes through the leak and will create a pressure on the air in the chamber surrounding the can which is greater than atmospheric pressure. This will cause the water column to shift as the inner end of the water column

is subjected to this increased pressure while the outer end through the pin is subjected to atmospheric pressure. The inner end of the water column is depressed by this increased pressure on the chamber surrounding the can. If the leak is of sufficient extent to cause the water column to shift to a position beneath the lower end of the sleeve 35 it will break the circuit.

In Fig. 3 the water column is shown as subjected to pressure due to the leak in a can and the water column has been depressed so as to break the circuit. This all occurs while the testing unit is traveling between the positions indicated by the pin *b* and the pin *c*. The pin *c* now engaging the head 29 of the control valve will rotate another step, thus moving the passage 52 out of alignment with the opening 48 and closing the passage 52. In Fig. 13 of the drawings the position of the valve is shown diagrammatically where the chamber 4 is connected to the atmosphere and the chamber is being closed at atmospheric pressure. In Fig. 14 the valve is shown in the position where the water column is subjected to the pressure on the chamber surrounding the can and in Fig. 15 the valve is shown as shifted so as to disconnect this central passage from the chamber 4 and to trap or close the passage leading to the upper end of the water column. This will hold the water column in its shifted position. If there is a leaky can then the water column is depressed so as to break the circuit it will be held in this depressed position when the valve is turned regardless of the condition of the pressure on the chamber 4. This enables the support for the can to be raised and the chamber opened and the can lifted from the chamber to a position similar to that shown in Fig. 2 so that it may be ejected from the machine.

While the testing unit is traveling from the position indicated by the pin *c* to the pin *d* if there is a leaky can it is ejected from the machine. The pin *d* then turns the valve through another step to the position indicated in Fig. 16. This is an idle turning of the valve. When the head passes the pin *E* the valve is turned through another step and this causes the passage 53 leading from the central chamber or passage in the sleeve 35 to pass the opening 48. When this passage crosses the opening 49 the trapped air bearing on the water column placed thereagainst by the leaky can is released and the water column returns to its normal level. At this time the chamber 4 is open to the atmosphere. As the head 29 passes the pin *a* it is given another turn and the passage 46 is connected through the valve to the atmosphere so that the chamber 4 can be closed without creating a pressure therein as has heretofore been described.

The water column either establishes or breaks a circuit leading to the control means

for the knockout device which ejects leaky cans. This control means is shown in Figs. 9 to 11. This control means includes a supporting bracket 54 carrying a suitable base of insulating material 55. Mounted on this base is a sleeve 56. Within the sleeve 56 which is of insulating material there is a vertical movable rod 57. This rod 57 carries a shoe 58 at its lower end, which shoe is provided with spaced downwardly projecting cam members 59. Extending between these cam members and bearing against the under face of the shoe is a spring contact plate 60. Said plate is secured by suitable screws 61 to the base 55. This contact plate limits the downward movement of the shoe. The rod 57 is provided with a recess 62. In this recess is located a coil wire 63. The upper end of the coil wire bears against an abutment 64 carried by an arm 65. The abutment 64 is of insulating material. The arm 65 is mounted on a plate 66 which is pivoted at 67 to a bracket 68 carried in turn by the base 55. A coil 69 is carried by this bracket and surrounds one arm of the bracket. The bracket is the core of the coil and when the coil is energized then this core will be magnetized and will pull the plate 66 in a downward direction. This is limited by the plate contacting with the core. Thus it will be apparent that when the coil 69 is energized the arm 65 will be held firmly in a fixed position with the plate 66 in contact with the core of the coil 69. On the upper face of the arm 65 is a metal contact plate 70. Also mounted on the base 55 is a standard 71 carrying a bar 72 of insulating material. Attached to this bar of insulating material are two terminal contact members 73 and 74. As clearly shown in Fig. 10 of the drawings, a current from a suitable source of supply is led through a circuit extending through the center of the machine so as to permit the testing units to move about the same. The wire leading from the source of supply for this control means is indicated in this figure at 75. This wire is connected at 76 to one terminal of the coil 69. The other terminal 77 of the coil 69 leads to the screw 61 and the contact member 60. When the testing unit passes this control means, the screw 40 at the upper end thereof engages the contact member 60 at the left as viewed in Fig. 9, and moves in the direction of the arrow along this contact member. The screw also engages the cam members 59 of the shoe 58, and lifts the rod 57 attached thereto. Each passing unit engages this contact member and also lifts the shoe. If the coil 69 is not energized then the raising of the rod 57 through the spring 63 will lift the arm 65 and thus establish a circuit between the terminal members 73 and 74. If, however, the coil 69 is energized, then the arm 65 will remain in fixed position and the spring 63 will yield to allow this lifting of the rod 57. It

will thus be seen that if the coil 69 is energized the terminals 73 and 74 will not be joined by the contact plate 70.

Referring again to Fig. 3, it will be noted that when the screw 40 passes underneath the contact plate 60 a circuit will be established through the water column if it is in position so as to connect the sleeves 35 and 36, the rod 38 and the outer sleeve 27 and pin or contact between this head 29 and the control member 31. This control member 31 is grounded and the ground makes the return circuit. It will thus be seen that when the water column establishes a circuit between the sleeves 35 and 36 and the screw 40 is in engagement with the contact 60 there will be a circuit established through the coil 69 and the coil will be energized. If, however, the water column is depressed because there is a leaky can, then this coil will not be energized as the circuit is broken and, therefore, the contact plate will join the terminals 73 and 74. The coil 69 is only energized for the interval when the screws of the control valves are passing the contact plate 60. If there is a leaky can then this control means connects the terminals 73 and 74. If the can is perfect and the water column normal, then the circuit is established through the coil 69 and the terminals 73 and 74 are not connected. These terminals 73 and 74 control an independent circuit which operates through electrically controlled means for ejecting the leaky can.

The knockout mechanism is shown in Figs. 5 and 6. A knockout lever 78 is pivoted at 79 to a bracket 80 mounted on the frame of the machine. A spring 81 connected to the bracket and to the arm normally holds the arm bearing against an adjustable stop 82. Mounted on the frame 1 of the machine is a base member 83. This base member is provided with an upstanding bracket 84 carrying an electric coil 85 having a core 86. Directly in front of this core 86 is an armature 87 attached to a rod 88 sliding freely in a supporting bracket 89 formed as an integral part of the base member 83. Pivoted to the outer end of the rod 88 is a link 90. The link 90 is in turn pivoted to the extreme outer end of the knockout lever 78. When the coil 85 is energized the armature 87 is drawn against the core and through the link 90 will swing the knockout lever 78 to the dotted line position indicated in Fig. 5.

The cans are indicated in broken lines. The cans C, C are traveling toward the station where they are ejected if they are leaky or where they pass if they are perfect. The can C' is a leaky can and the knockout lever 78 has forced it out of its path of travel off from the turret and discharged the same. If the can is not leaky then it passes by this knockout lever and comes in contact with the guide rail 91 which is secured by screws 92 to the frame of the machine so that it may

be adjusted to different set positions. This forces the can off from the rotating turret.

The circuit for controlling the coil of the knockout device is led through the center column of the machine and is indicated by the double lines in Fig. 10. The wire 92 leads to the contact member 74 and the wire 93 leads from the contact member 73 to the terminal 94 of the coil 85. The other terminal 95 of the coil 85 is connected to a wire 96 which leads through the column to the source of supply. It will thus be seen that when the terminals 73 and 74 are joined by the contact plate 66, then the coil 85 will be energized and the knockout lever 78 swung so as to eject the can from the machine.

It will be noted from the above that the circuit for the coil of the control means and the circuit for the coil for the knockout lever are independent of each other. Where there is a circuit established through the control means then no circuit is established through the coil for the knockout lever. On the contrary, when no circuit is established through the control means then the can will establish the circuit for the knockout lever.

The chamber in which the can is placed for testing is only slightly larger than the can and the volume of air in this chamber during testing is comparatively small. Air escaping through a relatively small leak will, therefore, change the pressure on this small volume of air in the chamber 4 very quickly. Furthermore, the column of water which is shifted is relatively small and the pressure necessary to shift the column is relatively small. Therefore, the machine is very sensitive and small leaks may be quickly detected and cans containing the same ejected. The machine operates continuously; the cans to be tested are fed in succession to the testing units as they pass the feeding-in station. As the units travel, the cans are put under pressure and enclosed in the testing chambers, and if the can contains a leak, the water column will be positioned for breaking the circuit and will be trapped in this set position until after the unit passes the ejecting station. The leaky can will, therefore, be ejected through the electrically controlled knockout means above described. The can is closed and put under pressure before the chamber surrounding the can is closed, and therefore, any bulging of the end of the can due to this pressure is accomplished before the chamber is closed which surrounds the can. The placing of the can under pressure will not effect the pressure on the surrounding can, unless there is a leak. While the machine is designed to operate with pressure applied to the can for testing, it will be understood that by slight modifications in the structure, a difference in pressure between the chambers surrounding the can and the chamber in the can may be otherwise ob-

tained. It is essential, however, that the can to be tested shall be caused to form a wall between two chambers, one of which is placed under a pressure differing from atmospheric, while the other is closed at atmospheric pressure, and this chamber which is closed at atmospheric pressure is so connected to the control valve as to control the mechanism for ejecting the leaky cans. Thus it is that when there is a leaky can, the pressure on the chamber controlling the ejecting means will be varied and the operation of the ejecting means brought about.

As noted above, the machine is an improvement on the machine shown in the O'Neil and Flook application, Serial No. 205,255, and many of the details of the machine have not been described. The features which are novel have each been fully pointed out. In the present machine, the cans are tested without immersing the same in water or other liquids, and therefore, after the can comes from the testing machine, it is not necessary to dry or otherwise treat the same.

It is obvious that minor changes in the details of construction and the arrangement of the parts may be made without departing from the spirit of the invention as set forth in the appended claims.

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

1. A machine for testing cans for leaks including means for forming an air chamber about the can, means for closing the can, means for establishing a difference in air pressure between the chamber formed in the can and the chamber surrounding the can, and means including a shiftable liquid column and an electric circuit controlled thereby whereby a change in the air pressure on the chamber surrounding the can caused by a leak in the can is utilized to eject the imperfect can.

2. A machine for testing cans for leaks including means for forming an air chamber about the can, means for closing the can, means for establishing a difference in air pressure between the chamber formed in the can and the chamber surrounding the can, and means whereby a change in the air pressure on the chamber surrounding the can caused by a leak in the can is utilized to eject the imperfect can, said last-named means including a shiftable water column, and an electrically operated ejecting means, the circuit of which is controlled by the water column.

3. A machine for testing cans for leaks including means for forming an air chamber about the can, means for closing the can, means for establishing a difference in air pressure between the chamber formed in the can and the chamber surrounding the can, and means whereby a change in the air pressure on the

chamber surrounding the can caused by a leak in the can is utilized to eject the imperfect can, said last-named means including a shiftable water column, electrically operated ejecting means for a leaky can, electric controlling means therefor including a circuit established by the water column when in normal position and interrupted when said water column is depressed by the accumulating pressure on the air chamber surrounding the can.

4. A machine for testing cans for leaks including means for forming an air chamber about the can, means for closing the can, means for establishing a difference in air pressure between the chamber formed in the can and the chamber surrounding the can, and means whereby a change in the air pressure on the chamber surrounding the can caused by a leak in the can is utilized to eject the imperfect can, said last-named means including a water column, one end of which is continuously subjected to atmospheric pressure and the other end of which is subjected to the pressure in said chamber.

5. A machine for testing cans for leaks comprising a series of traveling testing units, an electrically operated ejecting means disposed adjacent the path of travel of said units, each unit having means for independently controlling the ejecting means, said control means including a water column for establishing or interrupting an electric circuit for the control means, devices whereby one end of said water column is continuously subjected to atmospheric pressure and the other end of said water column is subjected to the pressure of a chamber adapted to be closed at atmospheric pressure, and means whereby a leak in a can may be utilized to vary the pressure on said chamber for shifting the water column so as to cause the ejecting means to eject the imperfect can.

6. A machine for testing cans for leaks comprising a series of traveling testing units including a chamber in which the can is placed for testing, a control valve, a water bath of constant level into which the valve extends, said valve having a vertical passage forming a water column, means for connecting the passage to the chamber while the can is being tested whereby a variation in the pressure of the chamber shifts the water column, an electrically operated ejecting means, and devices whereby said water column establishes or interrupts a control circuit for the ejecting means.

7. A machine for testing cans for leaks comprising a series of traveling testing units including a chamber in which the can is placed for testing, a control valve, a water bath of constant level into which the valve extends, said valve having a vertical passage forming a water column, means for connecting the passage to the chamber while the can is being tested whereby a variation in

the pressure of the chamber shifts the water column, an electrically operated ejecting means, devices whereby said water column establishes or interrupts a control circuit for the ejecting means, and means whereby the water column when shifted by a leak may be trapped so that the chamber may be opened, the can removed and ejected from the machine.

8. A machine for testing cans for leaks comprising a series of traveling testing units including a testing chamber in which a can is placed for testing, means for closing the chamber at atmospheric pressure and for closing the can, means for subjecting the can to air pressure after it is closed, an electrically operated ejecting means disposed adjacent the path of travel of said units, each unit having means for independently controlling the ejecting means, said control means including a water column for establishing or interrupting an electric circuit for the control means, and devices whereby one end of said water column is continuously subjected to atmospheric pressure and the other end of said water column is subjected to the pressure of said testing chamber.

9. A machine for testing cans for leaks comprising a series of traveling testing units including a testing chamber in which a can is placed for testing, means for closing the chamber at atmospheric pressure and for closing the can, means for subjecting the can to air pressure after it is closed, an electrically operated ejecting means disposed adjacent the path of travel of said units, each unit having means for independently controlling the ejecting means, said control means including a water column for establishing or interrupting an electric circuit for the control means, devices whereby one end of said water column is continuously subjected to atmospheric pressure and the other end of said water column is subjected to the pressure of said testing chamber, and means whereby the water column when shifted may be trapped so that the chamber may be opened, the can removed and ejected from the machine.

10. A machine for testing cans for leaks comprising a series of traveling testing units including a chamber in which the can is placed for testing, an electrically operated ejecting device adjacent the path of travel of said units, an electrically operated control means including a contact member for establishing the circuit of the ejecting device, a member mechanically operated by the passing unit for moving said contact member, and electric means for restraining the movement of said member having a circuit established or interrupted by a water column controlled by the pressure on the testing chamber.

11. A machine for testing cans for leaks comprising a series of traveling testing units

- including a chamber in which the can is placed for testing, means for closing said chamber at atmospheric pressure and for closing the can, means for subjecting said can to air pressure, a control valve associated with each chamber, a water bath of constant level into which the valve extends, said valve having a vertical passage forming a water column, spaced metallic sleeves in said valve disposed so as to be joined by the water column when in normal position whereby a control circuit may be established through said sleeves and water column, means for connecting the inner end of the water column to the chamber whereby a variation in pressure on the chamber due to a leak will shift the water column to break the circuit, and an electrically operated ejecting device controlled by the circuit through said water column.
12. A machine for testing cans for leaks comprising a series of traveling testing units including a chamber in which the can is placed for testing, means for closing said chamber at atmospheric pressure and for closing the can, means for subjecting said can to air pressure, a control valve associated with each chamber, a water bath of constant level into which the valve extends, said valve having a vertical passage forming a water column, spaced metallic sleeves in said valve disposed so as to be joined by the water column when in normal position whereby a control circuit may be established through said sleeves and water column, means for connecting the inner end of the water column to the chamber whereby a variation in pressure on the chamber due to a leak will shift the water column to break the circuit, an electrically operated ejecting device controlled by the circuit through said water column, and means whereby the water column when shifted by a leak may be trapped so that the chamber may be opened, the can removed and ejected from the machine.
13. A machine for testing cans for leaks comprising a series of traveling testing units including a chamber in which the can is placed for testing, a control valve associated with each unit and including a sleeve mounted for rotation about a vertical axis, a head carried by said sleeve for intermittently turning the same, a water bath of constant level into which the valves extend and move, a central metallic sleeve at the lower end of the valve and beneath the level of the bath, a central metallic sleeve at the upper portion of the valve with the lower end thereof above the level of the bath, an insulating sleeve between said metallic sleeves, said sleeves forming a central passage for a water column which establishes or interrupts the circuit through said metallic sleeves, an adjustable contact member at the upper end of the sleeve, yielding means interposed between said adjustable contact member and metallic sleeves, an electrically operated device for ejecting cans disposed adjacent the path of travel of the units, said contact member on the valve and circuit through the water column operating to control the operation of the ejecting means, and devices whereby the water column is subjected to the pressure on the air chamber and shifted when said pressure is varied by a leak.
- In testimony whereof, I affix my signature.
- JAMES H. O'NEIL.