

March 20, 1962

R. T. BEACH

3,025,837

CAN CRUSHING DEVICE

Filed June 15, 1959

4 Sheets-Sheet 1

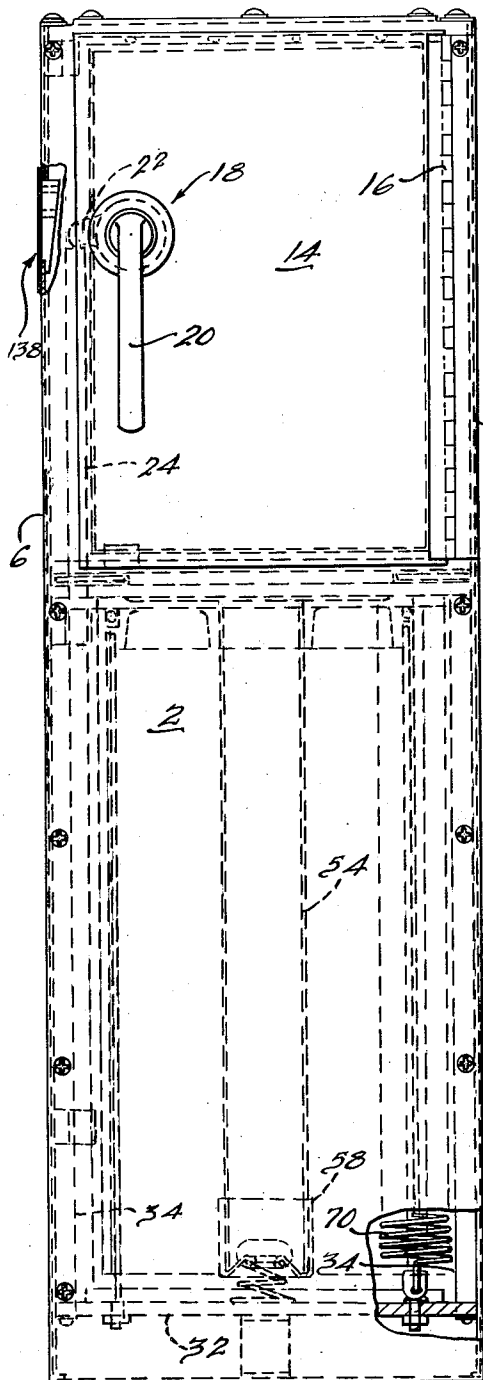


FIG. 1.

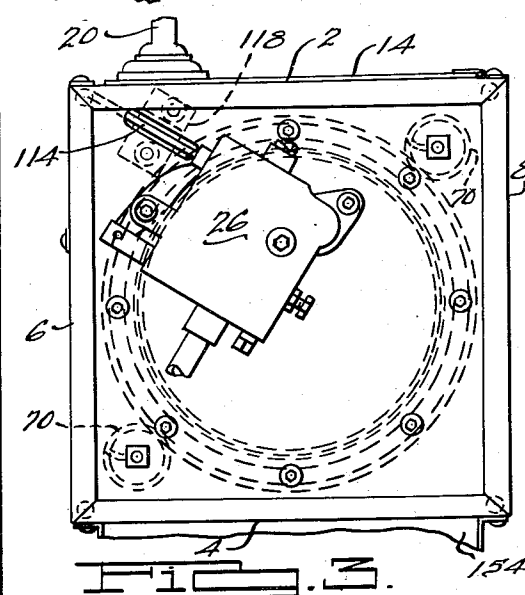
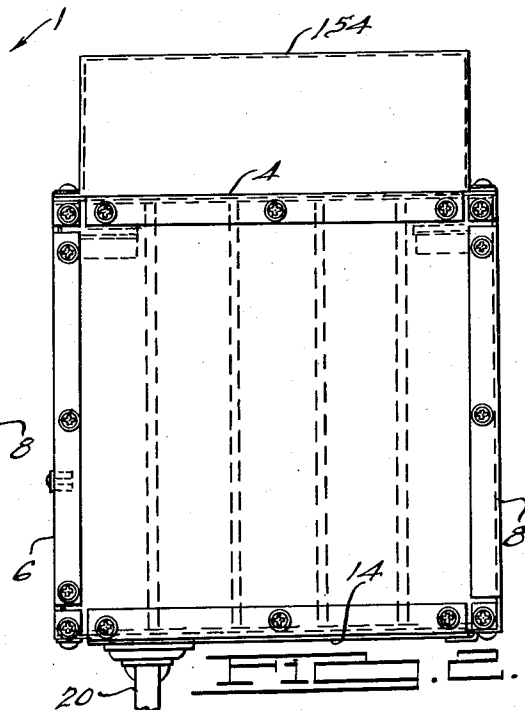


FIG. 3.

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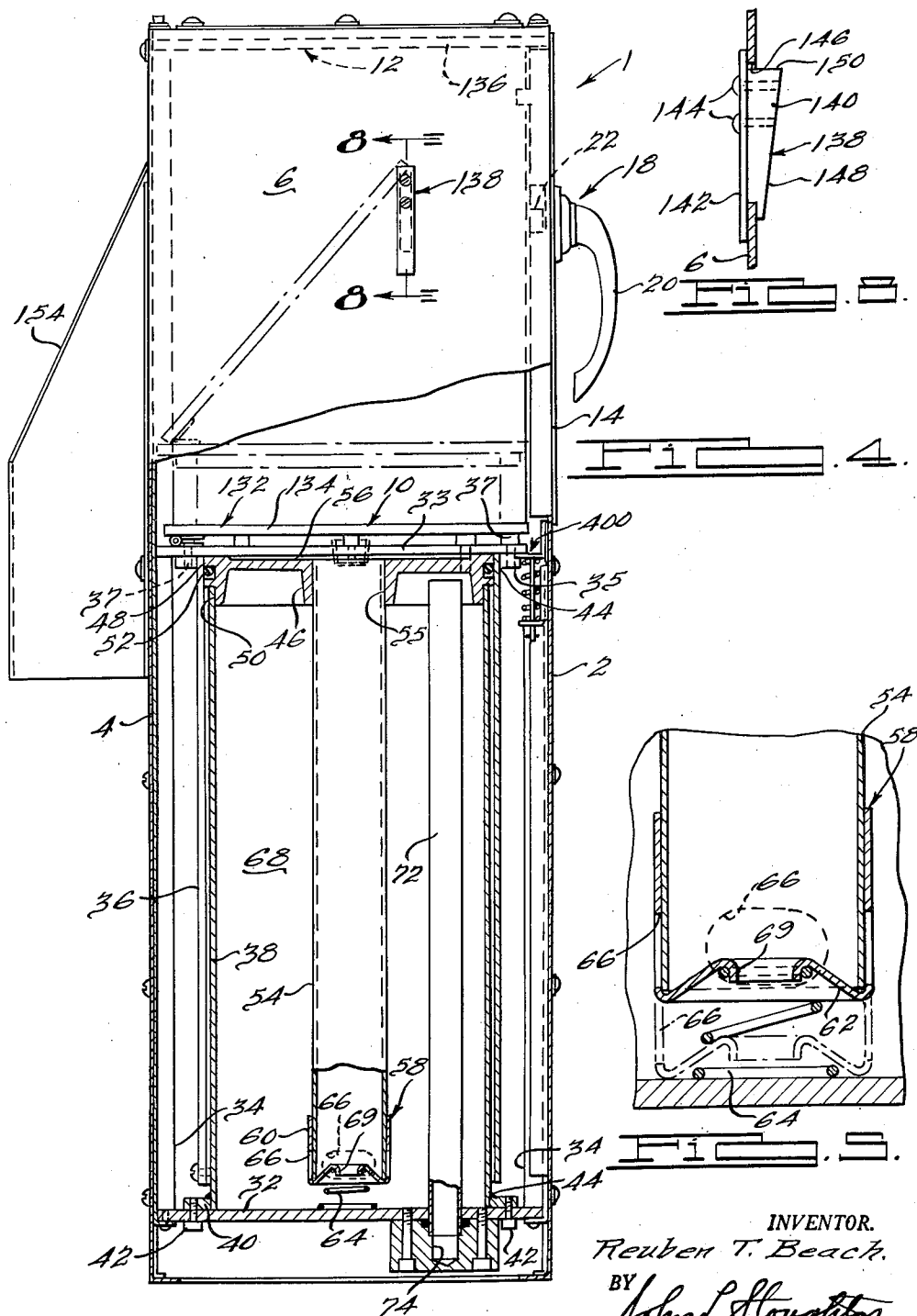
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4 Sheets-Sheet 2



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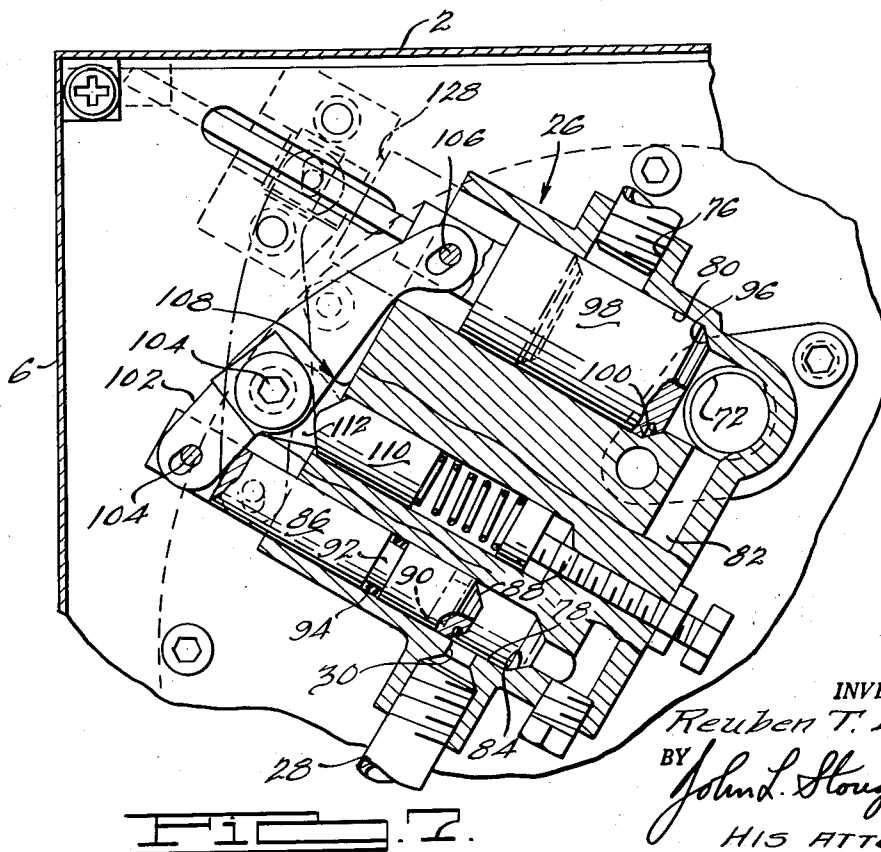
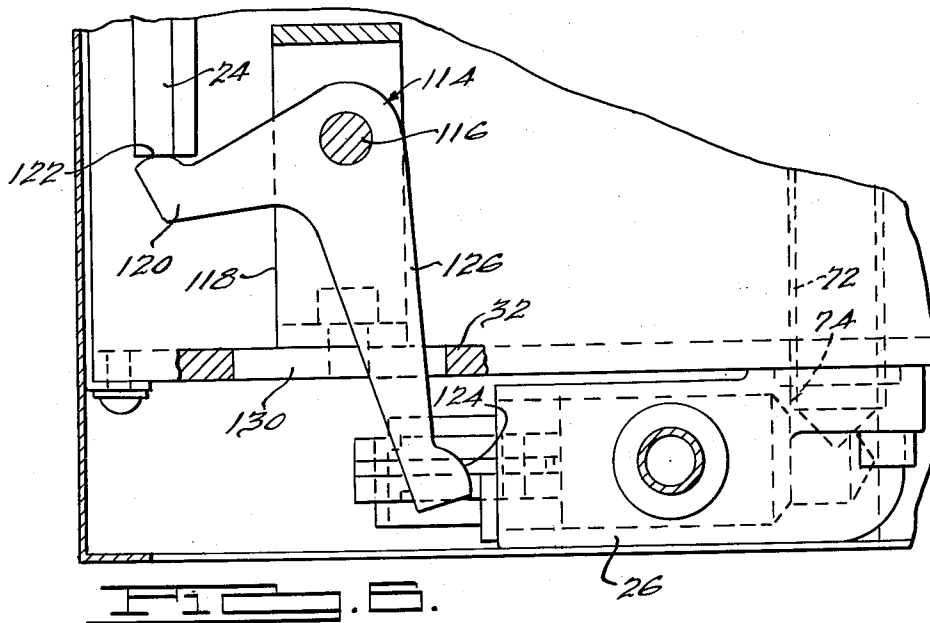
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CAN CRUSHING DEVICE

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4 Sheets-Sheet 3



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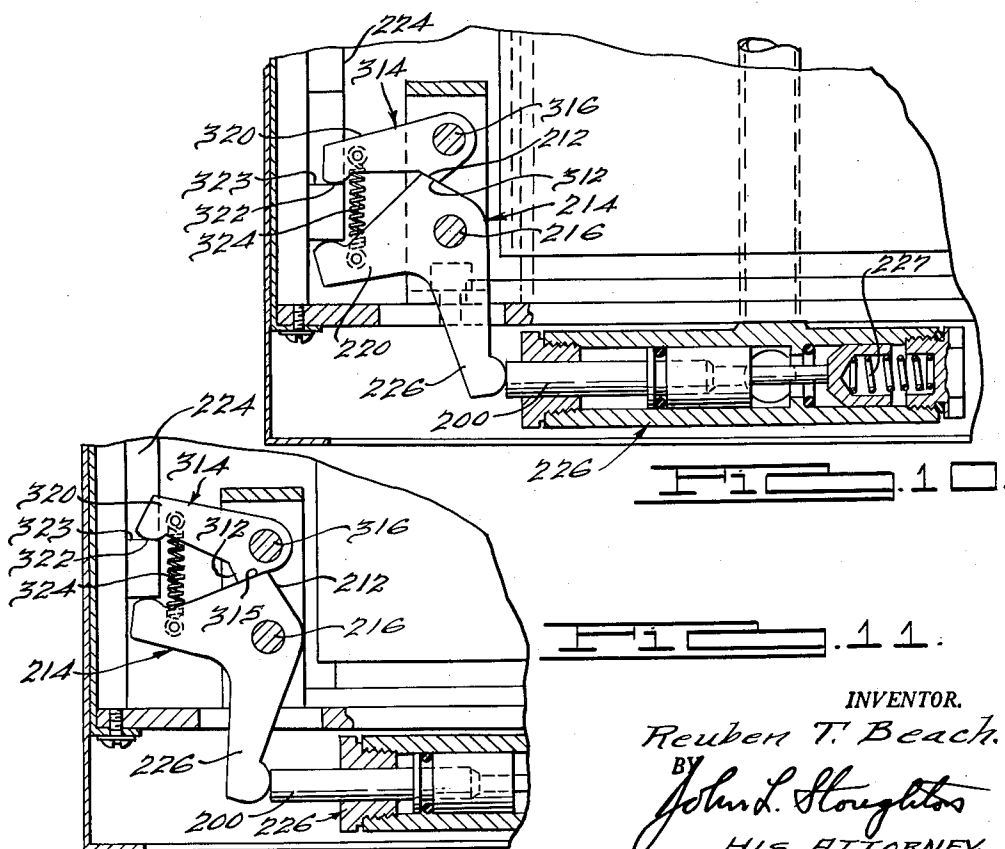
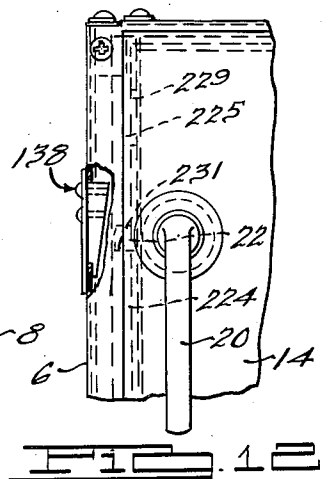
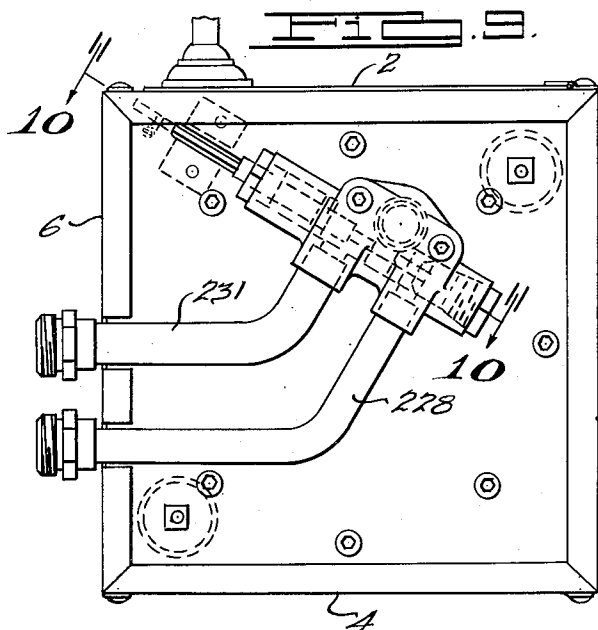
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R. T. BEACH
CAN CRUSHING DEVICE

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4 Sheets-Sheet 4



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3,025,837

CAN CRUSHING DEVICE

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Filed June 15, 1959, Ser. No. 820,185
7 Claims. (Cl. 121-38)

This invention relates to an improved can crushing device which is adapted to crush or compress, after they have been emptied, metal cans of the type in which food, oil, etc., are sold. This invention is an improvement over that shown in my copending application Serial No. 560,705 filed January 23, 1956, for Can Crushing Device, and now abandoned.

As disclosed in said copending application, the problem of disposing of cans becomes more and more acute as the use of this type of packaging becomes more and more common and the costs of transporting and otherwise dumping such used cans increases.

It is an object of this invention to provide a new and improved can crushing device.

Another object of this invention is to provide such a crushing device which is inexpensive to manufacture, trouble free in operation and which will satisfactorily crush the cans.

Another object is to provide such a can crushing device in which either a compressed gas or a liquid under pressure may be used as the energizing medium.

A further object is to provide such a crushing device in which the moveable element or piston is smoothly driven in the crushing direction and which will have a very rapid return stroke.

A further object is to provide an improved valve and valve actuating mechanism in which a single actuator may be moved in a first direction to lock the valve in a first position and in a second direction to unlock the valve for movement to a second position.

Another object is to provide a still different type of valve in which the valve is pressure actuated into the piston return position.

A still further object is to provide a new trip device for operating a can ejecting mechanism.

Other objects will be apparent from the specification, claims and the drawings in which:

FIG. 1 is a view in front elevation showing a can crushing device embodying the invention;

FIG. 2 is a top plan view of the device of FIG. 1;

FIG. 3 is a bottom plan view of the device of FIG. 1;

FIG. 4 is a side view in elevation of the device of FIG. 1 with certain parts shown in section;

FIG. 5 is an enlarged view of a portion of the device showing one of the valving elements;

FIG. 6 is an enlarged view of a portion of the device showing the actuating device for the power fluid control valve;

FIG. 7 is an enlarged sectional view of the power fluid control valve of FIG. 6;

FIG. 8 is a partial view taken substantially along the line 8-8 of FIG. 4 looking in the direction of the arrows;

FIG. 9 is a bottom plan view of the crushing device showing a modified form of control valve;

FIG. 10 is a sectional view of the form of device shown in FIG. 8 showing a modified form of power valve and the modified actuator therefor;

FIG. 11 is a view similar to FIG. 9 but showing the power valve actuator in another position; and,

FIG. 12 is a partial view showing the modified form of the upper end of the valve actuating rod.

Referring to the drawings by characters of reference the numeral 1 designates generally a can crushing device having an outer sheet material shell providing a front wall 2, a rear wall 4, and side walls 6 and 8. The upper

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portion of the front wall 2 is provided with an aperture or opening through which the cans to be crushed are inserted between the moveable crushing head 10 and a fixed upper head 12. The front opening is closable by a door 14 hinged as at 16 and latchable in closed position by a latch 18 having a handle 20 which is rotatable to actuate a bolt 22 which serves to latch the door closed and also to engage an actuating rod 24 which when depressed by this bolt 22 actuates the power fluid controlling valve 26 for admitting fluid (gas or liquid) from the fluid source connected by conduit 28 to the valve inlet 30 in a manner to be described below.

The device 1 is provided with a plate member 32 located adjacent the open bottom wall of the device 1. The rectangular upper head 12 is rigidly secured to the rectangular bottom wall member 32 by corner rods 34. The crushing head 10 includes a substantially rectangular plate 33 secured to a ring 35 as by studs 37. The ring 35 is in turn rigidly secured to the upper end of a moveable tubular member 36 as by welding whereby the plate 33 forms a head for the member 36. The member 36 telescopes over a second tubular member 38 which is secured to the bottom plate member 32 as by the ring 40 and studs 42. As shown members 36 and 38 are secured to the respective rings 35 and 40 by welding 44, but it will be appreciated that other ways of fastening the rings to the cylindrical members may be used. It will also be appreciated that the joints between the member 38, ring 40, and bottom plate member 32 as well as between plate 33, ring 35 and member 36 must be fluid tight and if desired a gasket could, of course, be used.

The upper end of the inner tubular member 38 is closed by an annular head 46 which has an upper portion 48 with an outer diameter substantially fitting the inner diameter of the outer tubular member 36 and a lower portion 50 of smaller diameter which fits within and is suitably secured in fluid tight relation to the upper end of the inner tubular member 38. The upper portion 48 is circumferentially recessed to receive an O-ring 52 which prevents fluid flow between the cylinder member 36 and head 46.

A fluid conveying tube 54 extends longitudinally of the cylinder member 38 and has its upper end portion suitably secured in fluid tight relation within the central aperture 55 of the annular head 46. The tube 54 communicatively connects an expansible chamber 56 located between the plate 33 and head 46 with a chamber 68 formed within the inner tube 38. It will be apparent that as fluid under pressure is supplied through the tube 54 into the chamber 56 that the head 10 and attached outer tubular member 36 will move upward to cause the head 10 to move toward the head 12 and, if the fluid is of sufficient pressure, crush a can placed between the heads 10 and 12.

The lower end of the tube 54 terminates a short distance above the bottom plate member 32 and is normally partially closed by an upwardly facing cup-shaped valving element 58. The element 58 has its cylindrical upwardly opening side wall 60 telescopically fitting the lower end of the tube 54 and its centrally apertured bottom wall 62 normally held in engagement with the lower end of the tube 54 by a spring 64 which preferably is of the helical conical shaped type whereby it will take the least possible longitudinal space when fully collapsed. This, as will be evident, permits the tube 54 to terminate nearer the member 32 and a reduced length to the tubing 38 since a greater proportion of the fluid in the chamber 68 may be utilized for movement of the element 58. The wall 60 of the element 58 is provided with a plurality of apertures 66, four being shown, which when the element 58 is in the full line position (FIGS. 4 and 5) are

closed by the wall of the element 58 and fluid flow there-through is prevented. This leaves the central aperture 69 in the end wall 62 as the only means of communication between the tube 54 and the chamber 68 (formed within the cylindrical member 38 intermediate the lower plate member 32 and the head 46). When however, the valving member 58 is in its lower position (shown in dot-dash line in FIG. 5) the apertures 66 are open and fluid may flow therethrough between the tube 54 and chamber 68. As will be subsequently explained the valving element 58 is normally held in its up position by the spring 64 and is moved to its lower position by the pressure of the fluid exhausting from the chamber 56 through tube 54 into chamber 68, as the head 10 is pulled downwardly toward the head 46 by springs 70 connected between the upper head 12 and the bottom plate member 32 (see FIG. 3).

Fluid is supplied to and exhausted from the chamber 68 through a tube 72 which extends longitudinally through the chamber 68 with its upper end terminating just below the head 46 and its lower end portion extending through an aperture in the plate member 32 and communicating with a port 74 of the power fluid valve 26 (see FIGS. 4 and 6). The valve 26 is provided with an exhaust port 76 for exhausting fluid from the chamber 68 via the tube 72.

The body of the valve 26 is provided with a pair of substantially parallel cylindrical passageways 78 and 80 having one end portion thereof joined together by a connecting passageway 82. The passageway 78 into which the inlet 30 opens is of lesser diameter than that of the passageway 80 into which the port 76 opens for a purpose which will subsequently be made clear.

Intermediate the port 30 and the passageway 82 the passageway 78 is provided with a valve seat 84 which is controlled by a cylindrical valve member 86 which slidably fits the passageway 78. The lower end of the member 86 may carry a resilient seat 88 if desired and upwardly from this seat 88 it may be provided with a first circumferential groove 90 and still further upwardly it may be provided with a second circumferential groove 92 which receives an O-ring 94 which cooperates with the passageway to provide a seal to prevent fluid flow outwardly of the passageway 78.

Intermediate the port 76 and the passageway 82, the passageway 80 is provided with a valve seat 96 which is controlled by a cylindrical valve member 98 which slidably fits the passageway 80. The lower end of the member 98 may carry a resilient seat 100, if desired, which is cooperable with the seat 96 to prevent fluid flow there-through. If desired the member 98 could be provided with an O-ring to prevent fluid flow outwardly of the open end of chamber 80.

A walking beam 102 is pivotally secured to the valve body as by a bolt 104. One end of the beam 102 is slotted to receive a pin 104 carried by the valve member 86 and the other end is likewise slotted to receive a pin 106 carried by the valve member 98. The beam 102 is resiliently urged into either of its two rotated positions (see FIG. 7) by means of a detent mechanism 108 comprising a spring urged plunger 110 and a V-shaped projection 112 on the beam 102. As will be understood from a study of FIG. 7, movement of the beam in a clockwise direction moves the member 98 downwardly to close the port 96 to prevent fluid flow outwardly of the port 76 and moves the member 86 upwardly to open the port 84 whereby fluid under pressure from the conduit 28 may flow through the passageway 82 into the lower end of the passageway 80 which is in open communication with the port 74 (full line position of FIG. 7).

In this position inlet pressure acts on the full area of the member 86 urging it upwardly and on the area of the member 98 located within the seat 96. Fluid will pass through the valve 26 until the pressure in the chamber 56 and port 76 increase sufficiently whereby the

force exerted on the member 98 overcomes the force exerted on the member 86 plus the force exerted by the detent mechanism 108. When this occurs the member 98 moves upwardly to open the port 96 and the member 86 moves downwardly to close the port 84. It will be noted that as the member 98 moves away from the port 96 the pressure below the member 98 acts on an enlarged area of the member and exerts an increased force to insure a positive valve movement. Before the member 98 opens the exhaust port 76 the detent mechanism will have passed overcenter and the force thereof which was opposing this movement of the valve now aids this movement and a rapid snap-action from "fluid admitting" to "fluid exhausting" positions of valve 26 will occur.

The valve 26 is actuated to its "fluid admitting" position by a bell crank lever 114 fulcrumed on a pin 116 carried on a U-shaped bracket 118 secured to the upper surface of bottom plate member 32 (see FIG. 7). The bracket is external of the cylindrical members 36 and 38. One arm 120 of the lever 114 has its camming surface 122 engaged by the actuating rod 24 which upon actuation rotates the lever 114 in a counterclockwise direction causing the camming surface 124 of its other arm 126 to engage the cam receiving surface 128 of the valve 26 to urge the valve into "fluid admitting" position. The arm 126 it will be observed extends downwardly through an aperture 130 in the bottom member 32. The valve 26 will be held in this "fluid admitting" position by the detent mechanism 108.

The crushing head 10 is much like the member 9 of my aforesaid copending application Serial No. 560,705 and includes a hinged platform 132 comprising rod like members 134 which cooperate with alternately spaced rods 136 on the under side of the upper head 12 to reduce the pressure required to crush the cans as described in said copending application. The chief difference between the construction shown herein and that of the copending application is in the latch 138. The latch 138 comprises a wedge shaped element 140 secured to an elongated spring element 142 as by drive screws 144. The spring element 142 resiliently holds the latch 138 within an aperture 146 in the wall 6. As the head 10 is moved upwardly, the adjacent portion of the platform 132 moves upwardly past the camming edge 148 of the wedge element 140 camming the element outwardly against the force of the spring element 142. At the upper end of the stroke of the head 10, the platform 132 will have passed beyond the upwardly facing shoulder 150 so that when the head 10 returns to its original position the platform 132 will rotate counterclockwise about its hinge point (FIG. 4) and the crushed can will slide through the aperture 152 in the rear wall 4 and through chute 154 secured to the wall 4.

In operation, the handle 20 is turned to unlatch the door 14 which is then opened and a can to be crushed is placed with one end on the head 10. The door 14 is then closed and the latch 18 turned so that the bolt 22 locks the door 14. This movement of the bolt 22 also causes it to engage the rod 24 and move it downwardly thus rotating the bell crank lever 114 to actuate the valve 26 to "fluid admitting" position as described above. Fluid then flows from the conduit 28 through the valve 26 and tube 72 into the chamber 68. With the cylindrical members 36 and 38 in the position shown in FIG. 4 the chamber 68 is normally filled with a liquid substantially to the top end of the tube 72. As the fluid, normally air under pressure, is admitted through the tube 72 into the space in chamber 68 above the liquid, the liquid is forced upwardly through the aperture 69 of the valving element 58 through the tube 54 into the chamber 56 forcing the head 10 upwardly in a can crushing direction. The rate at which liquid flows from chamber 68 into the chamber 56 is restricted by the size of the aperture 69 and the upward movement of the head 10 is rendered fairly independent of the crushing force and a smooth and posi-

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tive upward movement is achieved. Shortly the can begins to collapse and as it collapses more and more, the pressure in the chamber 56 will increase as well as that in the passageway 80 below the lower end of the valve member 98. When the can is compressed as much as desired, the pressure in passageway 80 will increase to the point where the valve 26 will be actuated into its "fluid exhausting" position as described above. The incoming fluid (air) is stopped and the air above the liquid level in chamber 68 starts to exhaust through the tube 72 and exhaust port 76.

The tension springs 70 help to return the head 10 and cylindrical member 36 to its downward position forcing the liquid from chamber 56 through tube 54 into chamber 68. The differential in pressure across the valving element 58 causes it to move downwardly against the force of the spring 64 and open the apertures 66 for increasing the rate of liquid return to the chamber 68. I have found that this action of element 58 is highly desirable since the restricted liquid flow is highly desirable for proper movement in the can crushing direction with a rapid return stroke which is accomplished by the open ports in the valve element 58.

In FIGS. 9, 10, and 11 there is shown a modified form of the valve actuating mechanism and a different form of valve 226 much like the valve shown in said copending application. In the construction shown in said copending application the bell crank lever is held in its valve actuated position by a pin which engages a shoulder on the bell crank lever and which pin holds the lever in its actuated position until it is moved away from the shoulder by the upward movement of the crusher. This mechanism utilizes two rods. The mechanism shown herein comprises single rod 224 which is similar to rod 24 and which engages one arm 220 of a bell crank lever 214 pivoted on pin 216 and which has an arm 226 engageable with the valve actuator 200 of the valve 226. The lever 214 is held in its actuated position by a shoulder 312 of a second lever 314 pivotally mounted on pin 316. The lever 314 has an arm 320 having a cam surface 322 resiliently held against an upwardly facing shoulder 323 on the rod 224 by a spring 324 connected between the lever arms 320 and 220. With the lever 314 its position as shown in FIG. 10 the shoulder 312 is engageable with a shoulder 212 on the lever 214 to hold the lever in its counterclockwise actuated position to hold valve 226 open against the force of spring 227 to permit fluid to flow to the chamber 68.

The lever 314 may however be rotated clockwise by means of the upward movement of the rod 224 to move the shoulder 312 out of engagement with the shoulder 212 of lever 214 thereby permitting the spring 227 of the valve 226 to move the valve 226 to fluid exhausting position. The rod 224 unlike the rod 24 has a portion extending upwardly beyond the bolt 22 and terminates in an upper lip 229 lying in the path of movement of the head 10. Downward movement of the rod 224 to open the valve 226 is accomplished in much the same manner as described above upon movement of the bolt 22 into latching positions. In this form the bolt 22 engages an upwardly facing shoulder 231 of the rod 224. As the lever 214 is rotated counterclockwise, the resilient action of the spring 324 permits the lever 314 to cam about the cam surface 315 to move relative to the lever 214. When the cam surface 212 moves beyond the cam surface 312, the spring 324 pulls the levers 214 and 314 into the relative positions shown in FIG. 10 to lock the lever 214 in a position to hold the valve 226 open to supply air to the chamber 68.

When the can is crushed and the head 10 reaches the upper end of its stroke, the head 10 engages the lip 229 and moves the rod 224 upwardly to rotate the lever 314 until the surface 312 no longer engages the surface 212 at which time the lever 214 is released and the spring 227 will return the valve 226 to its position in which air

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from the supply conduit 228 is terminated and air from the chamber 68 exhausts through the exhaust conduit 231. The relative positions of the levers 214 and 314 and valve 226 will then be as in FIG. 11. As in the preferred form the upward movement of the rod 224 also resets the latch 18 to its initial position.

In order to insure that the door 14 cannot be opened during a can crushing operation, a latch mechanism 400 is provided. This mechanism is spring urged into door locking position but is held in unlocked position by the head 10 when it is in its "fully down" position. This is substantially the same arrangement as is disclosed and claimed in the said copending application.

What is claimed and is desired to be secured by United States Letters Patent is as follows:

1. In a can crusher, a pair of cylindrical members adapted to telescope one within the other, first and second end members closing opposite ends of the inside one of said members and forming an interior chamber therein, a first tube extending through said first end member into said interior chamber and terminating within an upper portion of said chamber, a third member closing one end of the outside one of said cylindrical members, said third end member and said outer cylindrical member being cooperable with said second end member to form a second chamber which is expansible and collapsible upon relative movement of said cylindrical members, said interior chamber being of greater volume than the maximum volume of said second chamber, said second end member having an aperture therethrough, a second tube sealed within said aperture and extending into said interior chamber and terminating in a lower portion of said inner member, and asymmetric flow means cooperable with said second tube to control the rate of flow of fluid between said chambers.

2. In a can crusher, a pair of cylindrical members adapted to telescope one within the other, first and second end members closing the ends of the inside one of said members and forming an interior chamber therein, a first tube extending through said first end member into said interior chamber and terminating within an upper portion of said chamber, a third member closing one end of the outside one of said cylindrical members, said third end member and said outer cylindrical member being cooperable with said second end member to form a second chamber which is expansible and collapsible upon relative movement of said cylindrical members, said volume of said interior chamber being greater than the maximum volume of said second chamber, said second end member having an aperture therethrough, a second tube sealed within said aperture and extending into said interior chamber and terminating in a lower portion of said inner member, a check valve member cooperable with said second tube and effective to provide a greater impedance to the flow of fluid in a direction out of said interior chamber into said expansible collapsible chamber than in the reverse direction.

3. In a can crusher, a pair of cylindrical members adapted to telescope one within the other, first and second end members closing the ends of the inside one of said members and forming an interior chamber therein, a first tube extending through said first end member into said interior chamber and terminating adjacent an upper portion of said chamber, a third member closing one end of the outside one of said cylindrical members, said third end member and said outer cylindrical member being cooperable with said second end member to form a chamber which is expansible and collapsible upon relative movement of said cylindrical members, said second end member having an aperture therethrough, a second tube sealed within said aperture and extending into said interior chamber and terminating in a lower portion of said inner member, a cup shaped valve member having an end wall and an upwardly extending side wall telescopically fitting the outward end portion of said second tube, means pro-

viding a fluid flow passageway through said valve which is opened and closed upon movement of said valve member, said end wall of said valve member being provided with an aperture therethrough to form a fluid flow passageway past said valve member, and means normally maintaining said valve member in a position to restrict fluid flow through said apertures in said second tube.

4. In a can crusher, a pair of cylindrical members adapted to telescope one within the other, first and second end members closing the ends of the inside one of said members and forming an interior chamber therein, a first tube extending through said first end member into said interior chamber and terminating adjacent an upper portion of said chamber, a third member closing one end of the outside one of said cylindrical members, said third end member and said outer cylindrical member being co-operable with said second end member to form a chamber which is expansible and collapsible upon relative movement of said cylindrical members, said second end member having an aperture therethrough, a second tube sealed within said aperture and extending into said interior chamber and terminating in a lower portion of said inner member, a cup shaped valve member having an end wall and an upwardly extending side wall telescopically fitting the outward end portion of said second tube, said side wall being provided with apertures which are opened and closed upon movement of said valve member, said end wall of said valve member being provided with an aperture therethrough to form a fluid flow passageway past said valve member, and resilient means normally maintaining said valve member in a position to restrict fluid flow through said apertures in said second tube.

5. In a can crusher, a pair of cylindrical members adapted to telescope one within the other, first and second end members closing the ends of the inside one of said members and forming an interior chamber therein, a first tube extending through said first end member into said interior chamber and terminating adjacent an upper portion of said chamber, a third member closing one end of the outside one of said cylindrical members, said third end member and said outer cylindrical member being co-operable with said second end member to form a chamber which is expansible and collapsible upon relative movement of said cylindrical members, said second end member having an aperture therethrough, a second tube sealed within said aperture and extending into said interior chamber and terminating in a lower portion of said inner member, a cup shaped valve member having an end wall and an upwardly extending side wall telescopically fitting the outward end portion of said second tube, means providing a fluid flow passageway through said valve which is opened and closed upon movement of said valve member, said end wall of said valve member being provided with an aperture therethrough to form a fluid flow passageway past said valve member, and a helically coiled conically shaped spring interposed between said end wall of said valve member and said first end member for normally maintaining said valve member in a position to restrict fluid flow through said apertures in said second tube.

6. In a can crusher, a pair of cylindrical members adapted to telescope one within the other, first and second end members closing the ends of the inside one of said members and forming an interior chamber therein, a first tube extending through said first end member into said interior chamber and terminating adjacent an upper portion of said chamber, a third member closing one end of the outside one of said cylindrical members, said third end member and said outer cylindrical member being co-operable with said second end member to form a chamber which is expansible and collapsible upon relative movement of said cylindrical members, said second end member having an aperture therethrough, a second tube sealed within said aperture and extending into said interior chamber and terminating in a lower portion of said in-

ner member, a cup shaped valve member having an end wall and an upwardly extending side wall telescopically fitting the outward end portion of said second tube, said side wall being provided with apertures which are opened and closed upon movement of said valve member, said end wall of said valve member being provided with an aperture therethrough to form a fluid flow passageway past said valve member, said end wall of said valve member being concave outwardly and provided with a central aperture therethrough, said concave end wall having an outturned flange around the periphery of said central aperture, and a helically coiled conically shaped spring having its larger diameter seating against said first end member and its smaller diameter substantially equal to and telescoping about said outturned flange.

7. In a can crusher, a pair of spaced plate-like members, means fixedly secured to said members at spaced peripheral locations for holding said members against relative movement, a first hollow cylinder having one end portion thereof secured in fluid tight relation to a first of said spaced members with its other end portion extending toward but terminating short of the other of said spaced members, a first end member closing said other end portion of said first cylinder, a second hollow cylinder adapted to telescope over said first cylinder, a second end member closing a first end portion of said second cylinder which extends toward said other spaced member, said first end member having a peripheral portion outwardly of said first cylinder, said peripheral portion being provided with a peripheral aperture, an O-ring in said aperture and engaging the inner surface of said second cylinder to provide a fluid tight joint, said first end member being provided with an aperture therethrough, a first tube having one end portion sealed within said aperture and its other end portion extending toward said first spaced member, a cup-shaped valve member having an end wall and a cylindrical side wall, said side wall telescopically fitting over said other end portion of said tube, said end wall of said valve member having an aperture therethrough, said side wall of said valve member being provided with at least one aperture which is opened and closed upon movement of said valve member relative to said tube, a spring positioned between said end wall of said valve member and said first spaced member and resiliently urging said valve member toward said tube whereby fluid flow through said apertures is restricted, said first spaced member having an aperture therethrough, a second tube having one end portion sealed to said first spaced member and closing its said aperture, said second tube extending through the hollow interior of said first cylinder and having its other end portion terminating adjacent said first end member, a valve member carried by said first spaced member externally of said first cylinder and overlying said aperture in said first spaced member and controlling fluid flow through said second tube, said valve member having a first operative position to permit fluid to flow into and a second position to permit fluid exhaust from said first cylinder through said second tube, a liquid in said first cylinder, means for actuating said valve member into its said first operative position whereby fluid under pressure may be admitted into said first cylinder and propel said liquid through said first tube into an expansible-contractable chamber formed by said first and second end members and said second cylinder, to cause said second end member to move toward said other spaced member, and means rendered effective in response to fluid pressure in one of said cylinders for actuating said valve into its said second position, and spring means resiliently urging said second cylinder in a direction to contract said exhaustible-contractable chamber.

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