United States Patent [19]

Kontz

[11] **3,709,440**

[45] **Jan. 9, 1973**

[54] **HYDRAULIC POWERED BOTTLE CRUSHER**

[75] Inventor: **Robert F. Kontz,** Toledo, Ohio

[73] Assignee: **Owens-Illinois, Inc.,** Toledo, Ohio

[22] Filed: **Jan. 26, 1971**

[21] Appl. No.: **109,778**

[52] **U.S. Cl.** **241/36,** 100/49, 241/99, 241/262

[51] **Int. Cl.** **B02c 1/04,** B02c 25/00

[58] **Field of Search**....241/36, 94, 99, 262, 263, 264, 241/283; 100/49, 94, 98, 233, DIG. 2

[56] **References Cited**

UNITED STATES PATENTS

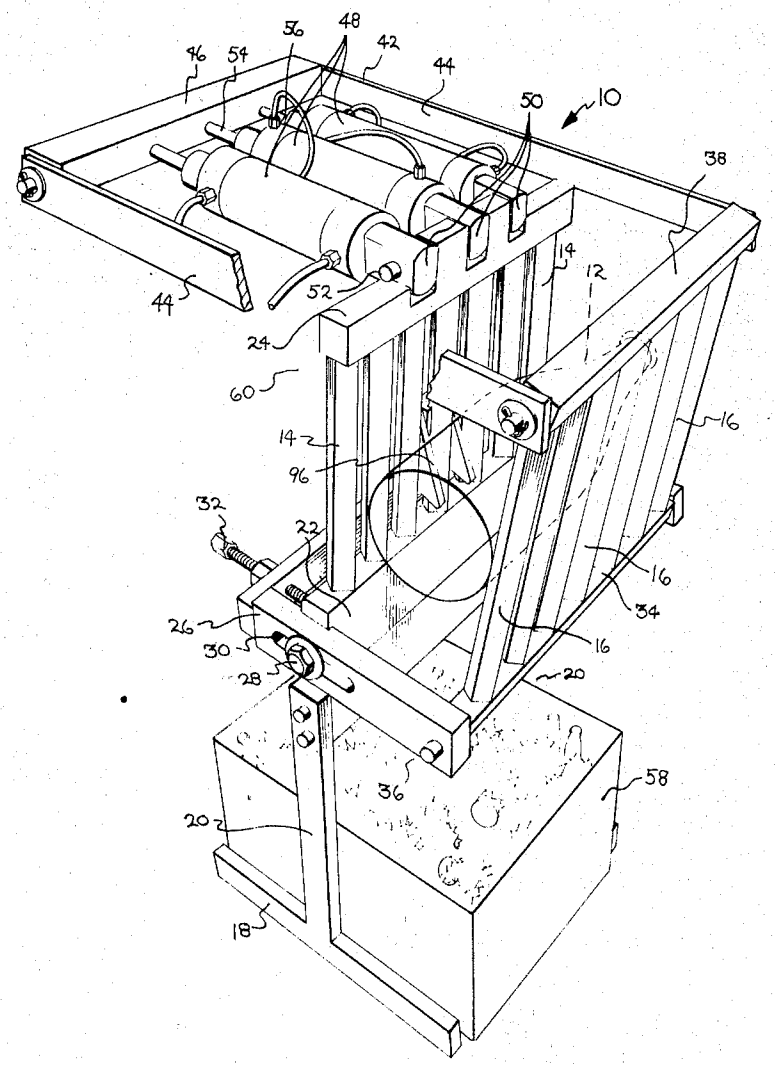
3,223,334	12/1965	Wuthrich	241/36
3,346,202	10/1967	Wuthrich	241/262
3,024,720	3/1962	Welsh	241/99 X
3,517,607	6/1970	Keagle	241/99 X

Primary Examiner—Robert L. Spruill
Attorney—Alan J. Steger and E. J. Holler

[57] **ABSTRACT**

This invention provides a hydraulic powered bottle crusher which is adapted to crush bottles into small pieces for recycling. This device utilizes hydraulic pressure from a standard municipal or household water supply system to actuate a double-action piston which is controlled by means of a four-way valve. The double-action piston is connected to a plurality of movable crusher bars which cooperate with a plurality of fixed crusher bars to squeeze and crush a bottle therebetween. This device features a unique trigger and valve spool which are responsive to the presence of a bottle between the fixed and movable crusher bars to actuate the four-way valve and double-action piston to advance the movable crusher bars into compressing engagement with the bottle and to actuate the four-way valve and double-action piston to retract the movable crusher bars after the bottle has been crushed.

5 Claims, 5 Drawing Figures



PATENTED JAN 9 1973

3,709,440

SHEET 1 OF 3

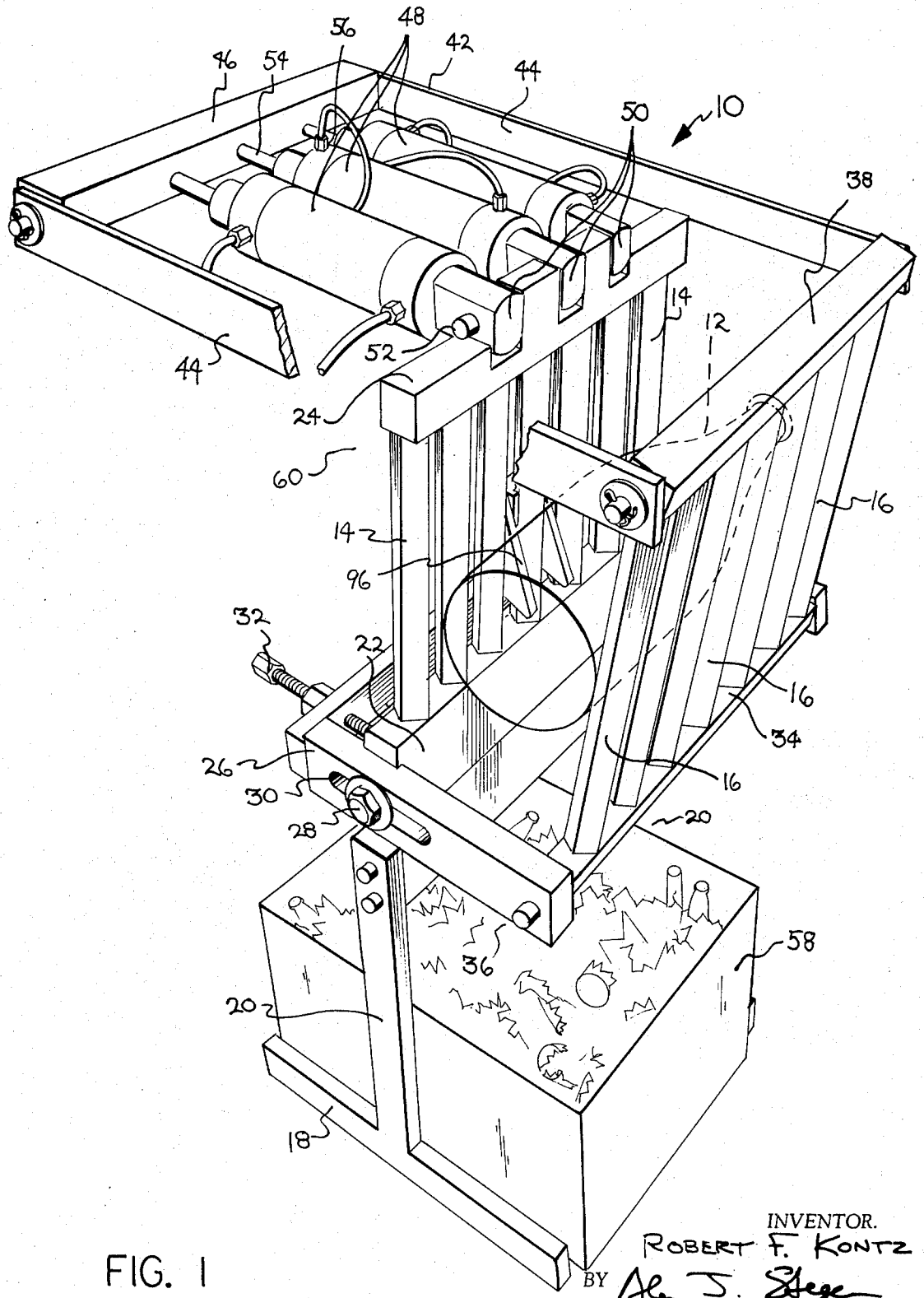


FIG. 1

INVENTOR.
ROBERT F. KONTZ
BY
J. Stege
&
E. J. Holler
ATTORNEYS

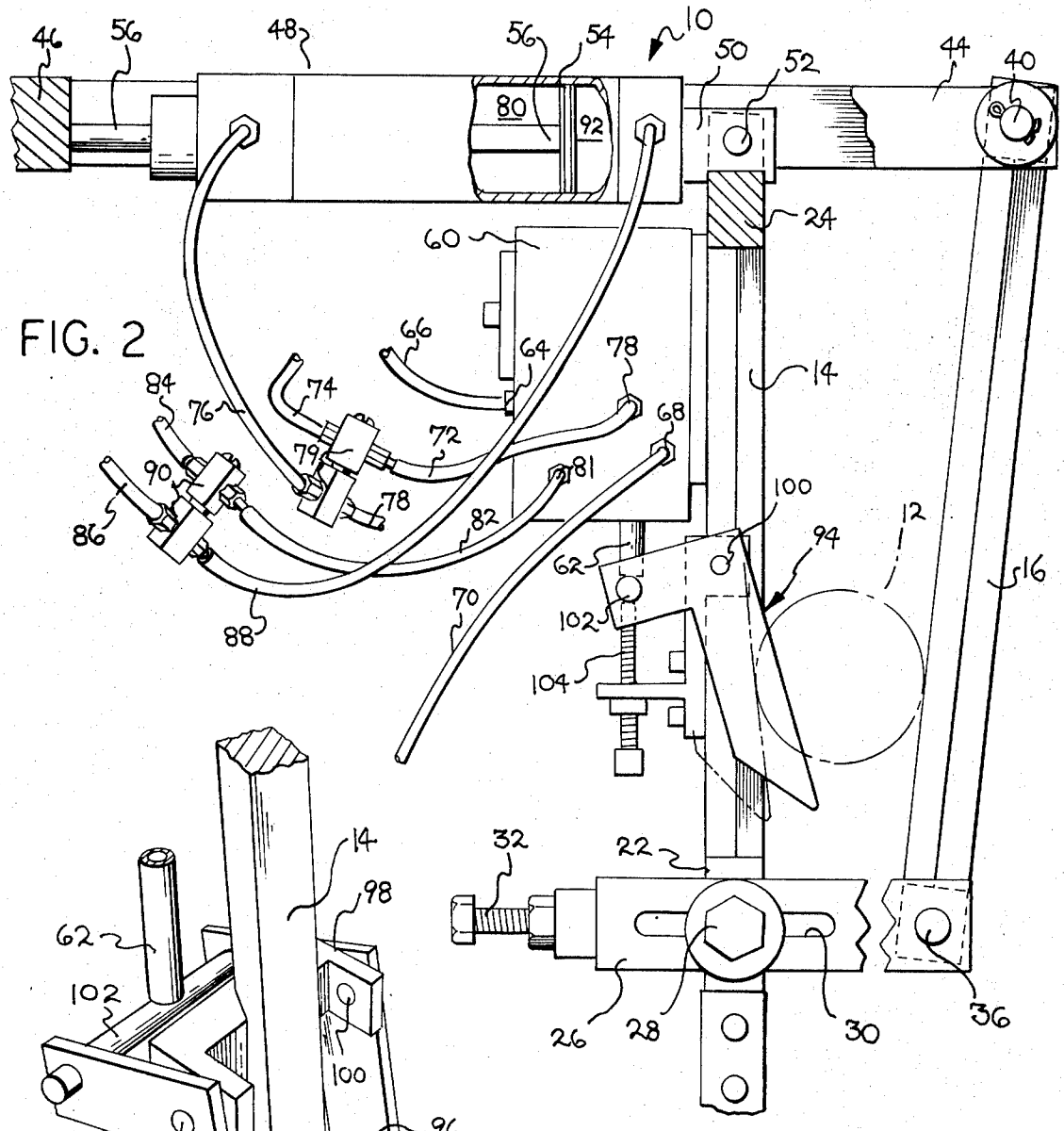


FIG. 2

FIG. 3

INVENTOR.
ROBERT F. KONTZ
BY Alan J. Stegge
E. J. Holb
ATTORNEYS

FIG. 4

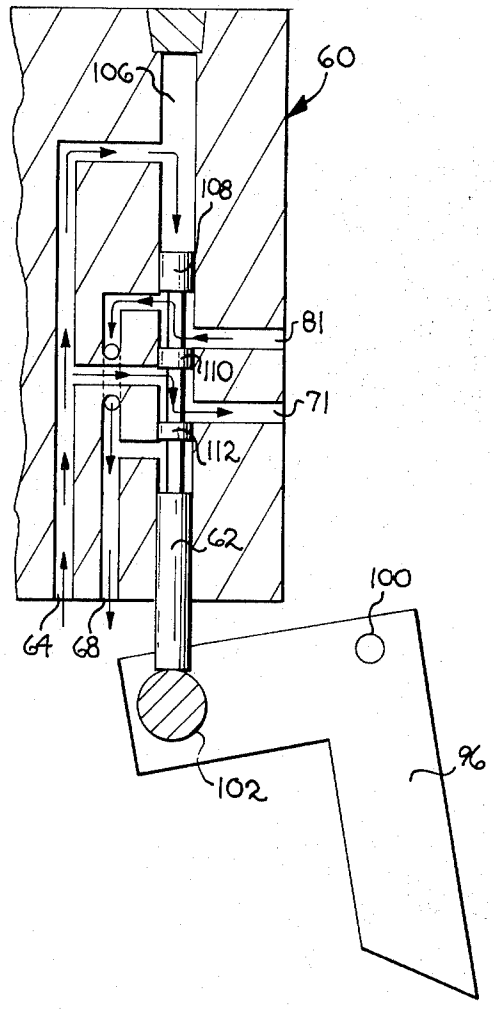
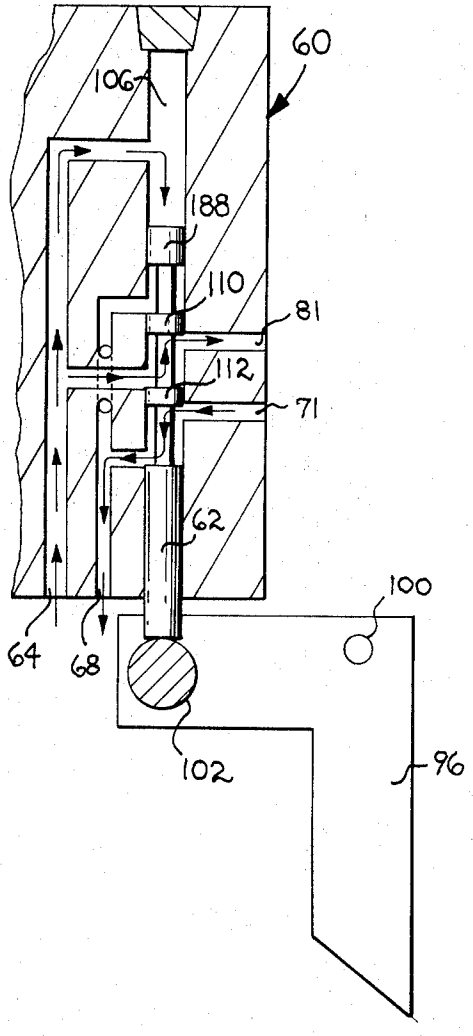


FIG. 5



INVENTOR.
ROBERT F. KONTZ
BY Alan J. Stegen
E. J. Holler
ATTORNEYS

HYDRAULIC POWERED BOTTLE CRUSHER

BACKGROUND OF THE INVENTION

This invention relates to a hydraulic powered bottle crusher which is adapted to crush bottles into small pieces for recycling. More specifically, this invention relates to a relatively compact device for crushing bottles which utilizes hydraulic pressure from a municipal or household water supply system to actuate the crushing mechanism.

As the population continues to increase, the problem of disposal of municipal refuse, including glass bottles, has become one of major importance. The volume of trash and garbage generated in our major metropolitan areas is increasing daily so that collection and disposal of this municipal refuse is becoming difficult.

In the interest of reducing the quantity of glass containers which appear in municipal refuse, at least one major glass container manufacturer has instituted programs across the country to repurchase glass bottles from consumers which are then crushed and recycled to be made into new glass containers. As this practice of purchasing and recycling glass bottles grows in popularity, it has become obvious that there is a need for a device which is adapted for crushing these bottles into small pieces suitable for utilization by the manufacturer in recycling processes.

SUMMARY OF THE INVENTION

It is, therefore, an object of this invention to provide a unique hydraulic powered bottle crusher which is adapted to crush bottles into small pieces for recycling. The unique device of this invention features a double-action piston which is actuated for movement in both directions by means of hydraulic pressure from a municipal or home water supply system. The double-action piston is connected to a plurality of movable crusher bars which cooperate with a plurality of fixed crusher bars to squeeze and crush a bottle therebetween. This device features a trigger and valve spool which are responsive to the presence of a bottle between the fixed and movable crusher bars to actuate the four-way valve and double-action piston to advance the movable crusher bars into compressing engagement with the bottle and to actuate the four-way valve and double-action piston to retract the pressure bars after the bottle has been crushed. Because the device of this invention does not necessitate electric motors or hydraulic pumps, it is a very quiet unit in operation and is well suited to be utilized in a home, store, or restaurant.

Other objects, features, and advantages of this invention will become obvious upon reference to the following detailed description and the drawings illustrating the preferred embodiment thereof.

IN THE DRAWINGS

FIG. 1 is a schematic perspective view of a bottle crusher unit incorporating the novel features of this invention.

FIG. 2 is an enlarged view of the bottle crushing portion of the unit of FIG. 1.

FIG. 3 is an enlarged perspective view of the trigger and valve spool utilized in the bottle crusher of this invention.

FIG. 4 is a schematic view of the four-way valve, valve spool, and trigger utilized in this invention showing these components in the starting or open position prior to a bottle being inserted into the crusher unit.

FIG. 5 is a schematic view of the four-way valve, valve spool, and trigger of FIG. 4 showing these components in the crushing position after a bottle has been placed into the crusher unit of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, a bottle crushing device incorporating the features of this invention is shown schematically in FIG. 1 and indicated generally by the numeral **10**. The bottle crusher **10** is designed to crush a bottle, such as that indicated by the numeral **12**, between a plurality of fixed crusher bars **14** and a plurality of movable crusher bars **16**. The bottle crusher **10** includes a base portion **18** from which vertical struts **20** extend upwardly to support a fixed cross beam **22**. The fixed crusher bars **14** are attached at their lower end to the fixed cross beam **22** and at their upper end to a cross bar **24**. Mounted for sliding movement on the cross beam **22** is a frame **26** which supports the movable crusher bars **16**. The frame **26** is secured to the cross beam **22** by means of a lock screw **28** which resides in an adjustment slot **30** to allow for adjustment of the frame **26** relative to the cross beam **22**. An adjustment screw **32** is also provided to adjust and fix the position of the frame **26** relative to the cross beam **22** to compensate for various size bottles that are to be crushed by this device. The movable crusher bars **16** are supported at their lower end on a pivotable frame member **34** which is attached for pivotable movement relative to the frame **26** by means of pins **36**. The movable crusher bars **16** are attached at their upper extremity to a frame member **38** which in turn is pivotably attached by means of pins **40** to a movable drive link frame **42**. The drive link frame **42** includes a pair of side drive links **44** which are pinned at one end to the frame member **38** and pinned at the other end to a cross drive link **46**. It should be noted that the crusher bars **14** do not necessarily have to be fixed and could be pivoted about their lower end so that both crusher bars **14** and **16** would be movable relative to each other.

A plurality of cylinders **48** are mounted at one end on cross bar **24** by means of struts **50** and pin **52**. As can be seen in FIG. 2, each of the cylinders **48** include a double-action piston **54** which is connected by means of connecting rod **56** to the cross drive link **46**. It should be apparent that movement of the pistons **54** within the cylinders **56** will result in movement of frame **42** relative to cross bar **24** and concurrent movement of movable crusher bars **16** relative to the fixed crusher bars **14**. It should be understood that the number and size of the cylinders **48** utilized will, of course, be dependent upon the amount of force necessary to move the frame **42** and the movable crusher bars **16** relative to the fixed crusher bars **14**. In many instances, the use of one large cylinder would be sufficient and the selection of three cylinders here is utilized merely to illustrate the various possibilities of the system which depend upon the size and type of bottles being crushed.

A suitable collection container **58** is provided and positioned below the opening between the fixed crusher bars **14** and the movable crusher bars **16**. This collection container **58** may be of any suitable type adapted to receive the pieces of broken glass and transport them to a desired collection point. A relatively strong corrugated paperboard carton has been found to be very sufficient for this purpose.

To understand the hydraulic system which actuates the double-action piston **54** within cylinder **56** to thereby result in movement of the movable crusher bars **16** relative to the fixed crusher bars **14**, reference should initially be made to FIGS. **1** and **2**. The hydraulic system utilized in the bottle crusher **10** of this invention features a four-way valve **60** which is attached to the outer side of the fixed crusher bars **14**. The four-way valve **60** selected in this device is of the pilot type having a valve spool **62** whose position controls the flow of fluid therethrough. The four-way valve **60** includes an inlet port **64** to which is attached a supply line **66** which may be connected to any source of municipal or home water supply. The four-way valve also includes an exhaust port **68** to which is connected a conduit **70** which serves as a suitable drain line from the system. The four-way valve further includes a third port **71** which communicates by means of conduits **72**, **74**, **76**, and **78** and suitable couplings **79** to the left hand end of each cylinder **48**. These conduits **72**, **74**, **76**, and **78** thereby conduct the flow of water into and out of the chamber **80** which is to the left of the piston **54** within cylinder **48**. A fourth port **81** is provided on the four-way valve **60** and is connected by means of conduits **82**, **84**, **86**, and **88** and couplings **90** to the right hand end of each of the cylinders **48**. Thus, the conduits **82**, **84**, **86**, and **88** conduct the water into and out of the chamber **92** on the right side of the pistons **54** within cylinders **48**. Further details of the operation of the four-way valve **60** will become apparent in conjunction with the later description of FIGS. **4** and **5**.

An important part of the control system of this device is the movable cam or trigger mechanism **94** which includes a pair of right angle flanges **96** which are pivotally mounted to one of the fixed crusher bars **14** by means of a U-shaped frame **98** and a pair of pins **100**. The flanges **96** have a cross bar **102** pinned therebetween, which in turn is attached to the valve spool **62** which controls the flow of the water through the four-way valve **60**. The trigger mechanism **94** also includes a threaded adjusting rod **104** which can be utilized to control the stop position of the flanges **96** when they are allowed to pivot freely into the space between the fixed crusher bars **14** and the movable crusher bars **16** (i.e., when there is no bottle present between the respective crusher bars). To understand the operation of the trigger mechanism **94** and the four-way valve **60** to control the operation of the bottle crusher **10**, reference should be had to the schematic diagrams shown in FIGS. **4** and **5**.

In FIG. **4** the device is pictured in the starting position which corresponds to the position of the trigger mechanism **94** as shown in solid lines in FIG. **2**. As can be seen in FIG. **4**, the four-way valve **60** has a pilot chamber **106** located adjacent to the upper end of the spool valve **62** which is connected to the water inlet port **64**. Thus, at all times a pilot force equal to the pressure of the water supply entering the valve **60** through inlet **64** is maintained on the upper end of the spool valve **62**. Thus, when the trigger flanges **96** are in the position shown in FIG. **4**, the spool valve **62** is positioned such that its lands **108**, **110**, and **112** are positioned to connect the inlet **64** with the port **71**, and the port **81** with the exhaust or drain port **68**. Thus, in this position the water supply flows through port **71** and conduits **72**, **74**, **76**, and **78** to the left hand chamber **80** within the cylinders **48** to thereby force the piston **54** towards the right hand end of cylinders **48** with the result that the movable crusher bars **16** pivot to the right or open position prior to receiving a bottle to be crushed. Simultaneously, the port **81** is connected directly to the exhaust port **68** to thereby allow for the draining of water from chamber **92** on the right side of the piston **54** as the piston moves toward the right hand end of the cylinders **48**.

When a bottle **12** is positioned between the fixed crusher bars **14** and the movable crusher bars **16**, the trigger **94** pivots to the position shown in dash-dot lines in FIG. **2** and the valve spool **62** is moved upwardly to assume the position shown schematically in FIG. **5**. In FIG. **5** it can be seen that the lands **108**, **110**, and **112** have moved upwardly so that inlet port **64** is directly connected to port **81** so that the flow of water through the four-way valve **60** is now reversed and inlet water is now caused to flow into chamber **92** on the right side of piston **54** to thereby force the piston **54** towards the left in cylinder **48**. Simultaneously, port **71** is connected to the exhaust or drain port **68** to thereby facilitate the draining of water from chamber **80** as the piston **54** moves to the left within cylinder **48**. Thus, as the piston **54** is forced to travel to the left within the cylinder **48**, the frame **42** and movable crusher bars **16** are forced to pivot in toward the fixed crusher bars **14**. This movement of the movable crusher bars **16** continues to point where the compressive force on the bottle **12** forces it to break into a number of pieces which then fall into the collection container **58**. Once the bottle **12** has broken and the pieces fallen away from the trigger flanges **96**, the pilot water pressure within the chamber **106** is sufficient to force the valve spool **62** to slide downwardly and return to the position shown in FIG. **4**. Once it has returned to the position shown in FIG. **4**, the four-way valve **60** is again reversed so that the inlet water port **60** is communicating directly with port **71** to conduct water to chamber **80** and force the piston **54** to move to the right within cylinder **48** to thereby pivot the movable crusher bars **16** to the open position for receipt of a new bottle to be crushed.

Thus, the unique control system of this bottle crusher **10** which incorporates a four-way valve **60** and a trigger mechanism **94** is adapted to sense the presence of a bottle between the fixed and movable crusher bars to reverse the flow of water through the four-way valve to thereby actuate the double-action piston **54** to advance the movable crushing bars **16** toward the fixed crushing bars **14** to thereby compress and crush the bottle placed therebetween. Once the bottle has broken and fallen away from the crusher bars, the control system of this device senses the absence of the bottle and reverses the flow of water through the four-way valve so that the double-action piston moves to pivot the movable crusher bars to an open position for receipt of a new bottle to be crushed.

Therefore, from the preceding description, it should be apparent that the unique bottle crushing device of this invention, which operates completely on hydraulic pressure derived from a municipal or home water supply system, is well suited to quickly and economically crush bottles into small pieces for recycling. The device as disclosed by this invention is well suited to be utilized in any number of bottle collection locations such as a home, restaurant, or food store. In addition, a unit such as disclosed in this invention is well suited to be attached to a group of beverage dispensing machines so that the bottles can be crushed for recycling and return by the same organization that services the dispensing machines.

I claim:

1. A bottle crusher unit for breaking bottles into pieces which is adapted to utilize municipal or household water pressure as a hydraulic power source comprising, in combination:

a fixed crusher member having a plurality of bars positioned parallel to each other at spaced intervals and interconnected at their ends by frame members;

a movable crusher member including a plurality of bars positioned parallel to each other at spaced intervals and interconnected at their ends by frame members, said movable crusher member positioned adjacent to and spaced from said fixed crusher member so that a bottle to be crushed may be received therebetween, said movable crusher member being pivotable toward said fixed crusher member to compress and crush said bottle into pieces and pivotable away from said fixed crusher member for receipt of another bottle to be crushed therebetween;

hydraulically responsive actuation means for controlling the position of said movable crusher member relative to said fixed crusher member;

valve means connecting said hydraulically responsive actuation means to said source of municipal or household water pressure;

control means for said valve means responsive to both the presence and the absence of a bottle between said fixed and movable crusher members to adjust the position of said valve means to thereby control the flow of water to said hydraulically responsive actuation means;

said hydraulically responsive actuation means including at least one cylinder having first and second hydraulic fluid openings in the opposite ends thereof connected to said valve means, a double-action piston positioned for sliding movement within said cylinder between said first and second hydraulic openings in the opposite ends of said cylinder and a piston rod connecting said piston to said movable crusher member;

said valve means including a four-way valve member including a valve spool adjustable to variably interconnect said source of water pressure, the first hydraulic opening in one end of said cylinder, the second hydraulic opening in the opposite end of said cylinder, and a drain line, said valve spool being engaged at one end of said control means and subjected to the source water pressure within said valve member at the other end;

and said control means includes a movable cam pivotally mounted on said fixed crusher bars and engaging one end of said valve spool, said movable cam being pivotable toward said four-way valve when a bottle is present between said fixed and movable crusher bars to force said valve spool to a position which connects said source of water pressure to said second hydraulic opening in said cylinder and said first hydraulic opening in said cylinder to said drain line to thereby force said piston toward said first hydraulic opening in said cylinder and advance said movable crusher bars toward said fixed crusher bars to crush said bottle therebetween, and said movable cam being pivotable away from said four-way valve in the absence of a bottle between said fixed and movable crusher bars to allow said water source pressure to return said valve spool to a position which connects said source of water pressure to said first hydraulic opening in said cylinder and said second hydraulic opening in said cylinder to said drain line to thereby force said piston toward said second hydraulic opening in said cylinder and retract said movable crusher bars away from said fixed pressure bars.

2. A bottle crusher unit as set forth in claim 1 further including removable collection means positioned beneath said fixed and movable crusher members for receiving said crushed bottle pieces.

3. In combination with a source of municipal or household water pressure, a bottle crusher for breaking bottles into pieces comprising, in combination:

a fixed crusher member having a plurality of bars positioned parallel to each other at spaced intervals and interconnected at their ends by frame members;

a movable crusher member including a plurality of bars positioned parallel to each other at spaced intervals and interconnected at their ends by frame members, said movable crusher member positioned adjacent to and spaced from said fixed crusher member so that a bottle to be crushed may be received therebetween, said movable crusher member being pivotable toward said fixed crusher member to compress and crush said bottle into pieces and pivotable away from said fixed crusher member for receipt of another bottle to be crushed therebetween;

hydraulically responsive actuation means for controlling the position of said movable crusher member relative to said fixed crusher member;

valve means connecting said hydraulically responsive actuation means to said source of municipal or household water pressure;

control means for said valve means responsive to both the presence and the absence of a bottle between said fixed and movable crusher members to adjust the position of said valve means to thereby control the flow of water to said hydraulically responsive actuation means;

said hydraulically responsive actuation means including at least one cylinder having first and second hydraulic fluid openings in the opposite ends thereof connected to said valve means, a double-action piston positioned for sliding movement

within said cylinder between said first and second hydraulic openings in the opposite ends of said cylinder and a piston rod connecting said piston to said movable crusher member;

said valve means including a four-way valve member including a valve spool adjustable to variably interconnect said source of water pressure, the first hydraulic opening in one end of said cylinder, the second hydraulic opening in the opposite end of said cylinder, and a drain line, said valve spool being engaged at one end of said control means and subjected to the source water pressure within said valve member at the other end;

and said control means includes a movable cam pivotally mounted on said fixed crusher bars and engaging one end of said valve spool, said movable cam being pivotable toward said four-way valve when a bottle is present between said fixed and movable crusher bars to force said valve spool to a position which connects said source of water pressure to said second hydraulic opening in said cylinder and said first hydraulic opening in said cylinder to said drain line to thereby force said piston toward said first hydraulic opening in said cylinder and advance said movable crusher bars toward said fixed crusher bars to crush said bottle therebetween, and said movable cam being pivotable away from said four-way valve in the absence of a bottle between said fixed and movable crusher bars to allow said water source pressure to return said valve spool to a position which connects said source of water pressure to said first hydraulic opening in said cylinder and said second hydraulic opening in said cylinder to said drain line to thereby force said piston toward said second hydraulic opening in said cylinder and retract said movable crusher bars away from said fixed pressure bars.

4. In combination with a source of municipal or household water pressure, a bottle crusher as set forth in claim 3 further including removable collection means positioned beneath said fixed and movable crusher members for receiving said crushed bottle pieces.

5. A bottle crusher unit for breaking bottles into pieces which is adapted to utilize municipal or household water pressure as a hydraulic power source comprising, in combination:

fixed crusher means;

movable crusher means positioned adjacent to and spaced from said fixed crusher means so that a bottle to be crushed may be received therebetween, said movable crusher means being pivotable toward said fixed crusher means to compress and crush said bottle into pieces and pivotable away from said fixed crusher means for receipt of another bottle to be crushed therebetween;

hydraulically responsive actuation means for controlling the position of said movable crusher means relative to said fixed crusher means;

mechanically actuated hydraulic valve means connecting said hydraulically responsive actuation means to said source of municipal or household water pressure;

and a movable control member for said mechanically actuated hydraulic valve means pivotably mounted on said fixed crusher means and responsive to both the presence and absence of a bottle between said fixed and movable crusher means to mechanically engage said mechanically actuated hydraulic valve means and adjust the position of said mechanically actuated hydraulic valve means to thereby control the flow of water to said hydraulically responsive actuation means.

* * * * *