July 17, 1956 P. M. CASADY 2,754,835

APPARATUS FOR CLEANING HOLLOW TUBULAR ELEMENTS

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Fig. 1.

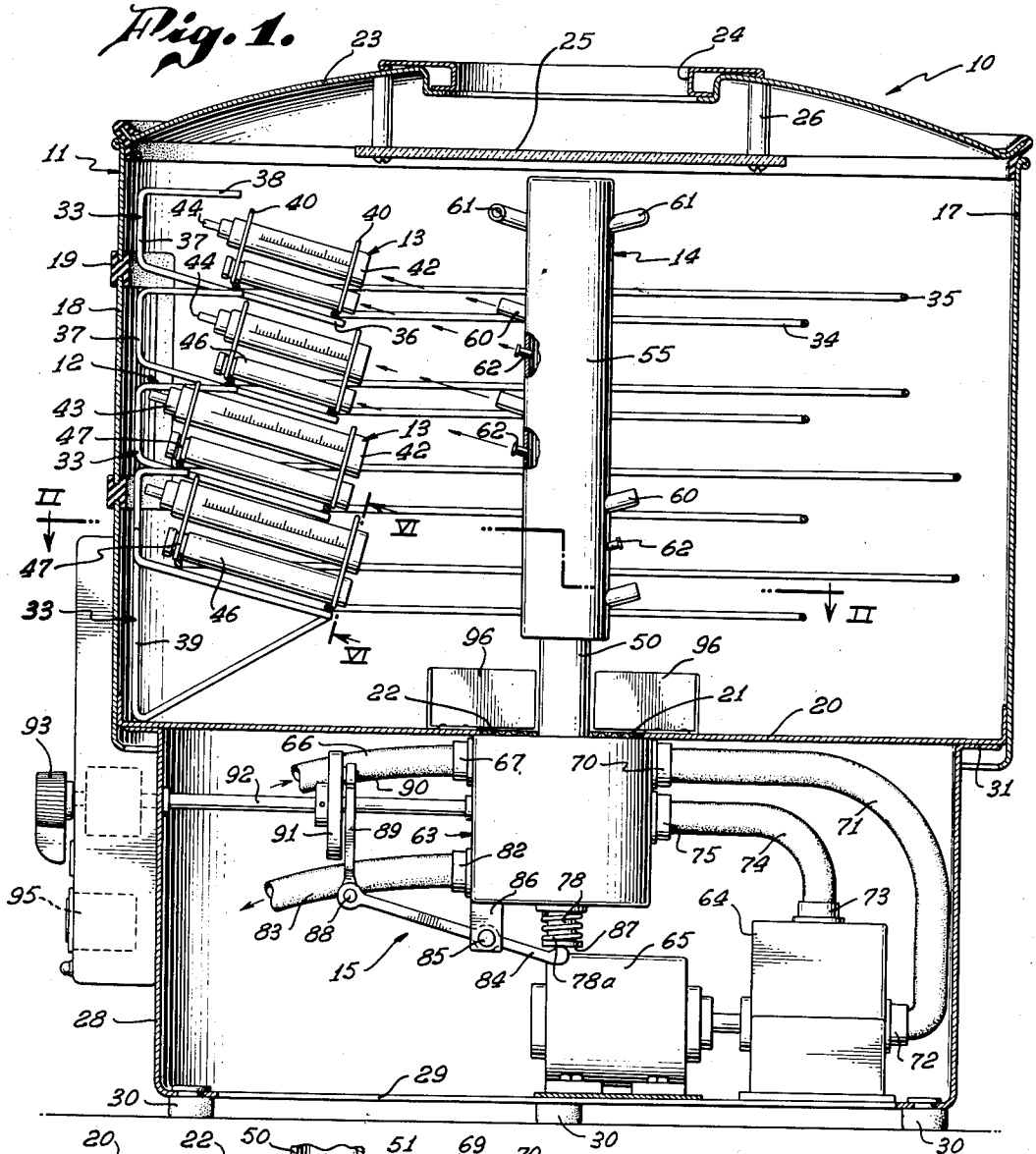
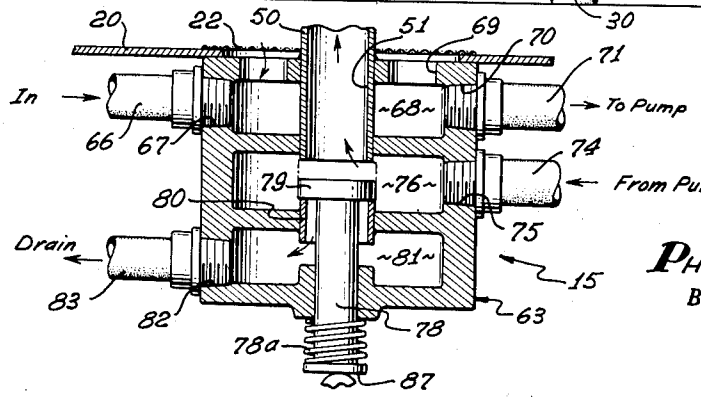


Fig. 3.



INVENTOR.
PHILIP M. CASADY,
BY
ATTORNEY.

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Fig. 2.

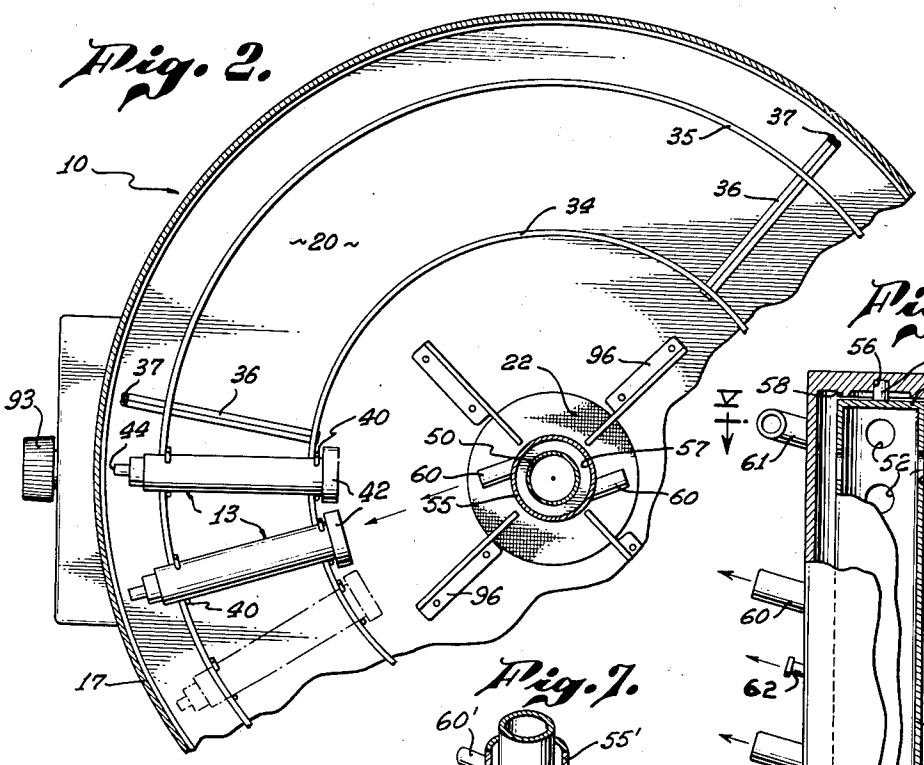


Fig. 4.

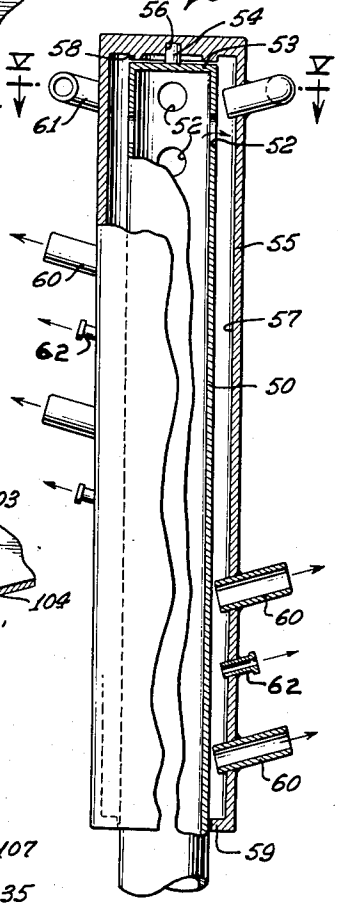


Fig. 7.

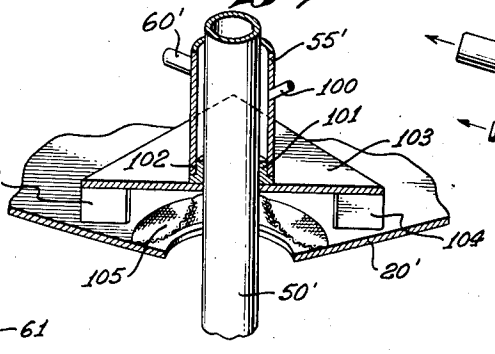
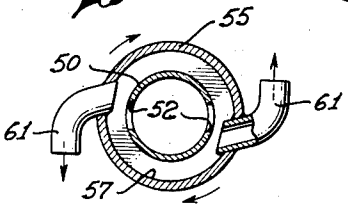


Fig. 5.



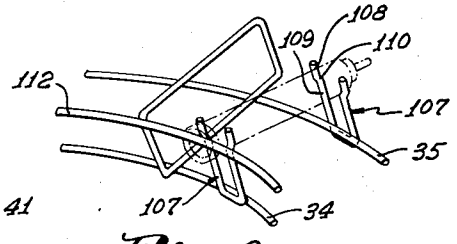


Fig. 6.

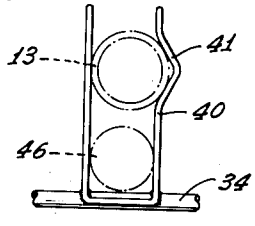


Fig. 8.

INVENTOR.
PHILIP M. CASADY,
BY
ATTORNEY.

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2,754,835

APPARATUS FOR CLEANING HOLLOW TUBULAR ELEMENTS

Philip M. Casady, Los Angeles, Calif., assignor to Medical Equipment Laboratories, Los Angeles, Calif., a corporation of California

Application October 23, 1953, Serial No. 387,999

10 Claims. (Cl. 134—112)

This invention relates to an apparatus for cleaning a plurality of hollow tubular elements each having at least one open end and more particularly to means for thoroughly cleaning and washing internal and external surfaces of syringes and the external surfaces of their associated plungers.

In treatment of patients in a hospital a great number of syringes are employed each day. Preferably, each syringe and plunger therefor should be cleaned after each use and before sterilization in order to prevent contamination of a solution being administered to a patient by a different solution previously contained with the hollow syringe. Some solutions used in the syringes tend to cling tightly to the internal surfaces of the syringes and are not readily removed therefrom. In some instances, certain syringes are not cleaned the same day in which they are used. The problem therefore of maintaining a sufficient number of clean syringes on hand and of effectively and thoroughly cleaning each syringe in order to prevent contamination is a serious one and one which heretofore has presented many difficulties and has consumed considerable time.

Present methods employed in hospitals for cleaning syringes and the associated plungers therefor include individually cleaning each syringe and plunger by washing the syringe and plunger in a suitable cleaning or washing fluid such as a detergent. Sometimes the surfaces of an individual syringe may be scrubbed by suitable brush means. In some instances used syringes are allowed to accumulate and are then cleaned by soaking a batch of syringes in a suitable container in which suitable cleaning fluid is carried. The syringes in the container are usually not individually cleaned by may be slightly agitated within the container while in soaking position to attempt to remove solutions clinging to the internal surfaces thereof. After such a batch of syringes have been allowed to soak for a predetermined time the cleaning fluid is drawn off and the batch of syringes may be rinsed in a suitable rinsing fluid. Obviously this latter method of cleaning syringes does not effectively and thoroughly clean internal surfaces of the syringes.

Obviously the manual efforts at cleaning a large number of syringes were inefficient and as a result several prior syringe cleaning machines have been proposed for cleaning and washing a plurality of syringes at the same time. One of such prior proposed machines has included mounting the syringes on the periphery of a wheel and then rotating the wheel so that the lower portion of the wheel is dipped into a detergent solution and syringes carried thereby are immersed into the detergent. When a syringe reaches the top of the wheel, it is so positioned that detergent is drained therefrom. Thus alternating dipping and draining of syringes is effected. A different prior proposed syringe cleaning machine has included mounting syringes with their open ends downwardly facing and submerging the syringes into a solution of detergent. Means are provided whereby an air stream is bubbled upwardly into the detergent in each syringe, thereby

causing slight agitation of the detergent therein. It will be obvious that such prior proposed machines did not effectively and efficiently clean and wash the internal surfaces of the syringe because of insufficient agitation of the cleaning fluid so as to effect a thorough washing of the surface.

The present invention contemplates a novel apparatus for thoroughly and completely cleaning a large number of syringes in a short period of time such as from three to five minutes, depending upon the condition of the syringes. The apparatus of the present invention contemplates forcibly injecting a jet stream of washing fluid into each syringe in such a manner that the fluid introduced thereinto subjects the internal surfaces of each syringe to a thorough flushing action.

In other words, the present invention contemplates ramming a large volume of washing fluid into a syringe and at a high velocity so that a vigorous, extremely turbulent, hard washing action is effected on the internal surfaces of the syringe. The present invention contemplates that this hard washing action be performed in an intermittent sequential manner so that each syringe is subjected to a cycle of washing and draining by the forcibly injected fluid and then draining said fluid therefrom. The apparatus of the present invention contemplates the handling of syringes or hollow tubular elements of different sizes and in the exemplary embodiment is capable of handling up to approximately 150 syringes at one time.

The primary object of this invention therefore is to disclose and provide a novel apparatus for effectively cleaning and washing a plurality of hollow tubular elements having an open end, such as syringes, in a minimum of time.

An object of this invention is to disclose and provide an apparatus for cleaning a plurality of open ended syringes wherein the internal surfaces thereof are subjected to relatively rapid washing and draining cycles which include vigorously flushing the internal surfaces thereof and draining the washing fluid therefrom.

Another object of this invention is to disclose and provide an apparatus for washing hollow tubular elements wherein the internal surface of each element is subjected to a forceful, vigorous, turbulent action of a washing fluid.

A different object of this invention is to disclose and provide an apparatus as above mentioned wherein open ended hollow tubular elements or syringes of different sizes may be cleaned.

The invention contemplates an apparatus for cleaning a plurality of syringes wherein the washing fluid employed therein is recirculated and wherein the washing cycle may be semi-automatically or automatically controlled in operation.

A further object of the invention is to disclose an apparatus as above described wherein the fluid employed for washing is also used for rotating the means for ejecting the fluid into each of said elements.

A still further object of this invention is to disclose and provide an apparatus for cleaning a plurality of syringes which is simply constructed, easy to manufacture and which effectively and thoroughly cleans each individual syringe.

Generally speaking, this invention contemplates such an apparatus as above mentioned wherein an enclosure is provided for supporting therein a plurality of vertically stacked annular racks arranged about a common axis and adapted to carry a plurality of syringes in radially, inwardly facing relation. Rotatable means is mounted virtually coaxial with said common axis and carries a plurality of longitudinally spaced nozzles, the axis of each nozzle being aligned with the axis of each tubular element carried by an associated opposed rack when the nozzle is rotated. The apparatus includes means for

supplying a washing fluid to said nozzles whereby a forceful jet stream of water is ejected therefrom and which sequentially enters into the open end of the opposed associated syringes as the nozzles are rotated. The inclination of the syringes causes rapid draining of the fluid injected thereinto so that each syringe is capable of receiving additional fluid from the nozzle as it repeatedly rotates past each element.

Other objects and advantages of this invention will be readily apparent from the following description of the drawings in which an exemplary embodiment of this invention is shown.

In the drawings:

Fig. 1 is a sectional view of an apparatus embodying this invention, the section being taken substantially in a vertical plane bisecting the apparatus.

Fig. 2 is a fragmentary sectional view taken in the planes indicated by line II—II of Fig. 1.

Fig. 3 is a fragmentary sectional view of a multi-ported valve means employed with the apparatus shown in Fig. 1.

Fig. 4 is an enlarged fragmentary sectional view of the means for ejecting fluid into said syringes.

Fig. 5 is a sectional view taken in the transverse plane indicated by line V—V of Fig. 4.

Fig. 6 is a fragmentary view taken from the plane indicated by line VI—VI of Fig. 1.

Fig. 7 is a fragmentary perspective view of a modification of the rotatable means and mounting means therefor.

Fig. 8 is a perspective view of a fragmentary portion of a modified rack for holding the syringes.

An apparatus embodying this invention is generally indicated at **10** and may generally comprise an enclosure **11**, a plurality of annular rack means indicated at **12** supported within the enclosure and of generally annular form for carrying in a circular arrangement a plurality of radially arranged hollow tubular elements or syringes **13**. A means for intermittently ejecting a jet stream of fluid sequentially into each syringe is generally indicated at **14** and may comprise nozzles having their axes aligned with the axes of opposed syringes during rotation. Beneath the enclosure **11** may be provided a means **15** for supplying washing fluid to the rotatable means **14**.

The enclosure **11** may comprise a cylindrical side wall **17** made of any suitable sheet material and preferably non-corrosive and stainless. The side wall **17** may be provided with a transparent window **18** mounted in an opening in said side wall by any suitable means such as a grommet **19**. A slightly dished concave bottom wall **20** may extend across the bottom of the side wall **17**, said bottom wall being provided with a central opening **21** having an annular screen **22** extending thereacross for permitting drainage of fluid from the enclosure into the means **15**. The bottom wall **20** is preferably made of the same material as side wall **17**.

A cover **23** may extend across and cover the top end of the cylindrical side wall **17**, said cover having an enlarged central opening at **24** for ventilating the enclosure **11**. A baffle plate **25** of transparent material may be carried by the cover **23** as by a screw and spacer block assembly **26** in spaced relation to the opening **24** for preventing splashing or discharge of fluid from the enclosure through the opening **24**. At the same time the transparent baffle **25** permits observation of the interior of the enclosure **11**.

Beneath enclosure **11** may be provided a cylindrical housing **28** of generally cylindrical form and of slightly smaller diameter than the side walls **17**. The housing **28** includes a bottom wall **29** which may be supported from any suitable supporting surface by means of a plurality of spaced shoes **30**. The top margins of the housing **28** may be turned radially outwardly to provide a circumferential flange **31** arranged to support the bottom wall **20** of the enclosure at its circumferential margins.

Supported within the enclosure **11** by the bottom wall **20** thereof may be the rack means **12** which comprises a plurality of vertically stacked annular racks **33**, said racks **33** being coaxially arranged about a common axis defined by the rotatable means **14**. Each rack means **33** may be formed in any suitable manner from wire stock of noncorrosive stainless material. Each rack means **33** may include a pair of concentric rings **34** and **35** joined together by a plurality of spaced radially extending wire elements **36**, some of which may extend beyond the outer ring **35** and are bent upwardly to provide a vertical portion **37** adapted to abut against the interior surface of the side wall **17** for coaxially positioning the rack with the means **14**. The vertical portions **37** are integrally joined with an inturned horizontal leg **38** which is adapted to provide a support for a rack to be positioned thereabove. The bottom rack **33** in addition to the structure already described, may include circumferentially spaced depending leg means **39** which rest upon the circumferential margin of the bottom wall **20** for spacing the bottom rack a selected distance above the bottom wall **20**.

Each rack means **33** may be provided with upstanding pairs of upwardly facing resilient wire clips **40**, each pair of clips **40** being radially aligned with respect to the axis of the rotatable means **14**, clips of each pair being carried respectively by the rings **34** and **35**. The wire clips **40** may be secured to rings **34** and **35** in any suitable manner as by spot welding. The forward clip **40** may be provided with an inwardly facing bent section **41** in one leg thereof so as to position a syringe **13** a selected distance above rings **34** and **35**. The rear or outer clip **40** may be similarly formed.

Each pair of clips **40** are adapted to carry and position a syringe **13** with the axis of the syringe inclined downwardly at a preselected angle of inclination. The angle of inclination of the axes of each syringe is preferably between 10° to 18° for reasons pointed out hereinafter. Each syringe includes a shoulder **42** which is positioned forwardly of the inner clip **40** so that when a jet stream of fluid hits the syringe, the shoulder **42** in engagement with inner clip 40 will prevent axial movement of the syringe. Each syringe **13** includes a rear portion **43** held by the outer clip **40** and each syringe may include a relatively small diameter passageway **44** leading axially from the interior of the main hollow syringe body.

A plunger **46** for each syringe may be held by the clips **40** below the syringe **13** in substantially the same radial arrangement as the syringes **13**. The outer clip **40** may grasp as at **47** an annular groove formed on such plungers **46**.

It should be noted that the racks **33** each position and carry a plurality of syringes with the axes of the syringes lying in a pattern of a frustrum of an inverted cone, the inverted cone in this example being relatively shallow. The open ends of such syringes face the vertex of the cone and are spaced therefrom a suitable selected distance. The vertex of the cone lies on the axis of the rotatable means **14**.

The rotatable means **14** for directing a jet stream of washing fluid intermittently and sequentially into said syringes may comprise a hollow upstanding post **50** carried by the bottom wall **20** and having a bottom portion **51** (Fig. 3) extending therebelow into the means **15** for supplying washing fluid. The hollow post **50** has its longitudinal axis virtually aligned with the axis about which the annular racks **33** are arranged. Adjacent the top portion of post **50** may be provided a plurality of circular openings **52**. The top wall **53** of the post may be integrally formed with an upstanding pin **54** for aligning and pivotally mounted an elongated hollow rotatable sleeve member **55** which is provided with an axial bore **56** for receiving said pin.

The hollow sleeve member **55** encircles the post **50** for

a major portion of the length of said post. The hollow sleeve **55** is preferably formed with an inner diameter greater than the outer diameter of post **50** so as to define therewith an annular longitudinally extending chamber **57**. The top end wall of the sleeve member **55** may be provided with a depending annular rib **58** adapted to provide annular bearing contact with the circumferential margins of the end wall **53** of the post. The bottom portion of sleeve member **55** may be provided with an inturned flange **59** providing a circular opening adapted to receive the post **50** and to serve as a guide bearing for the sleeve member **55**. It will thus be noted that the annular chamber **57** is closed at its lower end by flange **59** and provides a chamber for receiving fluids from the hollow post **50** through the ports **52** for discharging said fluid along the length of the sleeve member **55**.

The provision of a closed annular chamber **57** and openings **52** formed in the post at the top thereof causes the sleeve member **55** to lift slightly when washing fluid is flowing through openings **52** and into the chamber **57** for providing a water bearing between the opposed end walls of the post and the sleeve member. Thus the sleeve member **55** is readily rotatable.

Longitudinally spaced along the length of the sleeve member **55** in corresponding relationship to vertically stacked racks **33** may be a plurality of nozzles **60** each communicating with the chamber **57**. For dynamically balancing the sleeve member, nozzles **60** may be positioned in diametric relationship as shown in Fig. 4. Each nozzle **60** is secured to the sleeve member **55** with the axis of the nozzle inclined upwardly so as to be aligned with the axes of syringes **13** carried by an associated rack. With respect to an associated rack **33** and the syringes carried thereby, each nozzle **60** lies virtually at the vertex of the inverted cone formed by the pattern of the axes of the syringes. A jet stream of fluid ejected from each nozzle **60** will directly and fully enter into the open end of each syringe as the sleeve member is rotated.

A port **62** may be provided beneath each nozzle **60** for ejecting a stream of fluid against the end face of plunger **46**. Each port **62** is radially arranged with respect to the axis of the sleeve member **55** and is inclined upwardly.

Means for rotating the sleeve member **55** may comprise arranging nozzles **60** with their axes angularly related to a diameter of the sleeve member **55** which intersects the nozzle axis at the circumference of the sleeve member as shown in Fig. 5 so that the reactive force of the jet stream will rotate the sleeve member. If desired, as shown in Fig. 5, diametrically opposed angle-shaped nozzles **61** may be provided in virtually the same horizontal zone adjacent the top of the sleeve member for producing a further positive rotative force to the sleeve member by utilizing the flow of the washing fluid. The nozzles **61** also spray the outside surfaces of the syringes and plungers. It is understood other means may be employed for rotating the sleeve member **55**.

The means for supplying washing fluid to the hollow post and through the rotatable means **14** may comprise a multi-ported valve means **63**, a fluid pump **64**, a motor **65** to drive said pump and a source of washing fluid. The source of washing fluid may be connected through a hose **66** to the inlet port **67** of the valve **63**. The inlet port **67** leads to an upper compartment **68** which is ported as at **69** for communication through the screen **22** with the interior of the enclosure **11**. Opposite inlet port **67** an outlet port **70** may be provided for connecting compartment **68** to a hose **71** which leads to the intake **72** of the pump **64**. The pump **64** includes a discharge **73** which is connected to a conduit **74** which leads to an inlet port **75** formed in the valve means **63** and which leads to a compartment **76** below compartment **68**. The compartment **76** is normally in communication with the bottom end portion **51** of the hollow post **50**.

A valve member **78** normally biased to open position by a spring **78a** may be provided with a circular valve head **79** opposed to the open bottom end of the post **50** and adapted to be moved into seating relationship with the bottom edge face of the portion **51** for closing the open bottom end of post **50** to shut-off flow of washing fluid through the post **50**. In shut-off position the head **79** is spaced from its normal valve seat on cylindrical element **80** for permitting flow of fluid from compartment **76** to a compartment **81** which is provided with a drain port **82** connected with a drain hose **83**. Thus when the valve member **78** is in shut-off position, fluid from the enclosure will be pumped through the ports **69** to the pump and then discharged from the pump through the compartment at **76**, the cylindrical element **80** and the drain hose **83**.

Means for actuating the valve element **78** from open to shut-off position may comprise an arm **84** pivoted intermediate its end as at **85** to a depending bracket **86** carried by the valve means **63**. The free end of arm **84** bears against an end face **87** of the valve member **78** which extends without the body of the valve means **63**. The other end of arm **84** may be pivotally connected as at **88** to a crank arm **89** pivotally connected as at **90** to a rotatable member **91** fixed to a shaft **92**. The shaft **92** extends without the housing **28** and carries at its end an actuator knob **93** which is adapted to be partially turned for opening and closing of the valve means **63**.

In operation of the syringe cleaning apparatus of this invention the syringes **13** to be cleaned may be positioned in the racks **33** as illustrated in the drawings. The racks **33** may then be vertically stacked within the enclosure **11**. A selected amount of washing fluid, preferably containing a detergent, may be introduced into the enclosure by permitting a selected quantity of fluid to flow into the enclosure through the valve means **63** while the valve member **78** is in normally biased down position. It is not necessary to operate the pump during this filling operation because the fluid will flow upwardly through ports **69**.

After a selected quantity of washing fluid has been provided in the enclosure **11**, the pump may be started and the fluid in the enclosure will be drawn downwardly through compartment **68**, to the pump, through compartment **76**, upwardly through the hollow post **50** and ejected outwardly from the nozzles **60** in the sleeve member. The pump **64** continues to recirculate the washing fluid for a selected time as measured by an automatic timing device **95** diagrammatically illustrated as being carried by the housing **28** in Fig. 1 and operably connected to the motor and pump. The path of the fluid at the bottom of the enclosure is controlled and channeled so as to facilitate recirculation thereof by means of a plurality of angularly spaced, radially and upwardly extending vanes **96** arranged about the post **50**.

The action of the jet stream of fluid ejected from each nozzle **60** should be particularly noted. The pump **64** is selected so that fluid will be pumped through the rotatable means **14** and through each nozzle **60** at a relatively great velocity. A jet stream thus ejected from a nozzle **60** is virtually a solid stream with very little dispersion of the fluid particles thereof. This virtually solid stream of fluid hits a syringe which is axially aligned with the axis of the nozzle from which the stream is ejected in such a manner that a large volume of washing fluid is rammed into the syringe. The large volume of ramming fluid hits the end wall of the syringe and then attempts to double back upon itself with the result that an extremely turbulent action of the fluid is created within the syringe. This turbulent action provides a hard washing action which completely and thoroughly contacts entire internal surfaces of the syringe and thereby effectively flushes and washes said surfaces. In the syringes illustrated, the relatively small port **44** provided at the end is likewise thoroughly cleaned because the high

velocity ramming fluid introduced into the larger chamber of the syringe forces a part of said fluid under pressure through the smaller port and thus cleans the internal surfaces of said smaller port **44**. Immediately after the jet stream has hit a syringe, the jet stream passes to the adjacent syringe because of rotation of the sleeve member **53**. The downward inclination of the syringes relatively rapidly drains the fluid from each syringe so that when the nozzle is rotated past said syringe again, the syringe will be virtually empty and capable of receiving another ramming slug of jet fluid.

Rotation of the sleeve member **55** and the nozzles **60** is preferably performed at a rate wherein each syringe is subjected to the above described hard washing action approximately twice each second and a half. Maintenance of this intermittent hard washing action for a period of from three to five minutes serves to completely and effectively clean the internal surfaces of the syringes or of any other form of open-ended hollow tubular element placed in said racks.

Since the jet stream of fluid ejected from each nozzle is continuous, the stream of fluid also hits exterior surfaces of the syringes. The path of the jet stream is broken up and dispersed upon hitting the clips **40** and the exterior surfaces of the syringes so that washing fluid is forcibly and turbulently sprayed against exterior surfaces of the syringe and the exterior surfaces of the plungers **46**. A jet stream of fluid from each port **62** hits the end faces of the respective plungers **46** and thoroughly cleans said faces. A virtually complete washing of a syringe and its associated plunger is thus effected.

After the syringes have been thoroughly cleaned by the intermittent hard washing action of the detergent solution, the detergent solution may be drained in pumping from the enclosure and rinsing fluid introduced into the enclosure for circulation of the rinsing fluid for a predetermined length of time in order to completely and thoroughly rinse the internal and external surfaces of the syringes.

In Fig. 7 is illustrated a different modification of the rotatable jet nozzle means and the manner of mounting said rotatable means. A sleeve member **55'** includes nozzles **60'** as in the prior embodiment. In order to direct a jet stream of fluid against the end face of a plunger which is carried below the syringe on the rack, a small nozzle **100** may be provided in the sleeve member **55'** diametrically opposite to its associated nozzle **60'** and spaced below the nozzle **60'**. A jet stream ejected from nozzle **100** is inclined upwardly and hits the end face of a plunger carried by the rack.

The sleeve member **55'** carries a bearing ring **101** which is provided with an annular recess **102** for receiving the end of sleeve **55'**. The bearing ring **101** may be secured to the end of sleeve member **55'** in any well known manner. The inner face of the bearing ring **101** provides a bearing surface which engages the adjacent outer surface of post **50'**.

Secured to the bottom edge face of the bearing ring **101** may be a rectangular plate **103** lying in a plane perpendicular to the axis of sleeve member **55'**. The plate **103** carries at each corner a depending blade **104** having its bottom edge spaced above the bottom wall **20'** of the enclosure. The blades **104** lie in vertical planes which may intersect the axis of rotation of sleeve member **55'**. Below plate **103** a generally frusto-conical strainer or sieve member **105** may be provided for preventing foreign matter from entering the pumping unit and being recirculated through the system.

The plate **103** and the blades **104** carried thereby serve the purpose of controlling motion of fluid in the bottom of the enclosure so that fluid will properly drain through the opening in the bottom wall **20'**. The blades **104** may also act to slow down rotation of the sleeve member **55'**. The braking action of the blades **104** in the water assists in providing a greater range of control of the speed of rotation of the sleeve member **55'**.

In Fig. 8 is shown a modification of the rack means whereby syringes may be readily accurately positioned in the rack in proper position for receiving a jet stream of water. In Fig. 8 radially spaced aligned clips **107** are carried by rings **34** and **35** in a manner similar to that previously described. Each clip **107**, however, includes a laterally offset portion **108** on each upwardly directed leg **109**. The offset portions **108** are spaced apart so as to receive a selected size of syringe and the shoulders **110** formed thereby support said syringe.

In order to properly position a syringe longitudinally on the clips **107**, a positioning ring **112** is carried by the rack radially inwardly of the inner clips **107** and above the syringe axes when a syringe is held by clips **107**. The ring **112** is spaced from inner clip **107** so that the large open end of a syringe may be received and held in inner clip **107**. The other small end of the syringe carries a tip with which a hypodermic needle cooperates. The ring **112** is spaced close enough to the inner clip **107** so that if a syringe is reversed with large open end facing outwardly the small end will contact the positioning ring when the syringe is attempted to be inserted into clips **107**. Thus the syringe cannot be held by clips **107** with the wrong end presented to the jet stream.

It will thus be readily apparent to those skilled in the art that an extremely efficient and effective method of washing open-ended hollow tubular elements of various diameters may be readily accomplished. Various sizes of nozzles may be employed, depending upon the size of hollow tubular element to be washed. While a semi-automatic arrangement has been illustrated, it is understood that the apparatus of this invention may be made fully automatic by well-known means so that a complete washing and rinsing cycle may be automatically performed.

Various other modifications and changes may be made in the apparatus described above which come within the spirit of this invention and all such changes and modifications coming within the scope of the appended claims are embraced thereby.

I claim:

1. In an apparatus for washing syringes, the combination of: a hollow enclosure including a bottom wall; a plurality of vertically stacked annular racks arranged in the enclosure and supported thereby about a common axis, said racks having positioning means adapted to carry a plurality of downwardly inclined syringes having open ends radially inwardly facing toward said axis; a hollow, non-rotatable post extending upwardly from the bottom wall and virtually coaxial with said axis, said post including a plurality of openings therein and being in communication with a supply of washing fluid; a hollow rotatable sleeve member carried by the post and defining with the post a longitudinally extending annular chamber in communication with the fluid in the post; a plurality of longitudinally spaced nozzles on the sleeve member in communication with the chamber, each nozzle being inclined upwardly to align with positioning means on an associated rack for forcibly ejecting directly into the open end of each opposed syringe a jet stream of washing fluid during rotation of the sleeve member; and means for supplying washing fluid to the nozzles through said post.

2. An apparatus as defined in claim 1 wherein the bottom wall is provided with an outlet in communication with the means for supplying washing fluid for recirculating said washing fluid.

3. An apparatus as claimed in claim 2 wherein upstanding, radially extending vanes are provided on the bottom wall for directing flow of fluid to said outlet.

4. An apparatus as defined in claim 1 wherein each rack includes means for holding plungers associated with each syringe being washed for washing said plungers.

5. In an apparatus for washing hollow tubular elements each having at least one open end, the combination of: a hollow enclosure; a plurality of vertically stacked annular racks supported by the enclosure and

arranged about a common axis, each rack having positioning means adapted to carry a plurality of downwardly inclined elements having their open ends facing said axis; a hollow, non-rotatable post aligned with said axis and including a plurality of openings therein, said post being in communication with a supply of washing fluid; a hollow, rotatable sleeve member carried by the post and defining therewith an annular chamber extending longitudinally of said post in communication with fluid within said post; a plurality of longitudinally spaced ports in the sleeve member in communication with the chamber, each port being opposed to and aligned with positioning means on an associated rack for directing a jet stream of washing fluid into the open end of each element carried by said associated rack during rotation of the sleeve member; and means for recirculating washing fluid ejected from said ports.

6. In an apparatus for continuously, intermittently washing internal surfaces of hollow, tubular elements, each having an open end, the combination of: means to support and hold in circular arrangement a plurality of tubular elements with radially directed axes; nozzle means rotatably supported and having an axis of rotation coincident with the center of said circular arrangement and alignable sequentially with each of said tubular elements; means for rotating said nozzle means; means for supplying washing fluid under high pressure to said nozzle means; said support means having resilient clip means for holding said tubular elements against longitudinal movement upon impact of a ram jet of fluid from said nozzle means with said tubular elements.

7. In an apparatus for continuously, intermittently washing internal surfaces of hollow tubular elements, each having an open end, the combination of: means to support and hold in circular arrangement a plurality of tubular elements with radially directed axes; nozzle means rotatably supported and having an axis of rotation coincident with the center of said circular arrangement and alignable sequentially with each of said tubular elements; means for rotating said nozzle means; means for supplying washing fluid under high pressure to said nozzle means; said support means having means for holding said tubular elements against longitudinal movement upon impact of a ram jet of fluid from said nozzle means with said tubular elements, said support and holding means including radially spaced clip means for releasably holding a tubular element.

8. In an apparatus for continuously, intermittently washing internal surfaces of hollow tubular elements, each having an open end, the combination of: means to support and hold in circular arrangement a plurality of tubular elements with radially directed axes; nozzle means rotatably supported and having an axis of rotation coincident with the center of said circular arrangement and alignable sequentially with each of said tubular elements; means for rotating said nozzle means; means for supplying washing fluid under high pressure to said nozzle means; said support means having means for holding said tubular elements against longitudinal movement upon impact of a ram jet of fluid from said nozzle means with said tubular elements, said support and holding means including interconnected, concentric ring elements, clip means carried by each ring element along spaced radians of said ring elements to receive a plurality of tubular elements, and a positioning ring adjacent to the clip means carried by the inner concentric ring element for admitting a tubular element to said clip means in one position only.

9. In an apparatus for washing internal surfaces of a syringe having an enlarged open end at one end thereof, the combination of: a hollow enclosure including a bottom wall; a hollow, rotatable sleeve member positioned centrally of said hollow enclosure and supported by said bottom wall, said sleeve member being provided with a plurality of longitudinally spaced nozzle means; a plurality of vertically stacked annular racks arranged in the enclosure and provided with means to support in radial arrangement a plurality of syringes, said support means positioning said syringes in downward inclination with enlarged open ends facing said sleeve member and in alignment with said opposed nozzle means, said support means having resilient releasable means adapted to hold each syringe against axial movement; and means carried at the bottom of said sleeve member for at least partial immersion in fluid in the bottom of said enclosure for retarding rotation of the sleeve member.

10. An apparatus as claimed in claim 9 wherein the means carried at the bottom of said sleeve member include depending spaced vanes.

References Cited in the file of this patent

UNITED STATES PATENTS

321,128	Merriam	June 30, 1885
1,246,556	Crow	Nov. 13, 1917
1,323,216	Cornwall	Nov. 25, 1919
1,638,549	Ohmart	Aug. 9, 1927
1,763,992	Smith	June 17, 1930
2,237,209	Arnold	Apr. 1, 1941

FOREIGN PATENTS

699,209	Germany	Nov. 25, 1940