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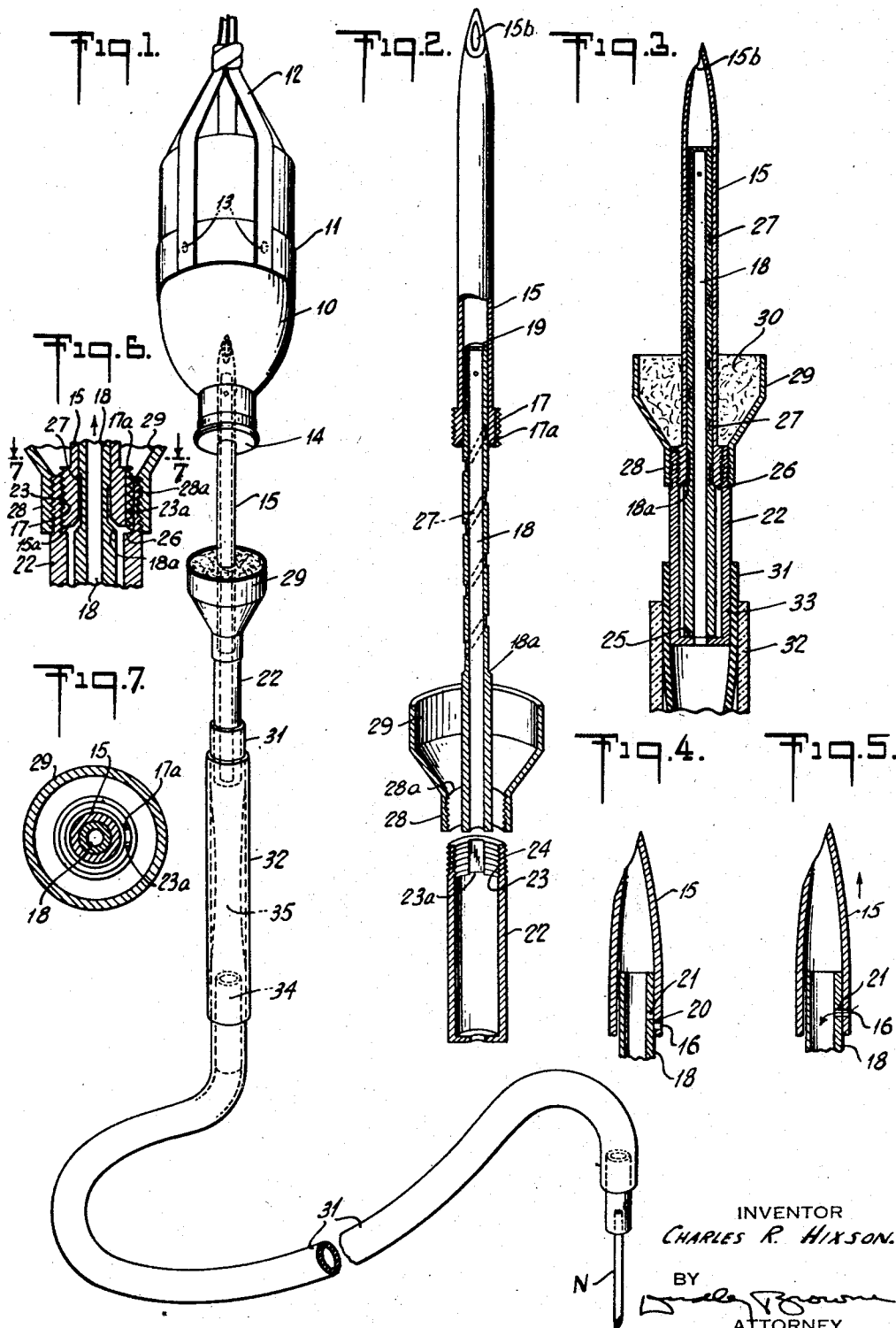
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FLUID TRANSFER APPARATUS

Filed Aug. 18, 1945

2 Sheets-Sheet 1



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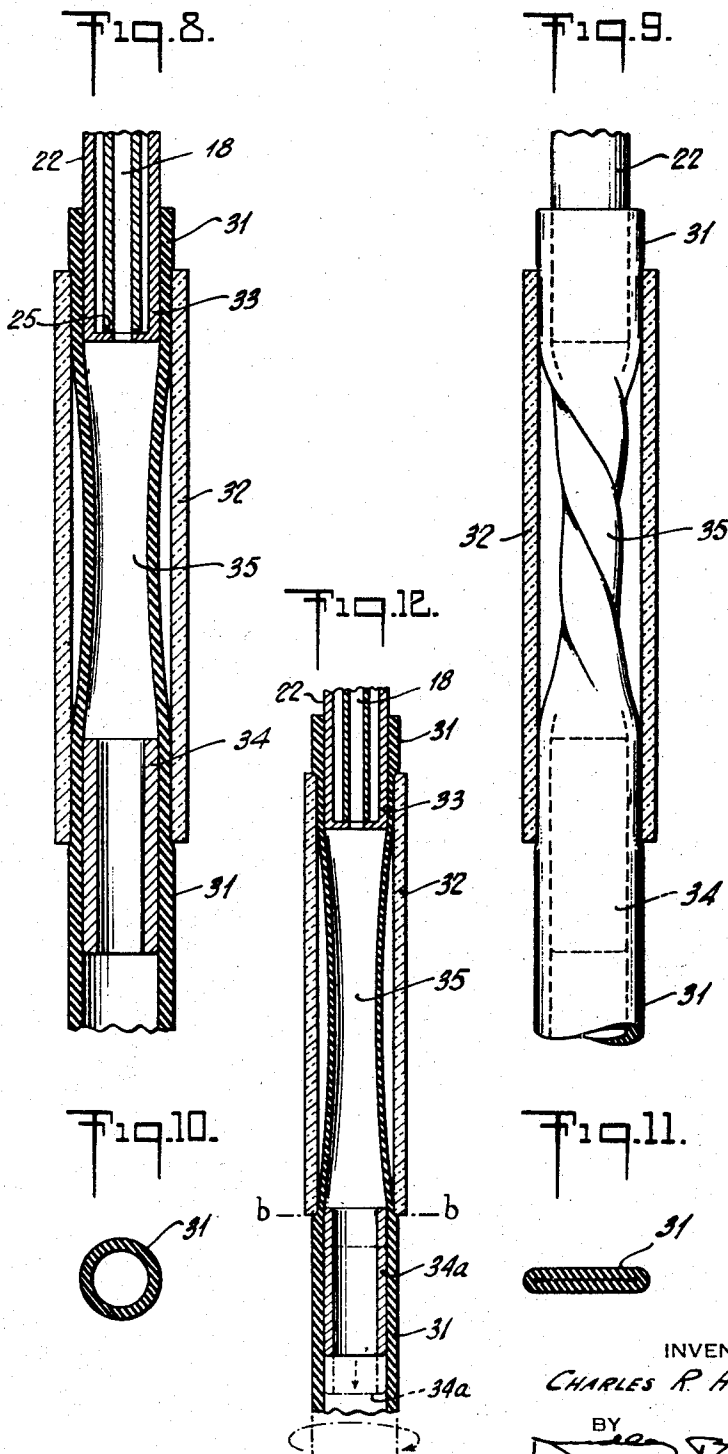
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2 Sheets-Sheet 2



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FLUID TRANSFER APPARATUS

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11 Claims. (Cl. 128-214)

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This invention relates to fluid transferring and dispensing apparatus. The method and apparatus disclosed herein may be used in whole or in part in connection with a wide variety of flow apparatus and for widely varied uses. It is well adapted for use in extracting liquid from containers, and particularly when it is desired to protect the contents of the container from contamination, including contamination from air or gas unintentionally introduced into the container, and to control fluid flow for a wide variety of purposes and in connection with a wide variety of operations such as may obtain anywhere including for example laboratories, hospitals, factories, and the like, and also in the field.

For the purpose of illustration of an embodiment of my invention, and without limitation as to the application of my method and apparatus, I have described it herein in connection with its application in transferring blood plasma from a sealed container for injection into a patient.

An object of the invention is to provide simple, practical and efficient apparatus of the above mentioned kind.

Another object of the invention is to provide improved means for initiating and actuating and controlling the flow of fluid through a conduit.

Another object of the invention is to provide simple, practical and efficient means for causing a flow of fluid mixed with air.

Another object of the invention is to provide means of the above mentioned kind which when operative for fluid flow will also be operative for mixing filtered air with said fluid without manipulation of separate control means.

Another object of the invention is to provide simple, practical and effective means for controlling the fluid flow through said flow apparatus.

Another object of the invention is to provide a non-metal valve for controlling flow through a conduit.

Another object of the invention is to provide cooperative and coactive means for actuating fluid flow from a sealed container and for regulating the flow.

Other objects of the invention will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangements of parts, and in the several steps and relation and order of each of said steps to one or more of the others thereof, all as will be pointed out in the following description, and the

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scope of the application of which will be indicated in the following claims.

The invention will best be understood if the following description is read in connection with the accompanying drawings, in which

Figure 1 is an elevational view of flow apparatus embodying my invention;

Figure 2 is an elevational view, partly in cross section, showing means for introducing gas into a container and for withdrawing fluid therefrom showing the parts in partly assembled or exploded relation;

Figure 3 is a longitudinal sectional view similar to Figure 2 showing the parts in fully assembled relation and connected to the upper end of a flexible tube comprising part of the conduit means of the device;

Figure 4 is a detailed view of the forward ends of the inner and outer members of the assembly shown in Figure 3 with their respective ports in unaligned relation;

Figure 5 is a view similar to Figure 4 showing the ports in aligned relation;

Figure 6 is an enlarged fragmental view of Figure 3 showing the air passage 23a connecting between the air filter and the air passage 27;

Figure 7 is a top plan view in section taken on the line 7-7 of Figure 6;

Figure 8 is a longitudinal section through the flexible portion of the conduit means illustrated in Figure 1 and forming flow control means for the embodiment of my invention shown herein;

Figure 9 is a view similar to Figure 6 but showing the flexible conduit comprising the valve means in twisted and constricted condition to control fluid flow through the device;

Figure 10 is a cross section taken through the flexible conduit valve while open;

Figure 11 is a similar view showing the valve twisted and constricted into a substantially closed position; and

Figure 12 shows a modification of the arrangement illustrated in Figures 8 to 11 inclusive.

The invention is directed to means for transferring fluid from a container to any receiver, and in the embodiment of the invention described herein conduit means is provided for transferring fluid from a sealed container 10 to needle member N for injection into a person who is to receive a blood transfusion. As illustrated herein the container 10 is a bottle of the kind used for blood plasma, having a band 11 around it, and a hanger 12 is shown detachably secured to band 11 as by snap fastener members 13. The hanger 12 may be of tape or any suitable material for

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suspending container 10 in inverted position, from any suitable support (not shown) while the fluid transfer is effected.

Containers for blood plasma and the like are usually sealed with a puncturable seal which is preferably of a material, such as a rubber like material, which is adapted to substantially close a puncture after the puncturing instrumentality is withdrawn. As shown herein the mouth of container 10 is closed by a puncturable seal 14. The forward end of a conduit member 15 extends through the mouth of the inverted container 10 and into the fluid within the container and has a port 15a at its extremity. Member 15 is preferably pointed or bevelled at its forward end rendering it needle-like to facilitate its insertion into container 10 through the seal 14. The member 15 besides being open at its forward end has a laterally extending port 16 through its wall, preferably adjacent its forward end. Member 15 is provided adjacent its rear end 15a with the external threads 17 which are scored vertically at 17a for the purpose described herein.

Projecting into member 15 through its rear end is another conduit member 18, having a bevelled shoulder 18a against which the chamfered rear end 15a of member 15 abuts when the device is fully assembled and in non-operative position. The forward extremity 19 of member 18 is closed and desirably extends well toward the forward end of member 15 and member 18 is also provided with a laterally extending port 21 extending through its wall preferably adjacent its forward end in position to register with port 16 as will be described. The portions of said members in which the said ports are located preferably fit snugly together as at 20, Figure 4, so that the wall of member 18 around port 21 will abut against the wall of member 15 around port 16, so that the ports when in register will form an orifice leading into member 18.

Members 15 and 18 are supported in a third tubular member 22 the forward end of which is provided with interior threads 23 and exterior threads 24. Member 18 extends through member 22 and may be secured thereto, preferably in a substantially concentric position, in any suitable way, as for example by the welded connection 25 which may conveniently be near the rear end of member 22. The external threads 17 on the lower end of member 15 engage the internal threads 23 of member 22, and when the members 15 and 22 are tightly screwed together the chamfered portion of the rear end 15a of member 15 will abut against the inclined shoulder 18a on member 18, and the unchamfered portion of the rear end 15a of member 15 will abut against the inwardly projecting shoulder 26, positioned adjacent the forward end of member 22 at the lower end of the internal threads 23 of member 22.

The ports 16 and 21 in members 15 and 18 respectively are disposed so that they will not be in register when member 15 is screwed together tightly with member 22, but will be in register when member 15 is unseated from shoulders 18a and 26 by a predetermined amount, such for example as by a half turn from its position of fullest threaded engagement with member 22, and when this slight unseating of member 15 occurs, as by the unscrewing of member 15 from member 22 as by a half turn of member 15, air will pass between members 15 and 22 respectively, through the scoring 17a of screw threads 17 and thus enter into the air space or channel 27 be-

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tween member 18 and member 15 above shoulder 26. The air channel 27 extends to the forward end of member 15 to transfer air or other gas into the fluid within container 10, and as shown herein is provided as a spiral channel formed in the external surface of member 18. The introduction of air into container 10 serves to break the vacuum therein and to initiate flow of fluid from said container into the interior of tubular member 18 through ports 16 and 21 when they are in register.

The external threads 24 of member 22 are threadedly engaged by internal threads 28a provided on the interior of the tubular portion 28 of a cup-like member 29 which as shown extends around the upper end of member 22 and the lower ends of member 15, its forwardly extending lip portion being of substantially greater diameter than the diameter of the member 15. The cup-like member 29 is filled with air filtering material 30 such for example as cotton, which, if desired, may be treated with an antiseptic solution. It will thus be seen that air entering cup-like member 29 will pass through the filtering material 30 and through the scoring 23a into the air channel 27 between members 15 and 18 when member 15 is unseated from shoulders 18a and 26 sufficiently to bring ports 16 and 21 into register, and will pass through air channel 27 to the open end of needle-like member 15 and thus enter the fluid in container 10, thereby causing fluid from container 10 to flow through the registering ports 16 and 21 and downwardly through tubular member 18 as stated above. When it is desired to stop the flow of fluid from container 10 it is only necessary to screw up member 15 until it fits snugly against shoulders 18a and 26 thereby moving port 16 out of register with port 21.

Member 18 discharges into a flexible tube-like conduit member 31 which serves as a continuation of conduit member 18 and is inserted through a rigid sleeve 32, and spaced portions of flexible tube 31 are expanded into frictional engagement with sleeve 32, as by tubular members 33 and 34 inserted in spaced apart portions of flexible tube 31 which are themselves within sleeve 32. If desired the lower end of flexible tube 31 may be threaded over the lower end of member 22, through which the lower end of member 18 extends, and in the latter case, as shown in Figure 3, the lower end of member 22 serves as expanding member 33 to expand a portion of flexible tube 31, outwardly against the inner surface of the upper portion of rigid sleeve 32 through which the flexible tube 31 extends. The tubular member 34, may desirably be of the same diameter as the member 33 and is inserted in flexible tube 31, in spaced relation to member 33 but so that member 34 serves to expand flexible tube 31 outwardly against the inner surface of rigid sleeve 32 preferably adjacent its lower end. The portion of flexible tube 31 intermediate the expanding means 33 and 34 is thus left unexpanded, and, upon rotation of either member 33 or 34, and the portion of flexible tube 31 expanded into frictional engagement with rigid sleeve 32 thereby, this intermediate portion, indicated generally as 35, may be twisted and constricted whereby the flow of fluid through the conduit may be controlled as desired. It will be understood that after either or both members 33 and 34 have been rotated relatively one to the other, causing the intermediate portion 35 of flexible tube 31 to be twisted and constricted,

engaged with the said internal threads of said first member, said third member having a pointed end adapted to pierce the seal of a sealed liquid container, said second member extending within said third member to a point adjacent the forward end of said third member and having a longitudinally extending air channel around its outer surface communicating with the end of said third member beyond said second member, and said second and third members each having a port through its wall adjacent its forward end positioned so that said ports are unaligned when said third and first members are fully threadedly engaged but may be brought into alignment to permit liquid from said container to flow into said second member when said members are less than fully interengaged, and a fourth tubular member surrounding the upper end of said first member and threadedly engaged with the said exterior threads thereof, said fourth member having a portion communicating with the atmosphere, and air filtering material in said portion, said portion also communicating with said air channel, through the space provided between the external threads on said third member and the internal threads on said first member when said members are not tightly screwed together, whereby filtered air may be introduced into the interior of said container through said channel and the forward end of said third member.

5. A liquid dispensing valve comprising an elongated hollow needle-like member adapted to extend into the mouth of a container, a first tubular member extending into said needle-like member through its unpointed end, a tubular support member into which said first tubular member extends, means joining said first tubular member to said support member, said support member being threaded both internally and externally and having an inwardly extending shoulder serving as a seat for said needle-like member, said needle-like member being provided with external threads adjacent its lower end adapted to engage the internal threads on said support member and to abut against said seat when completely threadedly engaged with said support member, said first tubular member being adapted to fit snugly within said needle-like member adjacent its forward end, said needle-like member and said tubular member each having a port in the respective portions of their walls which fit together snugly, positioned so as to be brought into register when said needle-like member is slightly unseated from the said shoulder of said support member, an air channel between said needle-like member and said first tubular member extending from above said shoulder to the forward end of said needle-like member, and air filter means intermediate the atmosphere and the said threaded connection between the needle-like member and the said support member, whereby, when said threaded connection is loosened to bring the ports of said needle-like member and said first tubular member into register, filtered air is admitted into the said channel and is transmitted into said container, and liquid from said container is caused to flow through the registering ports of said needle-like member and said first tubular member, into, and through said first tubular member.

6. A liquid dispensing valve comprising, a tubular support member having an inwardly projecting shoulder, a hollow needle-like member adjustably engageable with said support member and adapted when fully engaged to abut against said shoulder, a narrow tubular member project-

ing through said support member and into said needle-like member, means joining said narrow tubular member to said support member adjacent its lower end, said narrow tubular member being of a cross section adjacent its forward end to fit snugly within said needle-like member adjacent its forward end, an air channel extending between said narrow tubular member and said needle-like member from the region of adjustable engagement between said needle-like member and said support member to the forward end of said needle-like member, said needle-like member and said narrow tubular member each having a port extending through its wall adjacent its forward end and positioned so that when said needle-like member is unseated a predetermined amount the said ports will be in register and will thus communicate between the liquid in the container and the interior of said narrow tubular member, and air filtering material means operative when said needle-like member is unseated from the shoulder of said support member by an amount sufficient to bring the said ports of said needle-like member and said narrow tubular member into register to admit filtered air between said narrow tubular member and said needle-like member, to transfer filtered air into the container, thereby breaking the vacuum therein and causing fluid from said container mixed with air to flow through the registering ports of said needle-like member and said narrow tubular member, into and through said narrow tubular member.

7. In flow apparatus, an outer conduit member adapted to be inserted into a sealed fluid container and having an open forward end and a port through its wall adjacent its forward end, an inner conduit member having a portion insertable into said outer member including a portion adjacent its forward end adapted to fit snugly within said outer member and having a closed forward end and a port through its wall in its said snugly fitting portion, means for supporting said members with said inner member projecting into said outer member so that at least one of said members is rotatable to bring the said ports of said members into register, means operative when said ports are in register for admitting air between said inner member and said outer member, and an air channel extending between said members longitudinally and communicating with the forward end of said outer member.

8. In flow apparatus, a first conduit member having an open forward end and a port through its wall, a second conduit member having a portion insertable into said first member and having a port through its wall, means for supporting said members with said second member projecting into said first member so that said members are relatively movable to bring said ports into or out of register, means operative when said ports are in register for admitting air between said members, and an air channel extending between said members longitudinally and communicating with the forward end of said first member.

9. A fluid dispensing device comprising a hollow needle-like member, a tube-like member one end of which is insertable within said needle-like member, each of said members having a port in its wall spaced from the end of said needle-like member, means for supporting said members so that they are relatively movable one to the other to bring said ports into or out of register, an air channel extending longitudinally between said members and communicating with the forward end of said needle-like member beyond its

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the expanded portions of flexible tube 31 will be held against untwisting by their frictional engagement respectively with the rigid wall of sleeve member 32. Thus, by rotating one expanded portion of flexible tube 31 relative to the other expanded portion, the tube 31 may be constricted to any desired degree and flow through the conduit similarly controlled.

In Figure 12 there is illustrated another and preferred arrangement of the parts shown in Figure 8. According to the embodiment of the invention shown in Figure 12 member 18 discharges through the lower end of member 22 into the flexible tube 31. Flexible tube 31 is inserted through a rigid sleeve 32, and its upper end is held in position, as by tension and its frictional engagement between sleeve 32 and the lower end of member 22 which desirably projects a short distance inside sleeve 32.

A rigid tube 34a is also inserted into flexible tube 31 and extends into flexible tube 31 to a distance sufficient to cause tension on flexible tube 31 between the upper end of tube 34a and the lower end of sleeve 32, as illustrated in Figure 12. When the flexible tube 31, which is capable of being somewhat stretched, is pulled downward, away from sleeve 32, the top of member 34a is moved away from the lower end of sleeve 32, as for example to the position indicated in dotted lines in Figure 12, the tension on flexible tube 31, adjacent the lower end of sleeve 32, is relieved and tube 31 may be twisted in either direction. After tube 31 has been twisted to the desired extent and then released, thus permitting it to contract longitudinally, the tension on flexible tube 31 adjacent the lower end of sleeve 32, between the upper end of tube 34a and the lower end of sleeve 32, is renewed and a permanent seating of flexible tube 31 in its twisted position is effected by said tension and by friction on tube 31 in the plane b-b. Thus by pulling down on tube 31 below sleeve 32, twisting it as much as desired, and releasing it, the tube 31 may be constricted as desired and the flow through tube 31 may be controlled accordingly.

It will be understood that the flexible member 31 may discharge directly into any type of receiver, or may be extended as desired and connected with an instrumentality, such for example as a needle N, Figure 1, adapted for performing intracutaneous or intravenous injections into a patient who is to receive the plasma or other fluid being transferred through the conduit to which the invention described herein is directed.

It will thus be seen that there has been provided by this invention a method and apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As various possible embodiments might be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. A flow conduit comprising an outer tubular member insertable in a sealed container and having a port in its wall below its open forward end, an inner tubular member projecting into said needle-like member and closed at its forward

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end and having a port in its wall, means for supporting said members so that the ports of said members may be moved into or out of register, an air channel extending longitudinally between said members to the open forward end of said outer member, means operative when the ports of said members are brought into register to admit air to said air channel between said members for introduction into said container to actuate flow of fluid from said container, a flexible tube connected to said inner tubular member, a rigid sleeve surrounding a portion of said flexible tube, and a plurality of substantially rigid hollow members positioned in spaced relation in said flexible tube so that they expand spaced portions of said flexible tube outwardly into frictional engagement with said rigid sleeve leaving the portion of said tube within said sleeve which is intermediate said members in unexpanded condition, and so that one of said expanded portions of said flexible tube may be rotated in said sleeve relatively to the other of said expanded portions and again frictionally engaged with said sleeve, to twist and constrict the unexpanded portion of said flexible tube and thus control the flow through said conduit.

2. Flow apparatus comprising an elongated conduit having a flexible portion, the forward extremity of said conduit being closed and being inserted in a tubular member adapted to be inserted into a fluid container and having a port spaced from its open front end, said conduit also having a port adjacent its front end, means for mounting said tubular member so that relative movement may be obtained between it and said conduit to bring said ports into and out of alignment, means operative when said ports are aligned to pass air into said container causing fluid from said container to flow into said conduit through said ports, a rigid sleeve surrounding a portion of the flexible portion of said conduit and means for expanding spaced portions of the flexible portion of said conduit within said sleeve to frictionally engage the said expanded portions within said sleeve leaving the portion of said flexible portion of said conduit intermediate said expanded portions unexpanded and readily deformable.

3. A fluid dispensing device comprising an outer conduit member insertable into a container and having an opening at its forward end adapted to transfer gas into said container, and having a port adjacent its forward end, an inner conduit member the forward end of which extends into said outer member, said inner member having a closed forward end and a port adjacent its forward end, said members being relatively movable to bring their said ports into register to cause liquid to flow through said ports into said inner member, means for introducing gas into said outer member when said ports are in register, and means for controlling the flow of liquid within said inner member.

4. A device for introducing filtered air into a sealed liquid container and for withdrawing liquid therefrom which comprises, a first tubular member the upper end of which is threaded both interiorly and exteriorly, a second tubular member extending through said first member and projecting beyond its threaded end, said first and second tubular members being joined together adjacent their lower ends, a third tubular member extending over and around the said projecting portion of said second member and having threads around its lower outer surface

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said port, and means operative when said ports are in register to admit air into said air channel and inoperative when said ports are not in register.

10. A fluid dispensing device comprising a hollow needle-like member, a tube-like member one end of which is insertable within said needle-like member, each of said members having a port in its wall spaced from the end of said needle-like member, means for supporting said members so that they are relatively movable one to the other to bring said ports into or out of register, an air channel extending longitudinally between said members and communicating with the forward end of said needle-like member beyond its said port, said air channel being closed at its lower end when the said ports are not in register and being open at its lower end to transfer a flow of air to the container when said first mentioned ports are in register, and means for filtering air admitted to said air channel.

11. In flow apparatus comprising a flexible conduit, means for controlling the flow comprising a rigid sleeve surrounding a portion of said flexible conduit, and substantially rigid hollow members positioned in spaced relation in said conduit within, and adjacent the ends of, said rigid sleeve so that they expand spaced substantial portions of said conduit outwardly and frictionally against the inner portion of said sleeve adjacent

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the respective ends of said sleeve, leaving an unexpanded portion of said conduit between said members, whereby, upon rotation of either of said members and the portion of said conduit expanded by it, the portion of the conduit intermediate said expanded portions is twisted and constructed spirally to regulate the flow as desired and may be retained in the desired constricted position due to frictional engagement of said conduit between said sleeve and said sleeve expanding members respectively.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,065,829	Schwab	Dec. 29, 1936
2,168,270	Paisley et al.	Aug. 1, 1939
2,208,550	Shapiro	July 16, 1940
1,098,286	Miller	May 26, 1914
1,166,690	Kahn	Jan. 4, 1916
1,986,484	Schlueter	Jan. 1, 1935

FOREIGN PATENTS

Number	Country	Date
815,407	French	Apr. 12, 1937