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AIR FILTER MEANS

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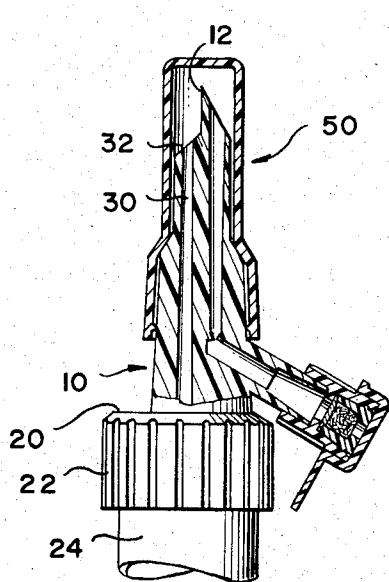


FIG. 1

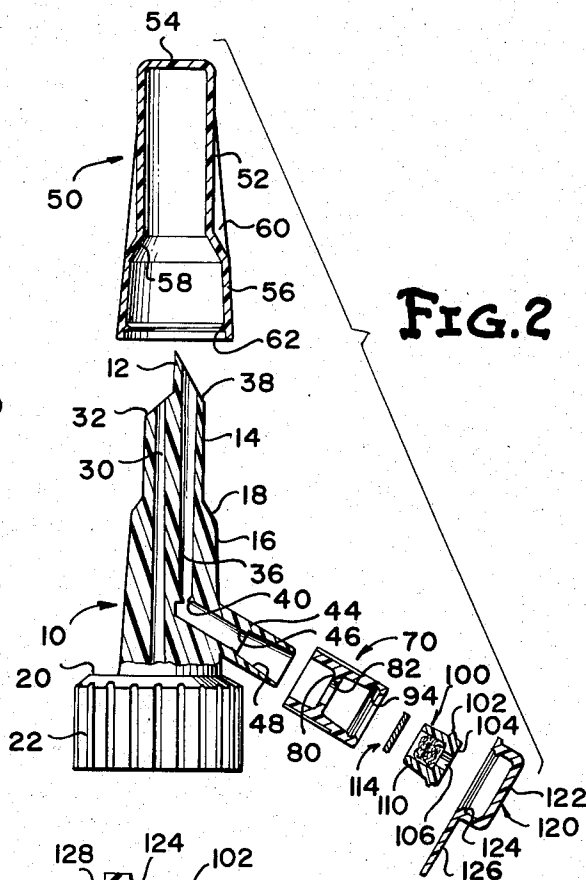


FIG. 2

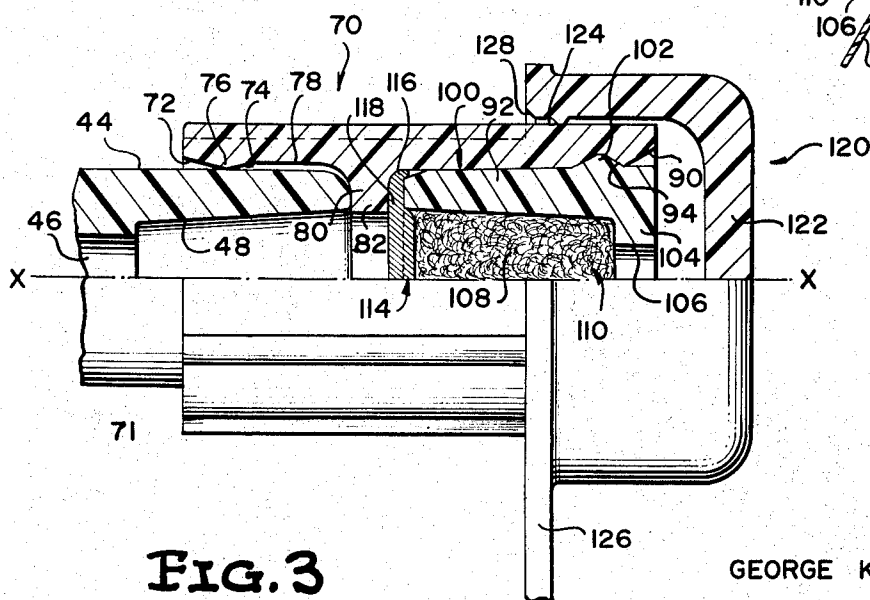


FIG. 3

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AIR FILTER MEANS

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ABSTRACT OF THE DISCLOSURE

An air filter for use with the piercing device utilized with intravenous injection apparatus, the filter comprising two separate filter media, such as loose cotton and a compressed disc, the cotton serving to filter bacteria but being permeable to liquid and the disc being impermeable to liquid, both filters disposed and retained in the air passage means of the piercing device.

The present invention relates to new and novel air filter apparatus, and more particularly to air filter apparatus adapted to be employed with a dual flow piercing device such as used with intravenous injection apparatus.

This type of dual flow piercing device including an end portion which is adapted to be inserted into an opening provided in a cap generally formed of rubber on an intravenous or blood bottle. This generally comprises a sharpened end portion to facilitate such insertion. The piercing device may have a pair of tapered outer surface portions of different cross sectional dimensions so as to facilitate a snug fit with different size opening as provided in the stoppers of such bottles.

A guard means is also provided for normally protecting the sharpened end portion of the piercing device, this guard means being adapted to be operatively associated about the sharpened end portion of the piercing device. When in position, the guard means serves to completely protect the sharp end portion of the piercing device and may also serve to provide a sterile seal therewith.

The piercing device may include a pair of passages formed therethrough each of which opens through the sharp end portion thereof. A first end of these passages comprises a liquid flow passage which opens at the lower end of the piercing device and is in communication with a drip chamber of a conventional nature associated therewith.

The other of the passages provided within the piercing device is an air passage which is in communication with an air inlet portion formed within a laterally extending projection on the body means.

Novel air filter means is provided in association with the air inlet portion so as to provide a sterile seal therewith and to effectively filter any air entering through the air inlet portion into the air flow passage which conducts the air into the intravenous bottom. The sterile seal means on the air filter means is so positioned when assembled as to ensure sterility adjacent to the air inlet of the laterally extending air inlet portion, and when this filter means is later removed, and an adaptor means or the like from an additional apparatus is inserted therein, it will not contact the area of possible contamination.

The air filter means of the present invention is of unique construction and is adapted to support two separate filter means. A first one of these filter means may comprise sterile absorbent cotton or the like which is adapted to filter out bacteria from the air passing therethrough. This type of filter means has been employed in the prior art for this purpose. A particular problem which occurs with this arrangement is the fact that liquid occasionally drips downwardly through the air passage tube of the associated piercing device and comes into contact with the absorbent

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cotton and may, from time to time, saturate the cotton to the extent that air can no longer pass therethrough, thereby rendering the apparatus inoperative.

In order to overcome this problem which has been present for some time in the art, the present invention incorporates a second filter means which is disposed intermediate the first filter means or the like and the open end of the filter apparatus which is in communication with the laterally extending projection of an associated piercing device. This second filter means may comprise a disc-like body of material which is retained in operative position and which is formed of a suitable material which is pervious to air and substantially impervious to liquid. With this arrangement, air drawn through the filter apparatus may pass through each of the two bodies of filter material and into an associated piercing device. On the other hand, liquid which may drip downwardly through the air passage and the associated piercing device cannot pass through the second filter means which is substantially impervious to liquid, thereby preventing saturation of the first body means formed of cotton or the like. Although the second filter means will prevent liquid from passing therethrough, it will still be capable of allowing air to pass therethrough so that the filter apparatus is at all times pervious to air and cannot be rendered inoperative in the manner which has occurred in the prior art as long as the bore formed through the filter apparatus or the air passages in the associated piercing device does not become completely filled with liquid which would be a very unusual circumstance since ordinarily only a relatively small amount of liquid will drip downwardly within the air passage means.

In order to enable simple and effective assembly of the various components including the two filter means, a plug means is provided which is a separate member and which can be permanently snapped into operative position within one end portion of the main body portion of the filter means. This plug means may be formed of polyethylene or other plastic and is of hollow construction including an end wall having an opening therethrough through which air may enter into the filter apparatus. The plug means serves to support the first body of filter material and further to clamp the second filter means in operative position.

In addition to the foregoing structure, closure cap means is also provided for closing off the air inlet opening provided in the air filter means, this closure cap means being so constructed as to form a sterile seal with the air filter means and to prevent any entrance of air into the apparatus until the closure cap means is removed. This closure cap means in fact controls the flow of liquid out of an associated intravenous bottle and the like, and liquid will not commence to flow from the bottle through the liquid flow passage of the piercing device until the closure means is removed from the air filter means.

An object of the present invention is to provide new and novel air filter means which is particularly adapted for use with a dual flow piercing device as employed with intravenous injection apparatus and the like.

Another object of the invention is the provision of air filter means adapted to provide a sterile seal with a projection provided on an associated piercing device.

Still another object of the invention is to provide air filter means including an arrangement for effectively removing bacteria from air passing therethrough and further providing closure means for normally closing off the air inlet opening of the apparatus until it is desired to use the apparatus.

Still another object of the invention is the provision of air filter means including means for preventing liquid which may drip in through an open end portion of the

filter means from saturating the air filter means to thereby assure free entry of air through the air filter means at all times.

Yet another object of the invention is to provide air filter means including a multiple filter arrangement in the air passageway through the air filter means and wherein each of the filters is pervious to air and one of the filters is substantially impervious to liquid.

A still further object of the invention is to provide air filter means which is quite simple and inexpensive in construction, and yet which at the same time is quite effective and reliable in use.

Other objects and many attendant advantages of the invention will become more apparent when considered in connection with the specification and accompanying drawings, wherein:

FIG. 1 is a vertical section through a dual flow piercing device illustrating the air filter means of the present invention mounted in operative position thereon;

FIG. 2 is an exploded view of the components illustrated in FIG. 1; and

FIG. 3 is a view partly in section on an enlarged scale illustrating the details of construction of the air filter means of the present invention.

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, and in particular to FIGS. 1 and 2, the dual flow piercing device is indicated generally by reference numeral 10 and is formed of a relatively rigid material such as polystyrene plastic and the like. The piercing device is of elongated configuration and includes a sharp upper end portion indicated generally by reference numeral 12 which is adapted to be inserted in the hole of an intravenous or blood bottle as the case may be.

The body means includes a first tapered outer surface portion 14 and a second tapered outer surface portion 16, these two tapered outer surface portions being joined by a beveled intermediate shoulder portion 18. It will be noted that the two outer surface portions 14 and 16 are substantially frusto-conical in configuration and are so constructed as to ensure a snug fit within the hole within which they are received, it being apparent that these two surfaces are designed to fit within holes of different diameter. The beveled shoulder portion 28 also facilitates insertion of the body means as far as possible in an associated hole.

The body means also includes an enlarged base portion 20 which joins with a downwardly extending annular flange portion 22 which defines a cavity therewithin for receiving the upper end of a drip chamber indicated by reference numeral 24. This drip chamber may be secured in operative position by suitable means (not shown) which forms no part of the present invention.

A liquid flow passage 30 extends longitudinally of the piercing device, passage 30 opening at its upper end through a sloping surface 34 at the sharp end portion 12 of the body means. This liquid flow passage also opens at the bottom of the piercing device into communication with the drip chamber 24.

The piercing device is also provided with an air flow passage 36 which extends substantially parallel with the liquid flow passage 30, the air flow passage opening at its upper end through a sloping surface 38 defined at the sharpened end portion 12 of the piercing device.

While the piercing device has been illustrated as having two offset tapered outer surface portions 14 and 16 joined by an intermediate shoulder portion 18 and with two offset sloping surfaces 32 and 38 at the upper end thereof, it should be understood that this outer configuration of the upper part of the piercing device may be modified to provide a generally uniformly tapered outer surface which terminates in a sharp pointed upper end.

The air flow passage includes a restricted portion 40 which serves as a metering arrangement for controlling the flow of air through the air passage. It will be noted that

the air passage flares to a greater dimension from a point near the restricted portion 40 to the upper end of the air passage, while the liquid flow passage flares to a greater dimension from the upper end thereof towards the lower end thereof.

The piercing device includes a laterally extending projection 44 having a passage 46 formed therein which comprises part of the air flow passage and which is in communication with a tapered bore portion 48 which opens outwardly of the projection. This provides the air inlet portion through which air is adapted to enter the piercing device.

A guard means is indicated generally by reference numeral 50 and may be formed of a semi-rigid plastic substance such as polyethylene, polypropylene or vinyl. The guard means includes an elongated hollow body portion 52 having a closed end 54 and an enlarged open end portion 56 with an intermediate beveled internal shoulder portion 58 disposed between these two portions. It will be noted that the upper part of the guard means is substantially cylindrical in configuration while the lower open end portion 56 may be provided with a taper similar to that provided on the lower surface 16 of the piercing device.

A plurality of spaced longitudinally extending ribs 60 are provided on the outside of member 50 to reinforce and rigidify the same. The open end portion 56 of body means 50 is provided with a peripherally extending radially inwardly directed rib 62 which is adapted to engage the outer tapered surface portion 16 of the piercing device as seen in FIG. 1 to retain the guard in operative position on the body means and to provide a sterile seal therewith.

Referring now particularly to FIGS. 2 and 3 of the drawings, the details of the air filter means are illustrated, and a body means is indicated generally by reference numeral 70, this body means including a main body portion having longitudinally extending ribs 71 formed on the outer surface and extending throughout a major portion of the length thereof, these ribs having a substantially circular cross section and being for example six in number disposed 60 degrees apart center to center. This body member may be formed for example of polyethylene plastic and the like.

The elongated hollow body means 70 has a first open end portion including an inwardly tapered entrance surface 72 to facilitate placing of this open end portion about the projection on the associated piercing device. Surface 72 may define an angle of approximately 15 degrees with respect to a line extending parallel with the longitudinal axis $x-x$ of body means 70. Surface 72 joins with a surface 74 which also may define an angle of approximately 15 degrees with respect to the longitudinal axis $x-x$, surfaces 72 and 74 defining a peripherally extending radially inwardly directed rib 76 which is adapted to engage the outer surface of the projection 44 to hold the filter apparatus in place and to define a sterile seal therewith.

The open end portion of body means 70 also includes a substantially cylindrical surface 78 which extends inwardly to an intermediate inwardly directed peripherally extending wall 80 having a hole 82 formed through the central part thereof. This wall 80 as seen in FIG. 3 may abut up against the outer end of projection 44 to limit inward movement of the filter apparatus with respect to the projection.

The opposite open end portion of body means 70 includes an entry surface 90 defining an angle of approximately 30 degrees with respect to the longitudinal axis $x-x$. This open end portion of the body means includes an inwardly extending tapered surface 92 which may describe an angle of approximately 2 degrees with respect to the longitudinal axis $x-x$. This open end portion of the body means is adapted to receive a plug means indicated generally by reference numeral 100. The inner sur-

face 92 is also provided with a peripherally extending groove 94.

Plug means 100 is provided with an outer surface which is substantially complementary to the surface 92 so as to be snugly received therewithin. This plug means is also provided on the outer surface thereof with an outwardly directed peripherally extending rib 102 which is adapted to fit snugly within the groove 94 for securing the plug in place once it has been inserted into the operative position illustrated in FIG. 3.

Plug means 100 includes an end wall portion 104 having a central hole 106 formed therethrough which comprises the air inlet to the filter apparatus and through which air is normally adapted to be drawn into the filter means.

The plug means is provided with a hollow cavity 108 therewithin in communication with hole 106, and a first filter means indicated generally by reference numeral 110 is disposed within cavity 108. Filter means 110 may comprise for example sterile absorbent cotton or the like which is adapted to filter out bacteria from air passing therethrough. It has been found in actual practice that this single body of sterile absorbent cotton is sufficient to adequately filter out bacteria passing through the apparatus as air is drawn therethrough.

A second filter means is indicated generally by reference numeral 114 and may comprise a disc-like member which is previous to air and substantially impervious to liquid, also porosity is such to permit passage of air, but not water or liquids. For example, this filter member may comprise a silicone impregnated disc of paper material and the like, glass fibers—vinyl, polypropylene or other plastic fibers, epoxy filled, etc. (hydrophobic materials). As seen most clearly in FIG. 3, this disc-like filter member 114 is adapted to be clamped in the operative position shown between the end 116 of the plug means and the adjacent flat surface 118 of the intermediate wall portion 80. The dimensions of the various components are such that when in the operative position as shown, the peripherally clamped portion of filter member 114 is compressed so as to be of less than normal thickness, while the intermediate middle portion of filter disc 114 may be expanded to have a greater than normal thickness and to be disposed partially within the cavity 108 of the plug means as illustrated.

The various components are illustrated in the exploded view shown in FIG. 2, and it is apparent that when it is desired to assemble the filter means, a suitable body of sterile absorbent cotton or the like 110 is first assembled within the cavity 108 of plug means 100, and the filter means 114 is then placed within the appropriate open end portion of body means 70 and pressed up against the intermediate wall portion 80. The plug means 100 is then forced into the operative position shown which may be readily accomplished due to the interengaging tapered surfaces, whereupon the rib 102 will snap into place within groove 94 formed in the body means so as to securely hold the plug means in the desired operative position with the filter means held in the operative relation shown with the disc-like filter member 114 being disposed adjacent to and in contact with the body of filter material 110.

A closure means is provided for closing off the inlet hole 106 of the air filter means, and this closure means takes the form of an integral closure cap indicated generally by reference numeral 120, this cap being formed of medical grade rubber or the like. Cap 120 includes a substantially cup-shaped main body portion which is adapted to fit about the outer surface of body means 70 as illustrated in FIG. 3. The flexible nature of the material in the cap permits it to be readily moved into operative position and removed therefrom when desired.

The main cup-shaped body portion 122 of cap 120 has formed on the inner surface thereof a peripherally extending radially inwardly directed rib 124 which is adapted to snugly engage the outer surface of body means 70 as

seen in FIG. 3 to maintain the closure cap in operative position and to provide a sterile seal therewith and to ensure that no air can enter through hole 106 until closure cap 120 is removed.

The body portion 122 of the closure cap is also provided with an integral laterally extending tab portion 126 which is adapted to be manually grasped for removing the closure cap when desired. In order to place the body portion 122 into operative position, it may be simply grasped and pushed toward the mounted position, a beveled entrance portion 128 facilitating such movement into the operative sealed relationship.

It is apparent from the foregoing that there is provided according to the present invention new and novel air filter means which is particularly adapted to be used with the piercing device of intravenous injection apparatus and the like. The air filter means is adapted to provide a sterile seal with an associated portion of the piercing device. The air filter means ensures effective removal of bacteria from air drawn therethrough and is provided with a closure means to prevent the entry of air into the air filter means until desired. The air filter means of the present invention also includes a disc-like filter member which is pervious to air and substantially impervious to liquid so as to prevent liquid from an associated piercing device from saturating the body of absorbent cotton which forms the other portion of the filter means so as to ensure free entry of air at all times through the apparatus. The air filter means is in addition quite simple and inexpensive in construction, and yet at the same time is quite effective and reliable in use.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

I claim:

1. In combination, a dual flow piercing device for use with intravenous injection apparatus and being formed of substantially rigid material, said piercing device being elongated and having a first end portion for insertion into a receiving opening, said piercing device having a pair of passages formed therein, each of said passages opening through said first end portion thereof, one of said passages being a liquid flow passage and opening through the opposite end portion of the piercing device, the other of said passages comprising an air flow passage, said piercing device having a laterally extending projection, said air flow passage opening at its opposite end through said projection, and air filter means associated with said projection, said air filter means comprising an elongated hollow body means having a bore formed longitudinally therethrough, said body means having a first open end portion including a peripherally extending radially inwardly directed rib for engaging the outer surface of said projection to provide a seal with respect thereto and to hold the filter means on said projection, said body means including an opposite end portion, a plug means, means for securing said plug means in fixed position within said second open end portion of the body means, first filter means disposed within said plug means, said plug means having an end wall portion having an opening formed therethrough for permitting the entrance of air through such opening and through said first filter means which is adapted to filter out bacteria from the air passing therethrough, said body means including an intermediate peripherally extending inwardly directed wall having an opening formed therethrough, second filter means comprising a disc-like member which is clamped between one end of said plug means and said intermediate end wall portion and further which is disposed adjacent said first filter means, said second

filter means being formed of material which is pervious to air and substantially impervious to liquid.

2. Apparatus as defined in claim 1 wherein said means for securing said plug means in place comprises a peripherally extending groove formed on the inner surface of the bore through said body means at the second open end portion thereof, and a complementary rib formed on the outer surface of said plug means which extends peripherally thereof and which is adapted to fit snugly within said groove.

3. Apparatus as defined in claim 1 including closure means for closing off the opening formed in said plug means until a desired time whereupon the closure means can be readily removed.

4. Apparatus as defined in claim 3 wherein said closure means includes a main substantially cup-shaped portion fitted over the outer surface of said body means at said opposite end portion thereof, and means on said closure means and extending about the inner surface thereof for engaging the outer surface of said body means for providing a seal therewith and for preventing the entrance of air through the opening in the end wall of the plug means until the closure means is removed.

5. Apparatus as defined in claim 4 wherein said closure means includes a laterally extending tab portion formed integrally therewith for facilitating removal of the closure means.

6. Air filter means for use with a dual flow piercing device as used with intravenous injection apparatus, said filter means comprising an elongated hollow body means defining a bore extending longitudinally therethrough, said body means including a first open end portion, said body means including an intermediate peripherally extending inwardly directed wall portion formed therewithin having a hole formed therethrough, plug means secured within the opposite open end portion of said body means, said plug means having an end wall portion defining an opening for the entrance of air therethrough, first filter means disposed within said plug means for filtering bacteria out of air entering through said last-mentioned opening, and second filter means disposed between said plug means and said intermediate wall portion, said second filter means comprising a disc-like member having the peripheral edges thereof clamped between one end of said plug means and said intermediate wall portion, said second filter means being pervious to air and substantially impervious to liquid.

7. Apparatus as defined in claim 6 including a cap closure means having a main body portion which is substantially cup-shaped in configuration, said cup-shaped portion of said closure cap means fitting snugly about the outer surface of said opposite end portion of said body means, said closure cap means having a peripherally extending internal rib formed thereon engaging said outer surface for providing a seal therewith, and means for readily removing said closure cap means.

8. Apparatus as defined in claim 7 wherein the means for readily removing the closure cap means comprises an integral laterally extending tab.

9. Air filter means for use with a dual flow piercing device as used with intravenous injection apparatus, said filter means comprising an elongated hollow body means having a bore formed longitudinally therethrough and said body means being open at opposite end portions thereof, a first open end portion of said body means having a peripherally extending radially inwardly directed rib for engaging the outer surface of a member for holding the air filter means on such member and for providing a seal with respect thereto, said body means including an intermediate peripherally extending inwardly directed wall portion having a central hole formed therethrough, plug means disposed within the opposite open end portion of said body means, means for securing said plug means in fixed relationship within said opposite open end portion of the body means, said plug means including an end wall portion defining an opening for permitting the entrance of air therethrough, a first filter means comprising a body of filter material disposed within said plug means and being adapted to filter out bacteria from air passing therethrough, second filter means comprising a disc-like member having the outer peripheral edges thereof clamped between one end of said plug means and said intermediate wall portion of the body means, said second filter means comprising a material which is pervious to air and substantially impervious to liquid.

10. Apparatus as defined in claim 9 including a cap closure means having a main body portion which is substantially cup-shaped in configuration, said cup-shaped portion of said closure cap means fitting snugly about the outer surface of said opposite end portion of said body means, said closure cap means having a peripherally extending internal rib formed thereon engaging said outer surface for providing a seal therewith, and means for readily removing said closure cap means.

11. Apparatus as defined in claim 9 wherein the means for readily removing the closure cap means comprises an integral laterally extending tab.

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