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[57] ABSTRACT

A stopcock including a hollow body member open at the top and having at least two lateral ports therein open to the exterior of the body. A key member including a sealing portion extends into the interior of the body through the open top thereof and is in sealing engagement with the interior walls of the body. A gripping portion is on the key and extends from the body. The key is rotatably positioned in the body so as to be shiftable to open and close the ports of the stopcock and regulate flow therethrough. Interengaging locking means are on the key and on the body to retain the sealing portion of the key in rotatable position within the body while permitting the gripping portion to be gripped and rotated to open and close the ports as desired.

8 Claims, 5 Drawing Figures

[58] **Field of Search** 251/309, 315, 312, 334

[56] **References Cited**

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Fig. 1

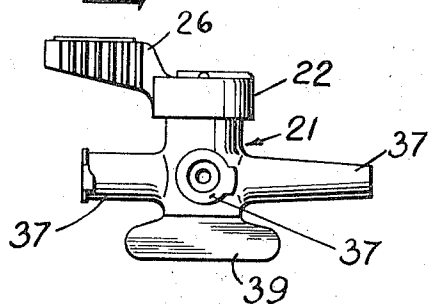


Fig. 2

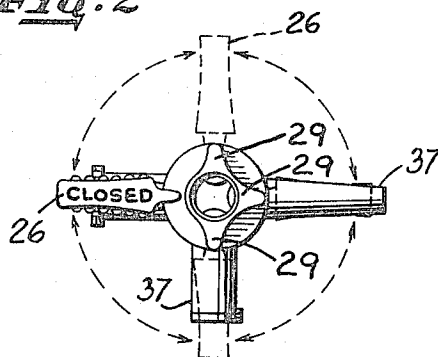


Fig. 3

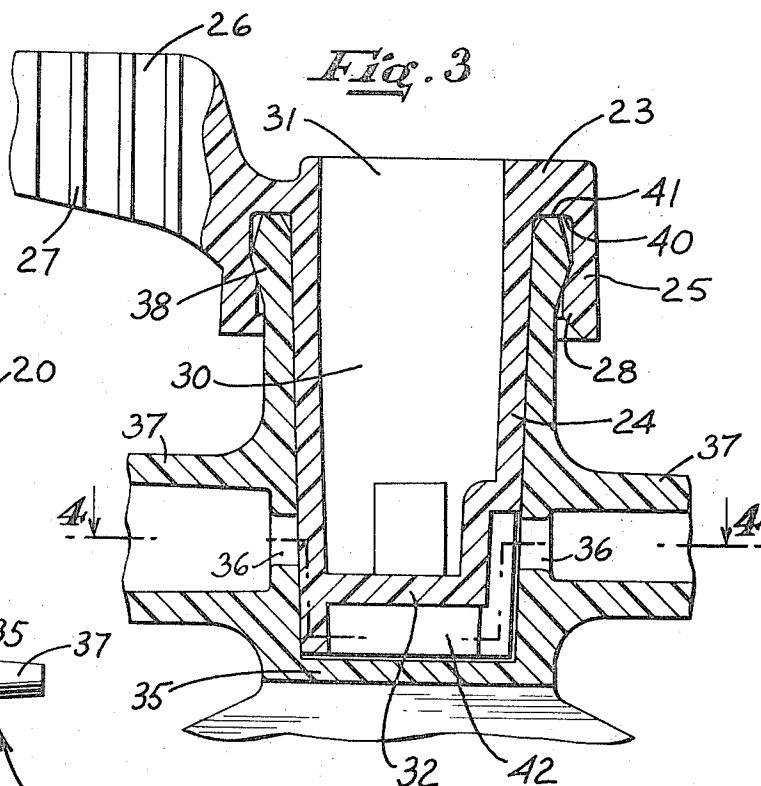


Fig. 5

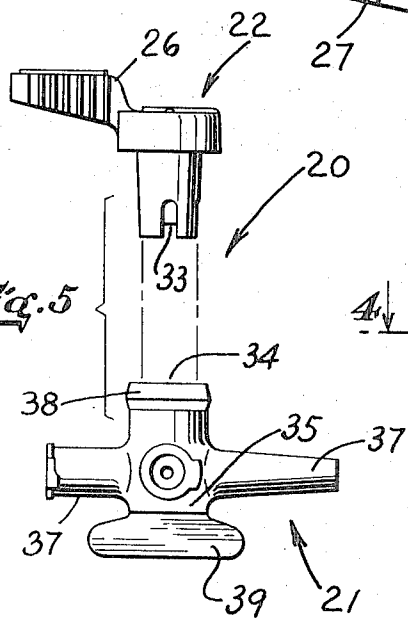
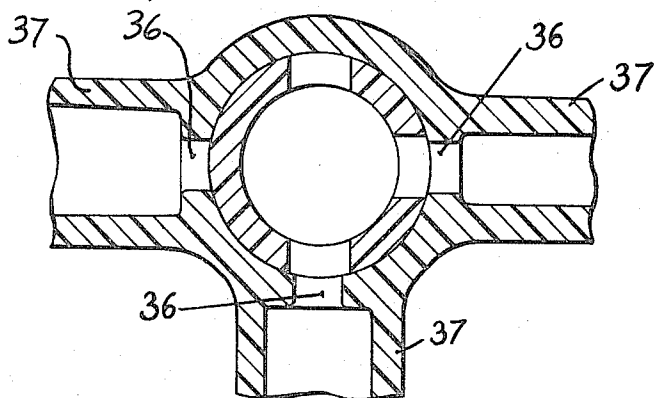


Fig. 4



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STOPCOCK

BACKGROUND OF THE INVENTION

In the stopcock field it is often desirable to provide a versatile product which may be used to control various flow paths and which is economical and simple in manufacture and assembly. This is particularly true in the medical field where stopcocks are prevalent in fluid administration applications to control and meter flow.

The medical field is concerned with utilization of disposable products to alleviate the necessity of resterilization and to keep costs on a low level. Additionally, it is desirable to provide a product of a minimum number of components with a maximum of fluid flow paths. Additionally, it should be kept in mind that in the medical field it is quite important that the stopcock be dependable in operation and be sturdy to alleviate the danger of disassembly or operational problems during use.

Three-way stopcocks are well known in the art as devices which employ three ports to increase the number of fluid path connections for the device in use. However, the known devices can be improved in several ways. The majority of the known devices employ a multiplicity of component parts to attain the desired number of flow paths, to assure proper seals between parts, and to provide a device which is easy to handle and efficient to use. It has been found that a large number of component parts naturally increases the manufacturing cost and the ultimate cost of the product. Additionally, the larger the number of parts to be interconnected, the greater the difficulties encountered in sealing the device so that positive control can be maintained over fluid flow. Also, it has been found that the known devices are often interconnected in a manner which might cause them to disassemble when they are subjected to handling as part of a fluid administration set or similar arrangement.

Naturally, it is readily apparent that in the medical field the above shortcomings are likely to produce problems in that positive fluid control is often of the essence and must be maintained and the breakdown of any component parts of a system, such as a stopcock, would be clearly undesirable.

SUMMARY OF THE INVENTION

With the above thoughts in mind, it is among the primary objectives of the present invention to provide a stopcock which has a maximum of fluid flow paths, a stopcock which is constructed of a minimum number of component parts thereby producing a low cost and economical device, a stopcock which has positive sealing surfaces to maintain positive fluid control, and a stopcock which has interlocked component parts to prevent chances of disassembly and loss of control of fluid flow in a system during use.

Thus, a stopcock is provided which includes a hollow body member open at its top and having at least two lateral ports therein open to the exterior of the body. A key member is provided having a sealing portion extending into the interior of the body through the opening top thereof and in sealing engagement with the interior walls of the body. The key member also includes a gripping portion which extends from the body. The key is rotatably positioned in the body so as to be shiftable to open and close the ports of the stopcock and

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regulate flow therethrough. Finally, interengaging locking surfaces on the key and on the body are provided to retain the sealing portion of the key in rotatable position within the body while permitting the gripping portion to be gripped and rotated to open and close the ports as desired.

With the above discussed objectives, among others, in mind, reference is had to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevation view of the stopcock of the invention;

FIG. 2 is a top plan view thereof with arrows showing the path of travel of the handle portion which is shown in phantom in three alternate positions;

FIG. 3 is an enlarged fragmentary sectional elevation view thereof;

FIG. 4 is an enlarged fragmentary top sectional view thereof taken along the plane of line 4—4 of FIG. 3; and

FIG. 5 is an exploded side elevation view thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Stopcock 20 includes two components, a body member 21 and a key member 22. The stopcock 20 may be constructed entirely of any common low cost material lending itself to disposability such as a conventional plastic material. The key should have some inherent resiliency for the reasons discussed below.

Key 22 includes a cylindrical base 23 having a tapered sealing portion 24 extending downwardly therefrom. Spaced from the outer wall of the tapered sealing portion and also extending from the base 23 is a depending annular skirt 25. Extending upwardly and laterally from base 23 and skirt 25 is a handle 26. A number of ribs 27 are on the handle surfaces to facilitate gripping of the handle and rotation of the key. On the inner surface of skirt 25 is an annular bead 28. Projecting upwardly from base 23 and spaced approximately 90° apart on the circumference of the base are three pointers or indicators 29. Handle 26 is mounted on the base so that it is located 90° from each of the two adjacent pointers 29. Therefore, by including handle 26 as an indicator marker, there are indication means on the base at each 90° interval about its circumference.

Key 22 is hollow and forms an interior chamber 30 open to the exterior of the key through opening 31 at the top and sealed at the bottom by bottom wall 32. Sealing portion 24 is substantially cylindrical in configuration with its side walls tapering from its integral connection to base 23 downwardly toward its interconnection with bottom wall 32. Spaced at 90° intervals about the outer circumference of the side walls of sealing portion 24 are three slots 33 which are vertically aligned with each of the three indicator points 29 respectively on the upper surface of base 23.

Body member 21 is hollow to provide interior chamber 34 which is sealed at the bottom by bottom wall 35 and open at the top to receive sealing portion 24. The inner cylindrical wall of body portion 21 is tapered from top to bottom to substantially conform with the outer tapered side wall of sealing portion 24. Adjacent the lower end of body portion 21 and spaced at 90 degree intervals about its circumference are three ports 36. A hollow lateral connector 37 communicates with

each port 36 respectively and has an outer surface which is adapted for connection to an element of a fluid system. It should be noted that each connector 37 is somewhat different in configuration to facilitate connection of the stopcock to a variety of different types of elements utilized in a particular fluid system.

Adjacent the upper peripheral edge of body 21 is an annular flange 38 which is adapted for interengagement with surfaces on key 22 in a manner discussed in detail below.

Extending from the bottom wall 35 of body 21 is a wing projection 39 which facilitates the mounting of the stopcock in assembled condition when it is desired to retain the stopcock in rigid position with respect to a given fluid system with which it is associated. Additionally, wing projection 39 provides a convenient handling surface for holding the stopcock during assembly with various connecting tubes in a fluid system.

In manufacture and assembly of the stopcock itself, the two component parts, key 22 and body 21 can be manufactured by a convenient molding process which is well known in the art. This is particularly true if the stopcock is constructed of a plastic material.

The outer tapered diameter of the side walls of sealing portion 24 is slightly larger than the inner diameter of the cylindrical tapered walls of body 21 which form chamber 34. However, since the interior of key 21 is hollow forming chamber 30, upon insertion of sealing portion 24 of key 22 into body 21, the side walls of sealing portion 24 will be slightly deformed and compressed. This slight deformation will positively seat key 22 in body 21 since the sealing portion 24 will tend to return to its initial relaxed configuration and will bear outwardly against the tapered walls of body 21 in sealing engagement.

Key 22 will extend into body 21 until the undersurface 40 of base 23 bears against the upper peripheral rim 41 of body 21. At this point, the key 22 is fully assembled to the body 21 to form stopcock 20 and a fluid passage chamber 42 is present between the bottom surfaces of sealing portion 24 and the inner surface of bottom wall 25 of body 21.

As key 22 is inserted into chamber 34 of body 21, it will move downwardly until annular bead 28 comes into contact with annular flange 38 on body 21. At that point, additional force is required to cause the resilient skirt 25 to deform and permit bead 28 to pass over flange 38. As the key 22 moves downwardly and bead 28 passes over flange 38, the resilient nature of skirt 25 will cause the skirt to return to its normal configuration and the skirt will snap into position with the upper surface of bead 28 in interengagement with the undersurface of flange 38 thereby preventing axial movement of key 22 with respect to body 21. In this position, stopcock 20 is fully assembled with body 21 bearing against undersurface 40 of base 23. Axial movement of the key with respect to the body is prevented while rotation of the key with respect to the body is permitted. As discussed above, the sealing engagement between the outer walls of sealing portion 24 and the inner walls forming chamber 34 in body 21 is present to prevent leakage and the engagement between bead 28 and flange 38 prevents disassembly of the parts. Rotation of the key with respect to the body is permitted and if desired, a suitable lubricant can be used to more readily facilitate rotation and appropriate opening and closing of the valve.

As shown in the drawings, handle 26 indicates the port 36 which is closed by the outer surface of sealing portion 24. The remaining two ports 36 are open to fluid passage chamber 42 in the stopcock so that fluid can flow therebetween. In this manner, a passage network is provided for fluid flow between an element connected to one connector 37 with an element connected to the adjacent connector 37. By rotating the handle 90°, a different arrangement of passageways through the stopcock is provided. It can be seen from the drawings that any two of the three ports 36 may be interconnected in fluid communication at any time or all three ports 36 can be in fluid communication at one time.

It is also envisioned that the center hollow chamber 30 of key 22 can be designed to accommodate a fourth flow path having its own shut-off valve position. The stopcock can also be modified in design to accept a rubber stopper for injecting medicaments at periodic elements of time through hollow center 30 of key 22. Naturally, in those circumstances an appropriate opening would have to be provided in the side walls or bottom wall of sealing portion 24 through which the fluid can pass when the stopcock parts are in the proper position.

It should be kept in mind that handle 26 is positioned above the substantial portion of the rest of stopcock 20 to facilitate connection of the stopcock with bulky elements of a fluid system by providing additional clearance for assembly procedures. Handle 26 can also be made hollow to reduce the weight of the stopcock and facilitate its handling in a fluid system.

It can be readily seen by the above detailed description that the three-way stopcock discussed above may be used as a flow or metering valve. It is usable in medical procedures for in-hospital use, laboratories, institutions and other medically oriented applications. It is also adaptable for use in various industrial environments. The stopcock can be used in a combination of assemblies to control batch monitoring or metering applications. A large variety of catheters, tubing sets, syringes, instruments and other types of adaptations can be used with the male and female Luer connectors to cover a broad use of applications.

The stopcock is of a two-piece assembly only with the sealing portion of the key which forms the valve seat being made hollow to enhance its compressibility and facilitate the sealing function. The snap-lock connection between the key and body alleviates the danger of disassembly of the stopcock during use. The snap-lock invention can be made so strong by a choice of materials that disassembly can be accomplished only by destroying the stopcock.

Thus, the above discussed objectives of the invention, among others, are effectively attained.

I claim:

1. A stopcock comprising:

a hollow plastic body member open at the top thereof and having at least two lateral ports therein open to the exterior of the body;

a plastic key member having a sealing portion extending into the interior of the body through the open top thereof and in sealing engagement with the interior walls of the body and a gripping portion extending from the body;

the key plastic member being rotatably positioned in the body so as to be shiftable to open and close the

ports of the stopcock and regulate flow there-through;

interengaging locking surfaces on the key and on the body to retain the sealing portion of the key in rotatable position within the body while permitting the gripping portion to be gripped and rotated to open and close the ports as desired;

the plastic key member being resilient and the sealing portion being hollow and of slightly larger outer diameter than the inner diameter of the body portion so that when the sealing portion is inserted in the body portion it will be partially formed and tending to return to its normal configuration while sealingly engage with the inner walls of the body;

the body having an annular flange extending from its outer surface and located adjacent the upper end thereof;

the annular flange being formed by two joining tapered surfaces meeting at an apex, one tapered surface being between the upper end of the body and the apex of the flange and the other tapered surface being located with respect to the upper end of the body with the apex and the one tapered surface therebetween;

the gripping portion of the key including a lateral base portion extending from the upper extremity of the sealing portion and terminating in an annular skirt;

the inner surface of the skirt having an annular bead including a locking surface tapering outwardly from top to bottom adjacent its lower end so that when the key is inserted into the body the bead will contact the one surface of the flange on the outer surface of the body and the resilient skirt will be deformed so that the key may be inserted until the bead passes over the apex of the flange and the resilient skirt will be permitted to return to its initial configuration and snap into position with the locking surface of the bead in locking engagement with the other surface of the flange on the body;

the locking relationship between the key member and the body being assisted by the resilient sealing portion of the key biasing the resilient body portion and flange outwardly while the skirt including the bead tends to return inwardly to its normal configuration thereby increasing the locking forces between the flange and the bead and preventing removal of the key from the body while permitting relative rotation therebetween.

2. The invention in accordance with claim 1 wherein the body has three lateral ports adjacent the bottom end thereof and spaced approximately 90° apart about

the circumference of the body.

3. The invention in accordance with claim 1 wherein the sealing portion is tapered from top to bottom in the direction of insertion into the body and the body has aligned corresponding taper from top to bottom to facilitate sealing engagement with the sealing portion, the sealing portion being of shorter length than the depth of the hollow body portion to thereby provide a fluid passage chamber between the bottom of the sealing portion and the body, and the body portion having at least two recesses on the outer surface thereof in position for vertical alignment with each of the ports in the body and communicating with the passage chamber between the bottom of the sealing portion and the body so that when at least a pair of recesses are aligned with at least a pair of ports fluid will flow through the stopcock and when the key is rotated so that the recesses are not in alignment with the ports of the body the walls of the sealing portion will prevent fluid from flowing through the stopcock.

4. The invention in accordance with claim 1 wherein the gripping portion of the key includes a handle extending away from the engaging surfaces on the key and the body to facilitate gripping and rotation of the key with respect to the body.

5. The invention in accordance with claim 1 wherein each of the ports includes a tubular connector extending laterally from the body with each connector having a configuration which facilitates its interconnection with a particular type of element utilized in a fluid system.

6. The invention in accordance with claim 1 wherein a wing-like projection extends from the bottom of the body to provide a readily available engaging surface to facilitate gripping of the stopcock and interengagement of the stopcock with holding means to fix the stopcock in position.

7. The invention in accordance with claim 1 wherein the gripping portion includes a cylindrical base extending laterally from the sealing portion and having its undersurface in engagement with the upper peripheral edge of the body and a handle connected to the base portion and extending therefrom, the base and the handle having indicator means thereon to define flow conditions through the stopcock.

8. The invention in accordance with claim 7 wherein a substantial portion of the handle is elevated above the remainder of the stopcock to provide clearance and facilitate assembly and use of the stopcock with other elements used in a fluid flow system.

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