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POST-OPERATIVE SURGICAL VALVE

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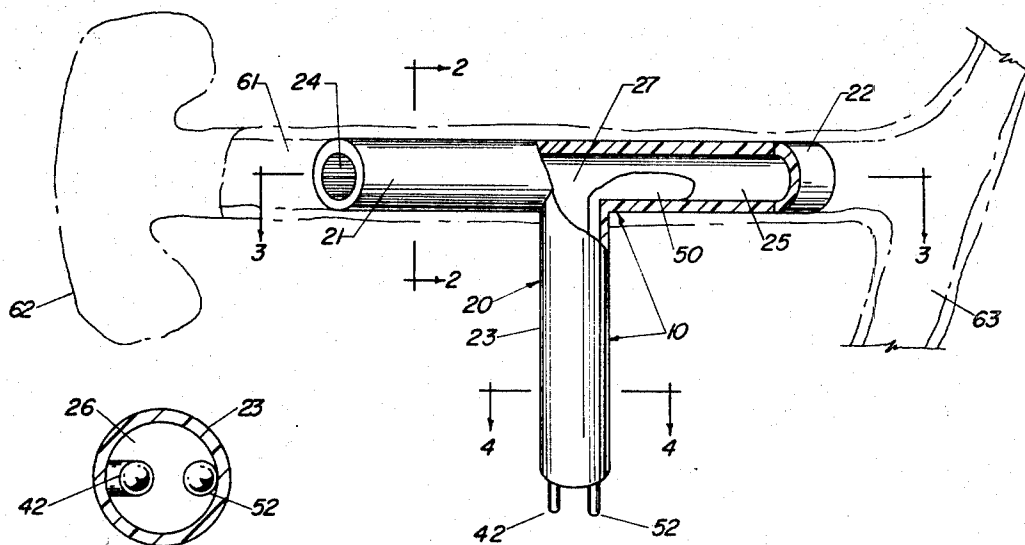


FIG. 5

FIG. 1

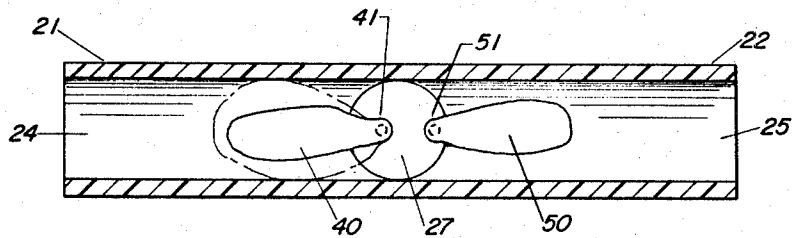


FIG. 3

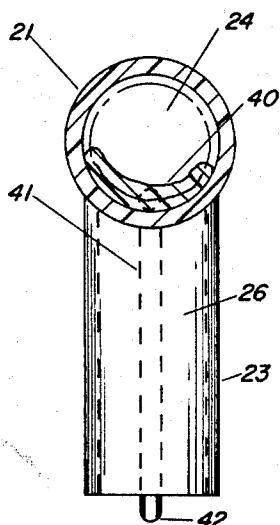


FIG. 2

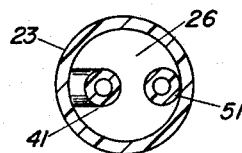


FIG. 4

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POST-OPERATIVE SURGICAL VALVE

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3 Claims. (Cl. 128—1)

ABSTRACT OF THE DISCLOSURE

This invention relates to valves for fluid lines and in particular to a valve safety device that is admirably suited as a surgical appliance for post operative care in gall bladder operations.

Specification

The gall bladder is a reservoir sac for the storage of bile fluid, said sac being attached to the bile-carrying common duct between the liver and the small intestine i.e. "ampulla vater." Sometimes the gall bladder becomes diseased or filled with saltine gall stones, thus necessitating surgical removal of the gall bladder. Following a gall bladder surgical removal, a longitudinal incision is made into the common duct and the interior wall thereof is mechanically scraped to physically open the common duct of accumulated gall stones and blood clots. This incision and mechanical scraping does induce a spasmodic condition within the common duct thus interfering with bile flow from the liver to the small intestine. To nullify the spasmodic effect, a T-shaped tube is commonly employed in post operative care, the two horizontal arms of the T-tube being placed within the longitudinally slit common duct to carry the bile liquid. Excess bile flows down the vertical base of the T-tube until the liver regulates its flow to compensate for the absence of the bladder reservoir. When this new stable condition is reached in some 10-15 days, the T-tube is removed; then, the common duct longitudinal incision and the patient's exterior surgical opening closes by contraction and air infiltration of granular cells and fibrous tissue.

However, during this 10-15 day normalizing or stabilizing period, one of the colinear horizontal arms of the T-tube is apt to become clogged with blood clots and/or salt precipitate from the bile fluid. If such an obstruction should occur in the tubular arm nearer to the liver, the patient is subjected to excruciating pain; if the obstruction should occur in the tubular arm nearer to the small intestine, there is interference with the patient's digestive process as evidenced by decreased absorption, nausea, vomiting, and cream-colored stools. In the prior art, attempts have been made to remove the obstruction within one of the colinear arms with a saline solution flush introduced through the vertical base or arm of the T-tube. However, this technique has not generally been satisfactory because the flush will normally take the path of least resistance through the unobstructed tubular arm, thus being unsuccessful in removing the obstruction of the clogged tubular arm. Because of the relative inaccessibility of the colinear tubular arms within the common duct, it is not medically desirable to re-enter and disturb the patient's abdominal cavity to remove the occlusion within the T-tube.

It is accordingly an object of the present invention to provide a valve for one or more of the branches of a multi-branch fluid line, said valve or valves being actuatable singularly or collectively from beyond the external confines of the multi-branch fluid line.

It is another object of the present invention to provide a remotely actuatable valve device for a T-tube spider member employed as a surgical appliance for post operative care of gall bladder operations.

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It is yet another object of the present invention to provide a surgical appliance which will ensure ready post-operative removal of an obstruction or occlusion within that common duct between the liver and the small intestine.

These and other objects and advantages are accomplished with a plurality of tubular arms integrally joined together as a spider member having a central chamber at the intersection of said tubular arms, there being a resiliently inflatable diaphragm located wholly within and attached against the internal sidewall of at least one intersecting tube at a remote position with respect to the spider central chamber, there being an elongate tubular stem integrally attached to the diaphragm, the outward end of said stem extending beyond the external confines of the hollow spider member.

In the drawing, wherein like numbers refer to like parts in the several views, and in which:

FIGURE 1 is a perspective view of the therapeutic valve safety device of the present invention, a central portion of the spider member housing being broken away to show the central internal chamber and an inflatable diaphragm disposed wholly within one of the hollow spider arms. The valve device is shown inserted within the common duct between the liver and the ampulla vater, said anatomical environment being shown in phantom line.

FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1.

FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 1.

FIGURE 4 is a sectional view taken along line 4—4 of FIGURE 1.

FIGURE 5 is a bottom plan detail view of a preferred form of the valve safety device.

The therapeutic valve safety device 10 of the present invention comprises a spider member having at least three tubular arms integrally joined together at a mutually intersecting relationship to provide a continuous, multi-branch internal passageway. The preferred spider member 20 is of T-shape form having integrally connected hollow tubular arms 21, 22, and 23, having interior hollow portions 24, 25, and 26, respectively. Thus, the continuous multi-branch passageway comprises interior hollow portions 24, 25, and 26, together with a central internal chamber 27 at the mutual intersection of 24, 25, and 26. Two of the hollow tubular arms of the preferred T-shape spider member are as cylindrical horizontal tubes 21 and 22 that are of approximately equal lengths and diameters, the longitudinal central axes of said horizontal tubular arms being in alignment so that the arms are substantially colinear. In normal usage, tubular arms 21 and 22 are to be inserted internally along the longitudinally severed common duct between the liver and the small intestine or "ampulla vater"; thus, the outside diameter of arms 21 and 22 should not exceed the inside diameter of the common duct, said inside diameter being of the order of 1 to 5 millimeters. The third arm of the preferred T-shaped spider 20 is a vertical drainage tube 23, the length of drainage tube 23 being normally greater than the combined lengths of arms 21 and 22.

To provide a controllable internal obstruction or valve for the tubular arms, a resiliently inflatable diaphragm is located wholly within the interior hollow portion of that arm or arms to be controllably valved. The diaphragm is attached against an internal wall of its tubular housing so that in its non-inflated or collapsed form, the diaphragm does not obstruct fluid flow through the tubular arm. If vacuum pressure or gravity are to be relied upon to collapse the unpressurized diaphragm, it should be attached against the internal lower wall. Further, the diaphragm must be positioned a sufficient distance from the central internal chamber so that in its inflated form the

diaphragm will obstruct fluid flow in its own tubular housing without obstructing the continuous inter-branch passageway of the remaining tubular arms. Attached to the resilient diaphragm there is an elongate tubular stem portion through which a pressurized-fluid (gas or liquid) may be introduced into the diaphragm. The outward ends 42 and 52 of the elongate stems 41 and 51 extend beyond the external confines of the spider member 20.

Enclosed within central opening 24 of tubular arm 21 is a diaphragm 40 that is resiliently inflatable to a normally globular form. An identical diaphragm 50 is enclosed within central opening 25 of horizontal arm 22. While several methods could be employed to attach the diaphragm against the tubular housing internal wall, preferably both the diaphragm and its tubular housing are provided of a thermoplastic resinous material, the two components being resinously welded together at an appropriate distance from central chamber 27.

Tubular elongate stems 41 and 51, which are attached to diaphragms 40 and 50 respectively, are positioned internally within central opening 26 substantially parallel to the elongate central axis of vertical tubular arm 23. The outward terminal ends 42 and 52 of stems 41 and 51, respectively, extend beyond the external confines of spider member 20 so that an external source of pressurized-fluid may be readily introduced through the stems into the communicating diaphragm. So as not to interfere with fluid flow through vertical tubular arm 23, the diameters of elongate stems 41 and 51 are smaller than the diameter of vertical arm opening 26. To further enhance unobstruction within opening 26, one or both of the stems e.g. stem 51, may be resinously bonded or otherwise attached to the interior wall of tubular arm 23.

Operation of the therapeutic valve safety device 10 is as follows. Arms 21 and 22 are inserted into the common duct 61 between the liver 62 and the small intestine 63 through a longitudinal incision (not shown) into the common duct. That portion of the common duct incision that is coextensive with arms 21 and 22 is reclosed with sutures so as to tightly hold arms 21 and 22 within the common duct. Vertical arm 23 extends outwardly through the remaining unsutured portion of the duct's longitudinal incision. Bile fluid from liver 62 flows internally along tubular arm above diaphragm 40 to central chamber 27. From chamber 27 bile fluid flow is divided into two substreams, one substream flows above diaphragm 50 of tubular arm 22 to small intestine 63, the other substream through vertical drainage arm 23 to a receptacle (not shown). If tubular arm 21 should become obstructed with a gall stone, a blood clot, or precipitating bile salts, the patient would be subjected to liver and common duct pressure and excruciating pain. If similar matter should obstruct tubular arm 22, the lack of bile flow to the small intestine would manifest itself as digestive distress and discoloration of the patient's stool. Whichever type obstruction should occur, the medical attendant will purposely close the opposite or unobstructed arm by injecting pressurized fluid into the diaphragm; then saline flush solution is introduced into opening 26 of drainage tube 23 to clear out the obstruction. For example, if tubular arm 22 should become obstructed, then pressurized-fluid is introduced through elongate stem 51 into diaphragm 50 which tightly expands against the interior cross-section 24 of tubular arm 21. The interior wall of diaphragm 40 is shown in phantom line in FIGURE 2. If the pressure of the pressurized-fluid within diaphragm 40 exceed that of the saline flush, and if the diaphragm is attached sufficiently remote of central chamber 27 so as not to obstruct same, then the flush liquid will be diverted through the inter-branch passageway between tubes 23 and 22 thus pushing against and hopefully removing the obstruction within tubular arm 22. Obviously, if the obstruction should occur within tubular arm 21, the same procedure is followed except that diaphragm valve 50 is

actuated to preferentially force the flush liquid against the obstruction within tubular arm 21.

After several days upon healing of the common duct incision and upon relief of the common duct spasmodic condition, the surgical appliance 10 is removed by pulling upon vertical arm 23 which causes arms 21 and 22 to be flexed or bent toward one another and through the remaining unsutured portion of the duct's longitudinal incision. For the valve device to so appropriately function as a post-operative surgical appliance, it is necessary that tubular arms 21 and 22 be sufficiently flexible to be upwardly bendable toward the longitudinal central axis of vertical arm 23. Preferably, vertical arm 23 should also be flexible so as to be readily manipulatable through the patient's surgical opening.

While the outward ends 42 and 52 of diaphragm stems 41 and 51 may be open, it is preferred that ends 42 and 52 be closed as shown in FIGURE 5 and that stems 41 and 51 be fabricated of a puncture-sealable resinous material. With this preferred sealed stem, the pressurized-fluid may be injected and/or withdrawn from the sealed stem with a needle type syringe. When a sealed stem and a needle type syringe are employed, high pressures can be introduced into the diaphragms to very tightly internally close arms 21 and 22. Further, after the pressurized fluid is withdrawn from the diaphragm and the stem, a partial vacuum results thus drawing the diaphragm tightly against the inner wall of arms 21 and 22 to insure maximum flow of bile and/or saline flush through tubular arms 21 and 22.

From the foregoing, the construction and operation of the valve safety device will be readily understood and further explanation is believed to be unnecessary. However, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claims.

I claim:

1. A post-operative valve for gall bladder surgical cases, said valve being adapted to fit within the common bile duct and comprising: a spider member having three arms disposed in a tri-branched continuous relationship, two of said arms being as a pair of horizontal hollow tubes, the cross-sectional size of each of said two horizontal tubes being sufficiently small that each said tube is adapted to fit within the common bile duct, the said two horizontal arms being sufficiently flexible to be upwardly bendable towards each other, the third of said arms being as a vertical hollow drainage tube, the adjacent ends of said three hollow tubes being integrally joined together to provide a centrally disposed internal chamber at the juncture of said continuous tri-branched passageway, a diaphragm disposed within both of the two horizontal hollow tubes, said two diaphragms being inflatable with a pressurized fluid to fill the interior cross-sectional opening of its surrounding horizontal arm, each diaphragm being disposed at a sufficient distance from the central chamber so as not to interfere with the inter-branch passageway of the remaining two arms when either diaphragm is inflated to fill the interior confines of its own passageway, each diaphragm being attached to an interior wall of its own tubular arm housing so as to collapse against said tubular arm housing when in the non-inflated form, each of said diaphragms having an elongate hollow stem for introduction of the pressurized fluid into the inflatable diaphragm, said elongate hollow stems being vertically disposed within the vertical hollow drainage tube, the lower terminal portion of each of said stems extending below the lower extremity of the vertical drainage tube, whereby when one of said diaphragms is inflated through its stem portion said inflated diaphragm closes the interior cross-sectional opening of its surrounding horizontal arm to prevent fluid flow along that portion of the common bile

duct located immediately adjacent to the inflatably-closed horizontal arm.

2. A post-operative valve for gall bladder surgical cases, said valve being adapted to fit within the common bile duct and comprising: a spider member having three arms disposed in a T-shaped relationship, two of said arms being as a pair of horizontal hollow tubes of approximately equal lengths the longitudinal axes of which are substantially colinear, the cross-sectional size of each of said two horizontal hollow tubes being sufficiently small that each tube is adapted to fit within the common bile duct, the third of said arms being as a vertical hollow drainage tube that is of greater length than the combined lengths of said horizontal tubes, the ends of said three hollow tubes being integrally joined together to provide a centrally disposed internal chamber at the juncture of said continuous tri-branch passageway, a diaphragm disposed within each of the two horizontal branches of said continuous tri-branch passageway, said diaphragms being inflatable with pressurized fluid to assume a globular shape so as to fill the interior cross-sectional opening of its surrounding horizontal arm, each diaphragm being disposed at a sufficient distance from the central chamber so as not to interfere with the inter-branch passageway of the remaining two arms when either diaphragm is inflated to fill the interior confines of its own passageway, a peripheral portion of each diaphragm being attached to a lower interior wall of its tubular arm housing so as to collapse against said lower interior wall when in the non-inflated form, each of said diaphragms having an elongate hollow stem for introduction of the pressurized fluid, said elongate stems being surrounded by the vertical hollow drainage tube, said stems being attached to the interior

sidewalls of said vertical drainage tube, the terminal portions of said stems extending beyond the confines of the vertical drainage tube whereby when one of said diaphragms is inflated through its stem portion said inflated diaphragm closes the interior cross-sectional opening of its surrounding horizontal arm to prevent fluid flow along that portion of the common bile duct located immediately adjacent to the inflatably-closed horizontal arm.

3. The post-operative valve for gall bladder surgical cases of claim 2 wherein the two horizontal arms are sufficiently flexible to be upwardly bendable away from the outward terminal ends of the diaphragm stems and towards each other, and wherein the diaphragm stems are fabricated of a puncture-sealable resinous material, the outward terminal ends of said stems being sealed and closed.

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