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DRAIN TUBE WITH ADJUSTING FRICTION LOCK

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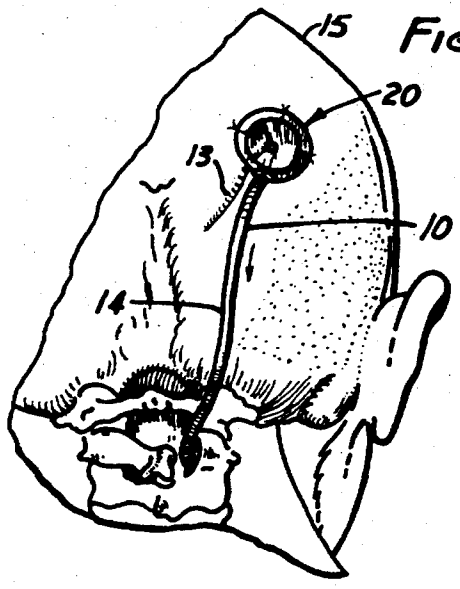

FIG. 1

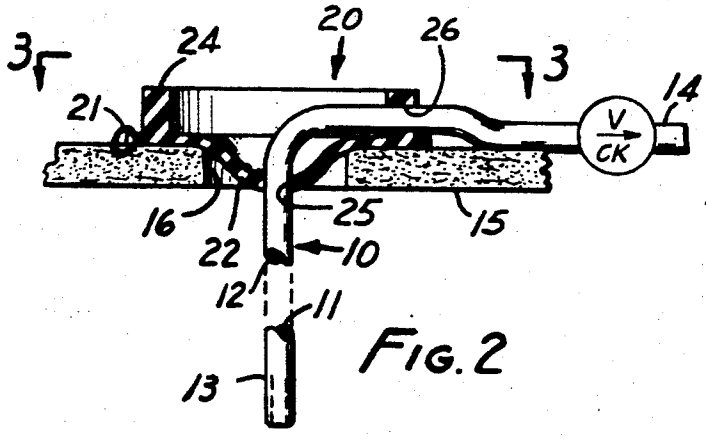

FIG. 2

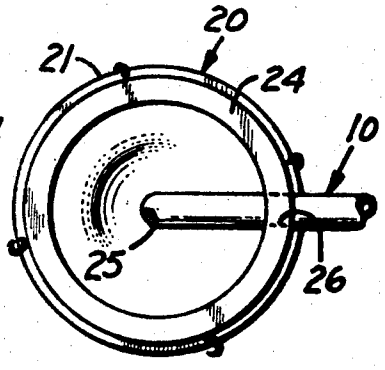

FIG. 3

INVENTOR.
RUDOLF R. SCHULTE

BY Argus & Mon
ATTORNEYS.

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DRAIN TUBE WITH ADJUSTING FRICTION LOCK

Rudolf R. Schulte, 3328 Calle Fresno, Santa Barbara, Calif. 93105

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ABSTRACT OF THE DISCLOSURE

This invention relates to the combination of a drainage tube for use in the human body and a lock member adapted to fit in a hole formed through cranial bony structure, and to be engaged by the bony structure for lateral support. The lock member has a flange, and a pair of nonaligned openings through which the tube passes whereby to make a frictional engagement with the tube, thereby to hold the tube against axial motion. Both the lock member itself and the tube lie flat against the bony structure so as to cause minimal cosmetic distortion.

This invention relates to a drainage tube for use in the human body and to means which enable its effective length readily to be adjusted.

There are many surgical procedures in which tubes are implanted in the human body in order to drain fluids from one region into another. Sometimes these tubes are maintained in a continuously open condition, and sometimes they include check means to limit the fluid flow to one direction only.

The usage of this class of tube for the purpose of alleviating the symptoms of hydrocephalus are shown in United States Patent No. 3,111,125 to Schulte and United States Patent No. 3,020,913 to Heyer where the drainage is from the brain to the heart. There are other disorders and diseases in which embedded drain tubes are used, an additional example being Torkilsden's procedure, which is a ventriculocisternostomy, a procedure for treating obstructive lesions involving the third and fourth ventricles and the aqueduct of Sylvus. In this procedure, one end of the tube is placed in the lateral ventricle and the tube then passes through a burr hole in the skull, then beneath the skin and against the occipital bone, downwardly to terminate in either the cisterna magna or in the cervical subarachnoid space. There are still other examples in the medical and neurosurgical field in which tubes of various kinds interconnect different regions of the human body.

In all such implants, there is a flexible tube which includes a lumen for fluid flow and two spaced apart ports through the tube to the lumen. The tube is placed so that the ports are placed in the respective regions from which fluid is to be drained and in which the fluid is to be drained. Obviously it is necessary for the tube to be of about the right total length, and, more particularly, to have just the right length from the region to be drained to some point where the tube is to be attached to the body. This latter length may be quite variable from patient to patient, and is best determined during the operation. Heretofore, surgeons have not had available to them a means to adjust the length of this portion of the tube, nor a convenient means to attach the tube to the body. Accordingly there has had to be an excessive amount of "cut and try," and a relatively complicated suturing procedure which it is advantageous to minimize or, even better, to eliminate altogether.

It is an object of this invention to provide in combination with a flexible tube, a lock which frictionally engages the tube so that the lengths of the respective ends

of the tube may readily be adjusted, and which lock is preferably provided with means for attachment to the human body.

It is another object of this invention to provide the lock in such a form that kinking of the tube is avoided even though the tube makes a right angle bend.

This invention includes, in combination, a tube having a lumen and a pair of axially spaced apart ports entering the lumen. A lock includes a pair of nonaligned openings, and the tube passes through these openings so as to be frictionally engaged by the lock. Adjustment in length can be provided by easing one end and pulling on the other.

According to a preferred but optional feature of this invention, the lock includes a flange whereby it may be readily attached to the body by suturing or otherwise.

According to still another preferred but optional feature of the invention, the lock has a generally flat plan, and the axis of one of the openings lies generally normal thereto, and the other lies generally in it.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings in which:

FIG. 1 is a rear elevation of a patient with a device according to the invention installed therein;

FIG. 2 is an axial cross section of the invention; and

FIG. 3 is a plan view taken at line 3—3 of FIG. 2.

The presently preferred embodiment of the invention is shown in the figures and includes a drain tube **10** having a central axially extended lumen **11** defined by a peripheral continuous wall **12**. Both ends of the tube may be open as shown to provide axially spaced-apart ports with no impediment between them, or either or both of said ends may be provided with check valve means as shown in the aforesaid Heyer patent, or any other type of check valve means to restrict the flow through the tube to a single direction. The tube is preferably made of medical grade silicone rubber, and is inherently flexible and elastic. It is shown making a right angle bend in FIGS. 1 and 2. End **13** passes into the brain of the individual where it may terminate at any desired region such as those disclosed above. End **14** extends downwardly adjacent to the occipital bone, to terminate with its opening at any desired region such as any of those described above.

Skull **15** is shown in FIG. 2 as including a burr hole **16** which was drilled therein for purposes of this operation and through which the tube passes. The function of this invention it to enable the length of end **13** readily to be adjusted either by itself or relative to the length of end **14** to provide means for making the bend shown without kinking the tube, and to provide retention means for the combination. For this purpose a lock **20** is provided which has a generally flat and circular plan as shown in FIGS. 2 and 3. There is preferably a circular flange **21** adapted to rest upon and overlap the occipital bone next to the burr hole. A depending portion **22** is generally dome-shaped and fits in the burr hole so as to give lateral support to the lock. A rim **24** is formed on the flange. The lock is therefore somewhat dished. An opening **25** passes through the depending portion at the center thereof. A second opening **26** passes through the rim. These openings have respective axes, the axis of opening **25** being vertical in FIG. 2 and the axis of opening **26** being horizontal therein. Preferably these axes are at right angles to each other. The lock is also preferably made of medical grade silicone rubber, and may also be inherently flexible and elastic, although it will usually be thick enough that as a structure it is stiffer than the tube. The size of openings **25** and **26** is preferably slightly less than the outer diameter of the drainage tube so as to exert a frictional force thereon. However, this is not essential, because a locking effect can also be

attained even if the openings **25** and **26** are somewhat larger, because the openings are not aligned, and a pull on the tube will exert a frictional side load at each opening.

Flange **21** can be sutured to the skull to hold the lock in place.

The use of the device should be evident from the foregoing. The surgeon may determine by any desired technique, including gradual insertion of the tube end **13** into the brain or the portion of the body, what the length of end **13** should be. Then by easing end **13** and pulling on end **14** he may slide the lock into place in the burr hole and stitch it in place. The length adjustment is locked and retained permanently, and is accomplished with no more effort than the aforesaid. Then the other end is inserted according to usual techniques. The generally flat-plan lock shown in the figures is desirable when the lock is to be placed beneath the skin where lumps visible on the surface are undesirable. The flatness of plan is of no interest when the lock is embedded in some body cavity. This lock, which operates as a friction lock, may be installed anywhere in the human body. By holding the ends as shown, this device prevents kinking at the right angle bend which is quite important in surgical drains where access is troublesome. The bend is entirely contained within the cavity.

Both offset and/or angular nonalignment of the openings is suitable. For example, the axes of the openings may be parallel but offset, instead of the right angle orientation shown in the drawings.

This invention is not to be limited by the embodiment shown in the drawings and described in the description which is given by way of example and not of limitation but only in accordance with the scope of the appended claims.

I claim:

1. A cranial drain tube with an adjustable friction lock member, the combination comprising: a flexible tube having an interior passage and a pair of axially spaced-apart ports entering the passage, the tube being adapted to pass through an opening in the bony structure of the cranium and enter the brain, the other end of the tube being adapted to discharge drainage fluid from the brain to another region of the body while passing beneath the scalp and along bony structure of the head, the tube making a right-angle bend between the two ends and ports adjacent to the opening in the bony structure; a lock member comprising a depending portion adapted to fit

in the opening through the bony structure so as to give lateral support to the lock member, a continuous, fully annular, peripheral rim of said depending portion adapted to lie against the bony structure adjacent to the opening in the bony structure and beneath the scalp, there being a cavity within the rim and the depending portion, and a pair of openings through the lock member, one of which passes through the depending portion, and the other of which passes through the rim, the tube passing through both of the openings of the lock member thereby forming the right-angle bend, the openings in the lock member being of such size relative to the outer diameter of the flexible tube as to make a tight fit with the tube as it passes through them, with the right-angle bend entirely contained in the cavity, the opening in the rim being so oriented as to direct the tube along the bony structure and beneath the scalp to provide minimal cosmetic distortion of the scalp, the length of the portions of the tube on each side of the lock member being adjustable by sliding the tube in the openings in the lock member, the frictional grip between the lock member and the tube maintaining the adjustment, and the boundaries of the cavity protecting the right-angle bend from kinking.

2. A combination according to claim **1** in which the rim includes an additional flange lying contiguous to the bony structure by means of which it may be sutured in place.

3. A combination according to claim **2** further including a check valve restricting flow through the passage to the single direction away from the brain.

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DALTON L. TRULUCK, *Primary Examiner.*

U.S. Cl. X.R.

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