

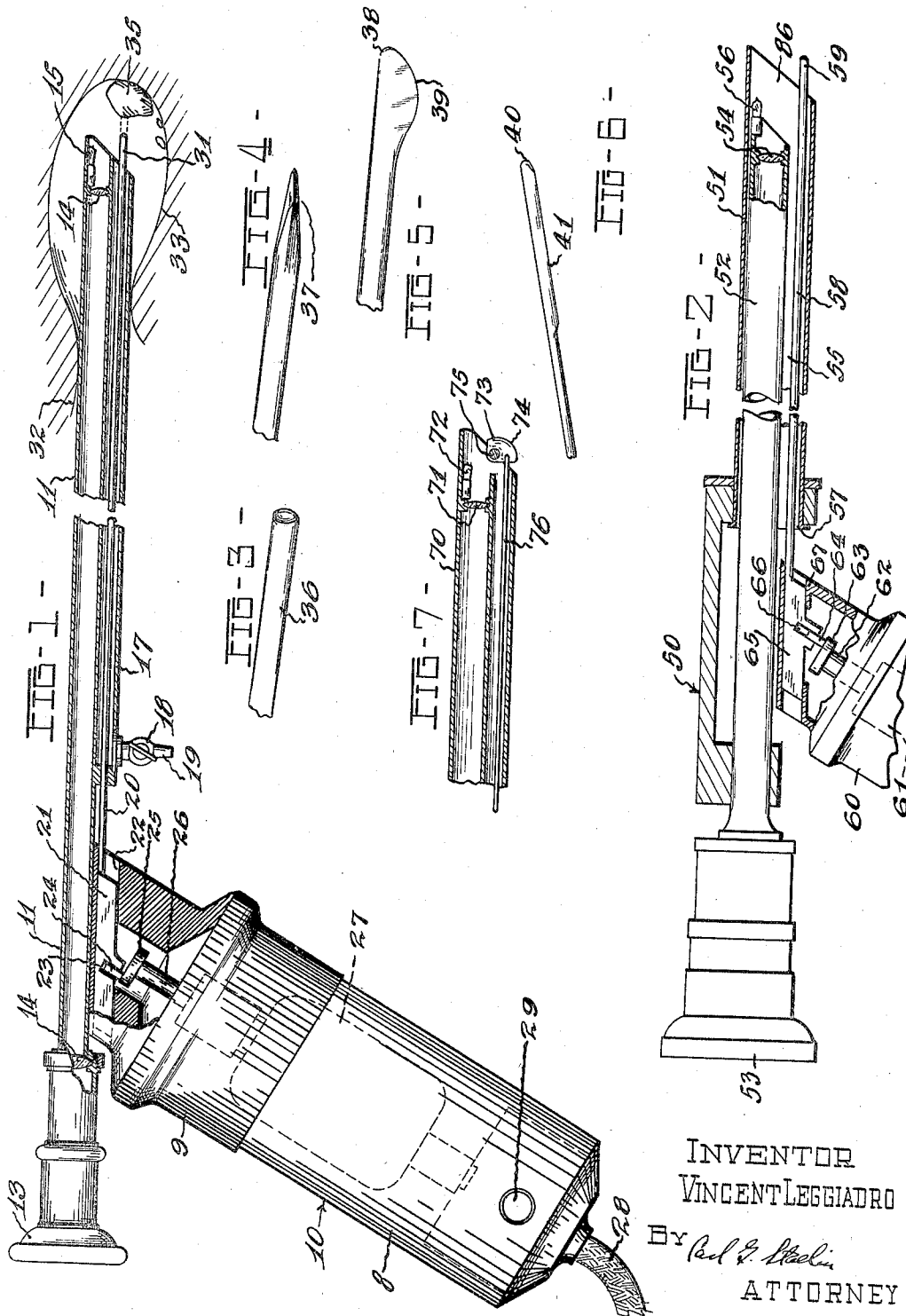
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LITHOTRITE

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LITHOTRITE

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7 Claims. (Cl. 128—328)

The present invention relates to a novel method and apparatus for subdividing or pulverizing stones in various cavities such as the bladder or kidney.

In the art of crushing stones in the bladder, it has been common to use an instrument such as a lithotriptoscope or similar instruments where the stone was crushed between co-acting jaws or male and female blades of a lithotrite. Instruments of this character were generally excessively large and caused pain in their introduction into the bladder; they could only act upon small stones and not upon a large or hard stone; and even small stones could not be crushed directly into small enough pieces to be expelled immediately; and danger was involved in the matter of breakage of the instrument while in the bladder. It is the aim of the invention to avoid the above difficulties.

Among the objects of the invention is to provide a method and apparatus which does not require a great opening through the urethra or other aperture, which requires only a short time of operation, and which is adapted to pulverize a stone of any consistency or size.

Another object of the invention is to minimize, if not entirely eliminate, danger of injury in the bladder, either by the action of the instrument in the bladder, or by the danger of breakage of the instrument while in use. In this connection it is desired to eliminate the use of large forces and stresses on the instrument, such as is necessary when using crushing jaws or similar instruments.

Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the drawing, in which:

Fig. 1 is an elevational view shown partly in section of an instrument embodying the present invention;

Fig. 2 is a fragmentary elevational view shown partly in cross-section of a modified embodiment of the present invention wherein a panendoscope or cystoscope or the like may be utilized in combination with the apparatus;

Figs. 3, 4, 5 and 6 are fragmentary detailed views showing various types of cutting points; and

Fig. 7 is a fragmentary cross-section view of a modified embodiment of the present invention. Referring more particularly to the drawing, reference character 10 designates a motor housing also adapted to act as the handle of the instrument. The housing is preferably constructed

in two parts, a lower part 8 and an upper part 9, fitting telescopically together and secured by suitable means. At the upper end 9 of the housing is mounted at an oblique angle a sheath 11, through which visual observations may be made. If desired, a telescope may be provided in the sheath consisting of an eye-piece 13, and lenses 14, or other suitable optical train to magnify the objects acted upon. A light 15 is mounted at the end of the sheath adapted to light the interior of the bladder.

Mounted in combination with the sheath 11 is a tube or sleeve 17 opening at one end into the bladder. A stopcock 18 and nipple 19 may be provided at the proximal end of the tube 17 to permit inflow or outflow of fluid through the tube, and thus act as a catheter if desired.

Within the tube 17 is a reciprocating rod 20, preferably composed of spring steel about 2 to 5 millimeters in diameter, and about 8 to 10 inches in length according to the length of the sheath 11. Other alloys, preferably non-corroding, may be used if desired, as well as different sizes and lengths.

The proximal end of the rod 20 is connected to a sliding arm 21, sliding in bearings 22, formed in the upper end 9 of the housing 10. The sliding arm 21 is provided with a slot 23, adapted to receive a pin or cam 24, to actuate the sliding arm 21. The pin 24 is mounted eccentrically upon a disc 25, at the end of a cam shaft 26 which communicates with and is actuated by an electric motor 27. An electric cable 28 and suitable switching means 29 may be provided to supply electrical energy to the motor 27.

The removal of the upper part 9 is useful in adjusting the degree of eccentricity of the pin or cam 24, or to replace the same with a cam having a different degree of eccentricity in order to adjust the length of stroke of the reciprocating rod 20. It has been found that the stroke should preferably be adjusted to the size of the stone to be crushed or pulverized.

The free end of the reciprocating rod 20 may be provided with a cutting point or blade 31, of design dictated by the type of operation and the size and consistency of the stone.

In operation of this device the sheath 11 is inserted through the urethra 32, or other opening, so that the end thereof projects into the bladder 33, or other cavity or organ. The stone 35 is then readily located by sighting through the eye-piece 13 and the sheath 11. The instrument should be brought into position so that the reciprocating rod 20 and the blade or cutting point 31 is in

front of, and in line with, the stone 35, in position to jab or thrust into it. The switch 29 is then thrown into operative position, actuating the motor 27 and causing the cam shaft 26 to revolve and move the cam or pin 24 eccentrically, whereupon the sliding arm 21 is caused to reciprocate at a high speed, and similarly actuate the rod 20 and the blade or cutting point 31. The blade or cutting point 31 strikes into the stone 35 as it rests on the bottom of the bladder 33. When struck, the stone may be slightly displaced, but owing to the elasticity of the bladder is caused to recoil. Repeated thrusts or jabs into the stone cause it to be rapidly split or pulverized without injury to the bladder or other organs.

I have discovered that it is unnecessary to hold the stone by separate instruments, and I thus avoid the possible danger of pinching the surrounding tissue, or causing large forces or stresses to be exerted by the instrument itself which may cause breakage, and I also eliminate the long time heretofore necessary in grasping the stone between two jaws.

The blade or cutting point 31 may be of various designs, as illustrated in Figs. 3 to 6. Fig. 3 shows a blunt point 36 acting as a hammer for various types of stones, such as one of softer consistency. Fig. 4 shows a sharp point or chisel 37 adapted, for example, for harder stones. Fig. 5 shows a point 38, having a cutting blade 39, adapted for cutting stones or tissue in the urethra or bladder, etc. Fig. 6 illustrates a reciprocating rod having a blunt end 40 and a cutting knife with a very narrow blade 41 along one side thereof. This may be used for removal of tissue or deformities from the urethra, bladder, neck of the bladder prostate and bladder tissue by way of the urethra (medical term "trans-urethral"), or through the open bladder by way of the abdomen or perineum, thus being suitable for use in the entire field of operation on bladder and surrounding organs.

In Fig. 2 I have illustrated an apparatus which may be combined with a conventional panendoscope or cystoscope or the like for practicing the present invention. Reference character 50 broadly designates a panendoscope shown in the drawing more or less diagrammatically, including a sheath 51, a telescope 52, having an eye-piece 53 and lens 54, a light 56, and a channel 55 being open both at the free end 56 and the proximal end 57. Into the proximal end of the channel 57 I insert a reciprocating rod 58 having a blade, cutting point or hammer 59 at the free end thereof, and being actuated by a suitable electrically driven actuator 60 at the proximal end thereof. The actuator 60 may be similar in design to that shown in Fig. 1, including a motor 61, a cam shaft 62, rotating disc 63 at the end of said shaft, and eccentric cam 64 and sliding arm 65 having a slot 66 into which said cam 64 is received. The sliding arm 65 is held in bearings 67 and is secured to the proximal end of said reciprocating rod 58.

The operation of this device is similar to that described in Fig. 1, the difference being that the reciprocating rod mechanism may be embodied in a separate instrument which is inserted through the sheath or channel of the panendoscope. My instrument may thus be suitable for use in connection with a panendoscope, cystoscope or other instrument conventional in the art.

In Fig. 7 I have illustrated a sheath 70 having a lens 71 of a suitable telescope, and a light 72 at the end thereof adapted to facilitate observa-

tion through the sheath. At the end of said sheath is mounted an oscillating knife 73 having a blade 74 at the exposed end thereof, which is pivoted by a suitable pin 75 mounted in said sheath. The knife 73 is actuated by means of reciprocating rod 76 secured at the end thereof to said knife 73. The operation of this knife 73 may be similar to that illustrated and described in my Patent No. 2,070,281. This blade is adapted to cut tissue or deformities in the urethra, bladder or surrounding organs.

Modifications and variations may be resorted to within the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. Apparatus for jabbing and subdividing naturally formed stones in a cavity such as a bladder, kidney or the like, comprising a narrow sheath adapted to have one end inserted into said cavity, means for making observations through said sheath to the interior of said cavity, lighting means in proximity to said end of said sheath, a rod disposed longitudinally in said sheath and exposed at said end thereof, and an electric motor mounted at the other end of said sheath for reciprocating said rod at high speed and causing it to jab into said stones.

2. Apparatus for subdividing naturally formed stones within a cavity such as a bladder, kidney or the like, which comprises a hollow sheath adapted to have one end inserted into said cavity, lighting means in proximity to said end of said sheath, a rod disposed longitudinally within said sheath and exposed at said end thereof, a cutting point at the exposed end of said rod, means for making observations through said sheath into said cavity, and electrically driven actuating means associated with the other end of said rod and adapted to reciprocate said rod and cause said cutting point to jab into and subdivide said stone.

3. Apparatus for subdividing naturally formed stones within a cavity such as a bladder, kidney or the like, which comprises a hollow sheath adapted to have one end inserted into said cavity, a rod disposed longitudinally within said sheath and exposed at said end thereof, lighting means in proximity to said end of said sheath, a cutting point at the exposed end of said rod, an electric motor mounted at the other end of said sheath, means for making observations through said sheath into said cavity, and a crank actuated by said motor and cooperating with said rod to reciprocate the latter and cause said cutting point to jab into and subdivide said stone.

4. Apparatus for subdividing naturally formed stones within a cavity such as a bladder, kidney or the like, which comprises a hollow sheath adapted to have one end inserted into said cavity, lighting means in proximity to said end of said sheath, a rod disposed longitudinally within said sheath and exposed at said end thereof, a cutting point at the exposed end of said rod, an electric motor mounted at the other end of said sheath, means for permitting observation through said sheath into said cavity, a crank actuated by said motor and a pin on said crank eccentric to the axis of revolution of said crank cooperating with said rod to reciprocate the latter and cause said cutting point to jab into and subdivide said stone.

5. Apparatus as claimed in claim 1, having a cutting knife blade at the end of said reciprocating rod.

6. Apparatus as claimed in claim 1, wherein

said reciprocating rod is provided with a blunt end at the said exposed operating end thereof, and a narrow knife blade along the side of said reciprocating rod in proximity to said blunt end
5 adapted to cut tissue or the like.

7. The method of removing naturally formed stones from the bladder which comprises distending the urethra, locating said stone, seating said

stone against the walls of said bladder, repeatedly jabbing said stone at high speed with short reciprocatory movements in a direction longitudinally of said urethra and communicated through said distended urethra, and thereby subdividing
5 said stone into particles capable of passing through said urethra and being discharged.

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