Dec. 3, 1968 L. V. ROZE 3,413,976

ARRANGEMENT FOR REMOVAL OF CONCRETIONS FROM URINARY TRACT

Filed July 29, 1963 3 Sheets-Sheet 1

Fig. 1.

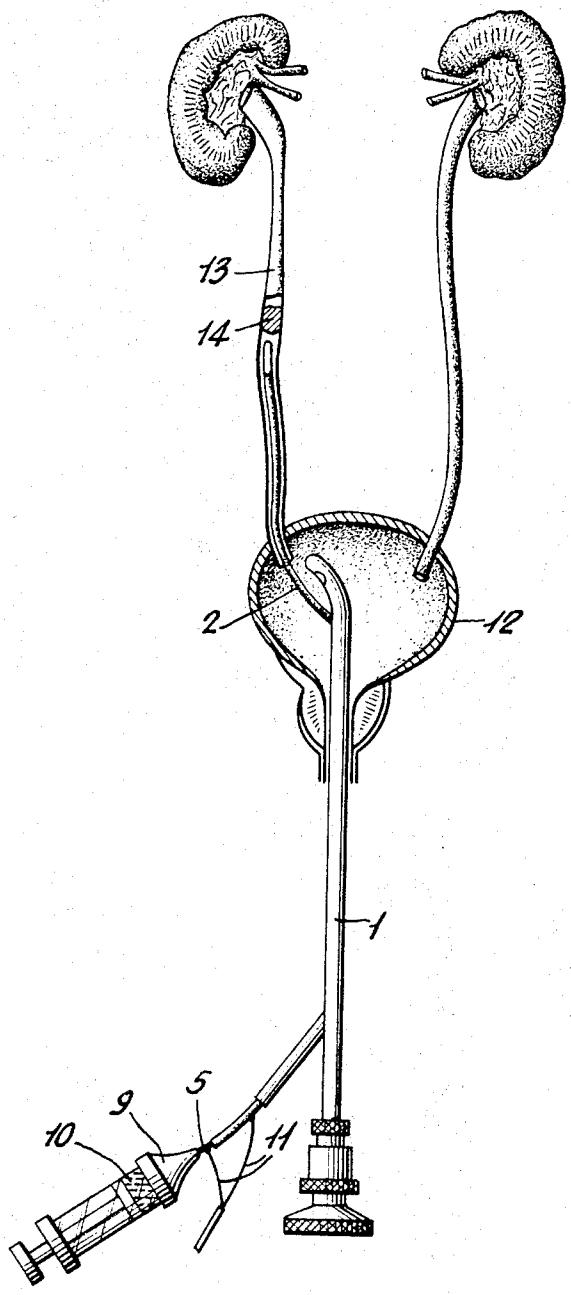
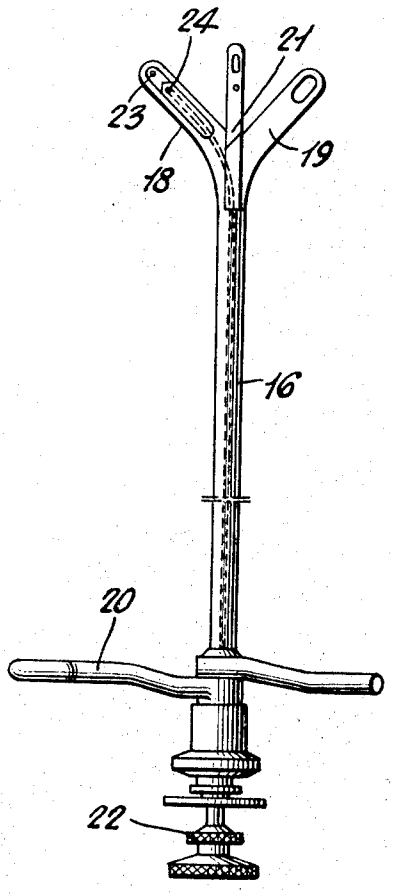


Fig. 7.



Dec. 3, 1968 L. V. ROZE 3,413,976

ARRANGEMENT FOR REMOVAL OF CONCRETIONS FROM URINARY TRACT

Filed July 29, 1963

3 Sheets-Sheet 2

Fig. 2.

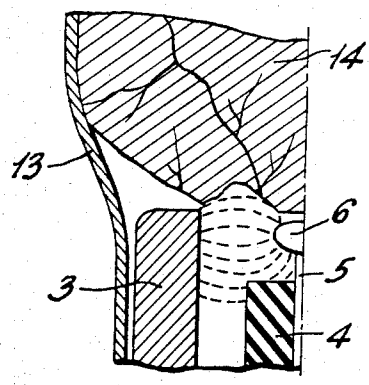


Fig. 3.

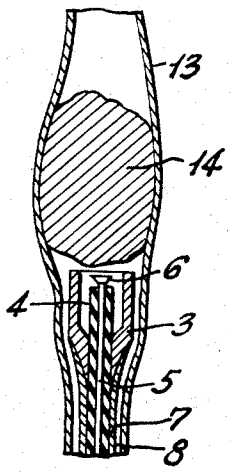


Fig. 6.

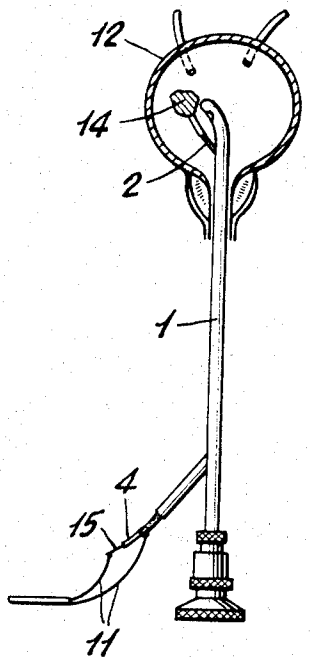


Fig. 4.

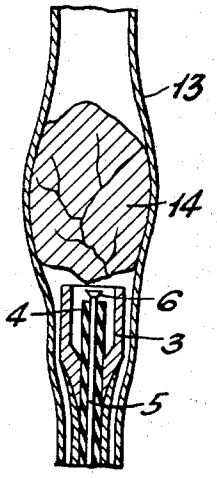
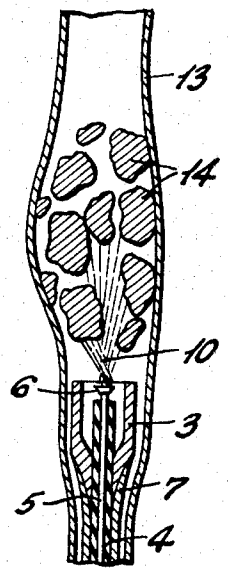


Fig. 5.



Dec. 3, 1968 L. V. ROZE 3,413,976

ARRANGEMENT FOR REMOVAL OF CONCRETIONS FROM URINARY TRACT

Filed July 29, 1963 3 Sheets-Sheet 3

Fig. 11.

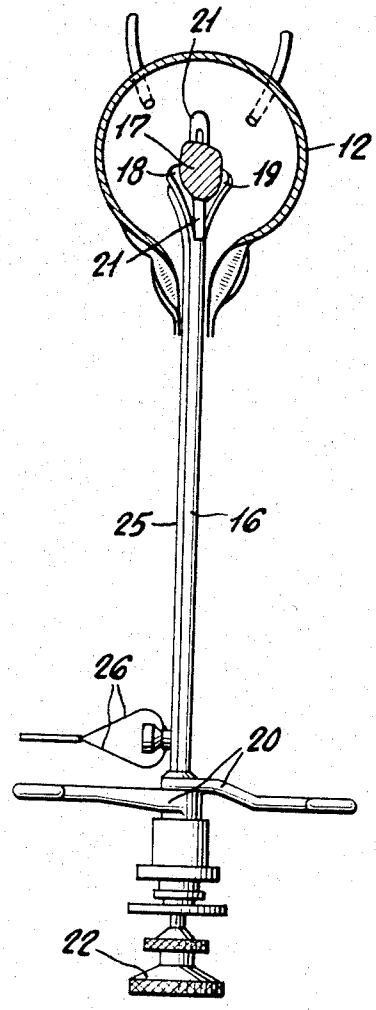
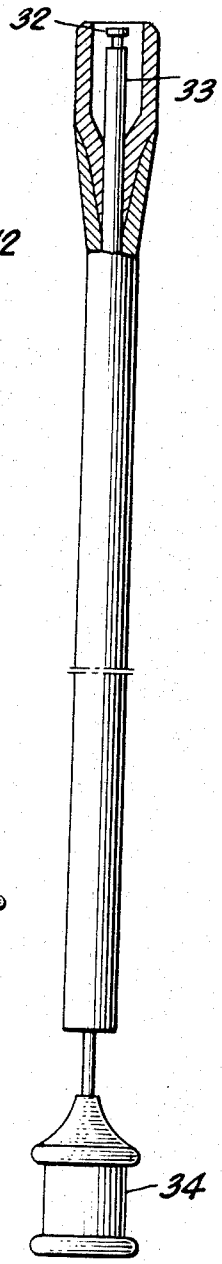
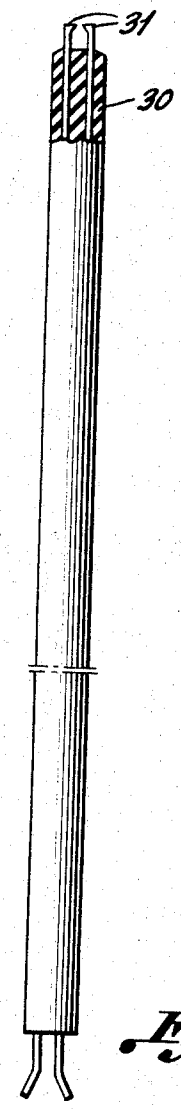


Fig. 8.

Fig. 10.





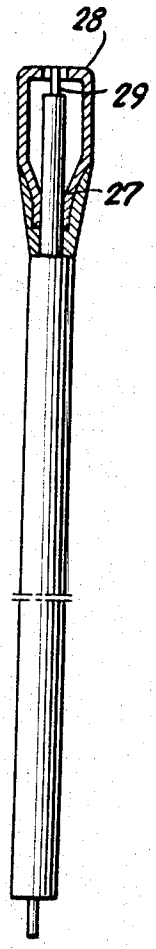


Fig. 9.

United States Patent Office 3,413,976 Patented Dec. 3, 1968

3,413,976

ARRANGEMENT FOR REMOVAL OF CONCRETIONS FROM URINARY TRACT

Leo Voolfovich Roze, Riga, U.S.S.R., assignor to Gosudarstvenny Elektrotekhnichesky Zavod VEF

Filed July 29, 1963, Ser. No. 298,059
3 Claims. (Cl. 128—328)

This invention relates to means for the removal of concretions from the urinary tract including the renal tubules and pelvis of the kidney, the ureters, the bladder, and the urethra.

It is known that mechanical tools with gripping elements are in use for the removal of the concretions. However, extraction of the concretions with the aid of these instruments is possible only partly with the use of special cystoscopes, bougies for widening the ureters, etc., which makes the operation complicated and rather painful. A lithotrite, an instrument used to crush a concretion prior to its removal, is also in use in present day surgery but this instrument is effective only in removing concretions from the bladder and the operation is also rather complicated.

Attempts to overcome the above problems have been made but none of such prior attempts have proven successful and an important object of the invention is to provide means for solving the problem.

Another object of the invention is to provide means effecting an easy and substantially painless removal of concretions from the urinary tract.

Broadly, the invention provides for the removal of concretions with their preliminary crushing being effected by electro-hydraulic impact.

The main object of the invention is to provide an arrangement for the removal of concretions from the ureter and the bladder with their preliminary crushing being effected by electro-hydraulic impacts.

Another object of the invention is to provide for the crushing of concretions in the ureter emptied of urine.

Another object of the invention is to provide for the crushing of concretions in the urinary bladder with their preliminary fixation.

A further object of the invention is to provide an instrument which is simple in structural detail and which includes a sonde provided with discharge electrodes.

Additional objects and advantages of the invention will become more readily apparent to persons skilled in the art from the following detailed description and annexed drawings and in which drawings:

FIG. 1 is a general view partly in elevation and partly in cross-section of an arrangement for crushing the concretions in the ureter with the components thereof being in the working position.

FIG. 2 is a fragmentary view in cross-section of the head of the instrument, the view being on an enlarged scale.

FIGS. 3–5 are fragmentary cross-sectional views of the head of the instrument illustrating its position relative to a concretion in the ureter prior to crushing, at the initial stage of crushing, and at the end of crushing, respectively.

FIG. 6 is a view partly in elevation and partly in cross-section showing an arrangement used for crushing the concretions in the urinary bladder.

FIG. 7 is an elevational view of another instrument which may be used for the removal of concretions from the urinary bladder.

FIG. 8 is an elevational view of the instrument disclosed in FIG. 7 and showing the same at the moment of gripping a concretion prior to the crushing thereof.

FIGS. 9, 10 and 11 are elevational views partly in cross-section of embodiments of the invention.

The removal of the stones with the assistance of the present instrument is preceded by crushing of the concretion by a high voltage electric discharge in fluids with a vacuum and a cavitation force taking place in the fluid at the moment of disappearance of the discharge so that an object located in the zone of the hydraulic impact will be crushed by the vacuum and cavitation force.

The arrangement according to the invention includes a steep pulse generator and a flexible sonde which is adapted to be introduced into the urinary tract with the generator connected to spaced electrodes so that an electro-hydraulic impact is produced between the electrodes during the electric discharge.

At least two embodiments of the instrument are provided:

(1) An instrument designed to crush a concretion in the ureter and the pelvis, and also in individual cases in the urinary bladder and urethra; the sonde of the instrument is provided with a channel for a fluid required to produce a hydraulic impact and evacuate the crushed concretion particles.

(2) An instrument for the removal of a concretion from the urinary bladder manufactured in the form of urological forceps provided with jaws for gripping and fixing the concretion and the jaws are equipped with electrodes designed to produce an electric discharge.

FIGS. 1 and 2 show an instrument for crushing concretions in urethra designed on the basis of a urologic cystoscope **1** through which is passed a sonde **2** having electrodes. The sonde is provided with a head **3** which serves as a negative electrode isolated by a tube **4** from positive electrode **5**. The electrode **5** is in the form of a long medicine needle having a boss at the end.

The sonde **2** is sheathed by a flexible envelope or covering **7** (FIG. 3) coated with a film of current insulating lacquer **8**.

The needle **5** is operably connected to a syringe **9** containing fluid **10** (distilled water, etc.). Electricity is supplied from the generator through conductors **11** with one of the conductors being connected directly with the needle **5** and the other to the envelope **7**.

In the position shown in FIG. 1, the cystoscope **1** is introduced into urinary bladder **12** through the urethra and the sonde **2** into one of ureters **13** with its head in the immediate vicinity of a concretion **14** situated in the ureter. Before switching on the current a certain amount of fluid **10** required to produce an electro-hydraulic effect is delivered into the ureter by the syringe **9**.

When the current is supplied it will be seen from the dotted lines in FIG. 2 that electric discharges are produced between the negative and positive electrodes **3** and **5**, respectively. As mentioned above, a vacuum and cavitation force develops at the moment of disappearance of the discharge for acting upon the concretion **14** and crushing the concretion gradually into separate particles. Following the crushing of the concretion, fluid **10** is supplied to the ureter **13** from the syringe **9** as shown in FIG. 5 for removing the crushed particles after the instrument is withdrawn thereby terminating the removal procedure.

The hydraulic impacts developed are noted for their brisk action which enables the concretion to be crushed into small particles and dependent upon the size and solidity of the concretion, the crushing cycle may be from several seconds to ten minutes. Hydraulic impacts of a proper dosage and direction have no harmful effects on the walls of the urethra and there is an absence of thermal action on the tissues. Moreover, a small amount of the fluid is sufficient for crushing a concretion.

As disclosed in FIG. 6, the same instrument can be used if it is necessary to crush a concretion in the urinary bladder **12**. In this case, it is not necessary for fluid **10** to be supplied and hence the use of the syringe **9**.

Central electrode **15** of this instrument can be manufactured without the channel for the fluid.

An instrument for removal of a concretion from the urinary bladder and shown in FIGS. 7 and 8 is in the form of urological forceps **16** provided with a device for gripping and fixing a concretion **17**. This device includes gripping jaws **18** and **19** which are pulled by handles **20** located at the base of the instrument **16**. The central passage of the instrument bears on anoptical inspecting device **21** attached to a removable head **22** equipped with an ocular.

Plate **23** fixed to the inner side of the jaw **18** serves as a negative electrode and the end of positive electrode **24** is also located at the same place. The electrode is supplied through a current conducting component **25** disposed at the side of the instrument and connected to the generator by conductors **26**.

FIG. 7 shows the instrument in the position with its jaws set apart, optical inspecting device **21** extended and when the instrument is inserted into the urethra, the inspecting device is retracted and jaws **18** and **19** fold together. After the instrument head is introduced into the urinary bladder **12**, the inspecting device is extended again and the jaws **18** and **19** set apart to their extreme position by maniplating the handles **20**.

With the instrument set in this position and viewing through the inspecting device **21**, the jaws are moved close to the concretion **17**.

By manipulating the handles **20**, the concretion is fixed by the jaws and then electric pulses are transmitted to the electrodes **23** and **24** from the generator. After the concretion is crushed, the inspecting device is retracted from the instrument with the aid of the head **22**. As soon as the inspecting device **21** is retracted, fluid can be supplied through the passage of the instrument **16** into the bladder to wash it of the crushed concretion.

The sonde shown in FIG. 11 is for removing concretions from the ureters and for this purpose, central electrode **32** is mounted in a tube **33** connected with the point of a needle **34**.

The sonde shown in FIG. 9 differs from that disclosed in FIG. 11 in that head **27** is provided with an end disc **28** having a cenral hole in which a positive electrode **29** is situated thereby preventing the possibility of inflicting any damage to the urethra tissues during the insertion of the sonde.

The sonde shown in FIG. 10 does not include a passage for a fluid supply. The sonde is very simple in structural detail and consists of a flexible stem **30** of insulating material and two electrodes **31** enclosed in the stem.

The pulse generator includes a power unit consisting of a transformer and a rectifier, an inductance coil, a spark gap, and a discharge circuit including a number of capacitor banks and an additional spark gap. The generator produces steep electric pulses and the crushing of the concretion is effected at a discharge voltage of 5–30 kw. and 700–1100 μa. current.

It should be noted that concretions of different chemical composition such as urates, oxalates or phosphate-carbonates can be successfully crushed with the aid of the invention and if the arrangement is properly used, the danger of damage to the tissues is practically eliminated, thus ensuring absolute safety for the patient.

More particularly, the generator provides impulses of short circuit current up to 10 ma. and the voltage of the impulses ranges from 2–16K volts. Impulses are developed during the course of the discharge of the condenser ranging from 0.01–0.04 mf.

The invention is not to be confined to any strict conformity to the showings in the drawings but changes or modifications may be made therein so long as such changes or modifications mark no material departure from the spirit and scope of the appended claims.

What I claim is:

1. An instrument for the removal of concretions from the urinary tract including means for introduction into the bladder and the ureter, a flexible sonde operably associated with said means, said sonde having a discharge head adapted to be positioned adjacent a concretion, said discharge head being defined by concentric inner and outer electrode, said outer electrode having an annular end portion surrounding the inner electrode with said annular end portion and the end of the inner electrode being located at the same level, a flexible current conducting envelope encasing said inner electrode operably connected with the outer electrode, a layer of insulating material between the conducting envelope and the inner electrode, fluid delivery means extending axially of said sonde and having an outlet opening adjacent said discharge head through which fluid is delivered into the zone of the concretion, means operably connected with said inner electrode and envelope for producing electric discharges having a voltage of 5–30 kw. and 700–1100 μa. current therebetween which in conjunction with the fluid delivered through said outlet opening develop an electro-hydraulic impact for crushing the concretion, and means for delivering fluid into the zone of the concretion.

2. The instrument as claimed in claim **1** in which said fluid delivering means is defined by axially extending means provided in said inner electrode is defined by a passage extending axially of said inner electrode.

3. An instrument for use in the removal of concretions from the bladder, comprising means adapted to be introduced into the bladder, gripping jaws on said means for fixing a concretion, said means having a central axially extending passage, a removable inspecting device associated with said passage, electrodes located on the inner sides of said jaws, and means operably connected with said electrodes for producing electric discharges having a voltage of 5–30 kw. and 700–1100 μa. current therebetween for crushing the concretion in the gripping jaws.

References Cited

UNITED STATES PATENTS

1,303,135	5/1919	Wappler	128—328
2,038,393	4/1936	Wappler	128—7
452,220	5/1891	Gunning	128—408
1,056,336	3/1913	Hurdman	128—407

LOUIS G. MANCENE, *Primary Examiner.*

G. E. McNEILL, *Assistant Examiner.*