

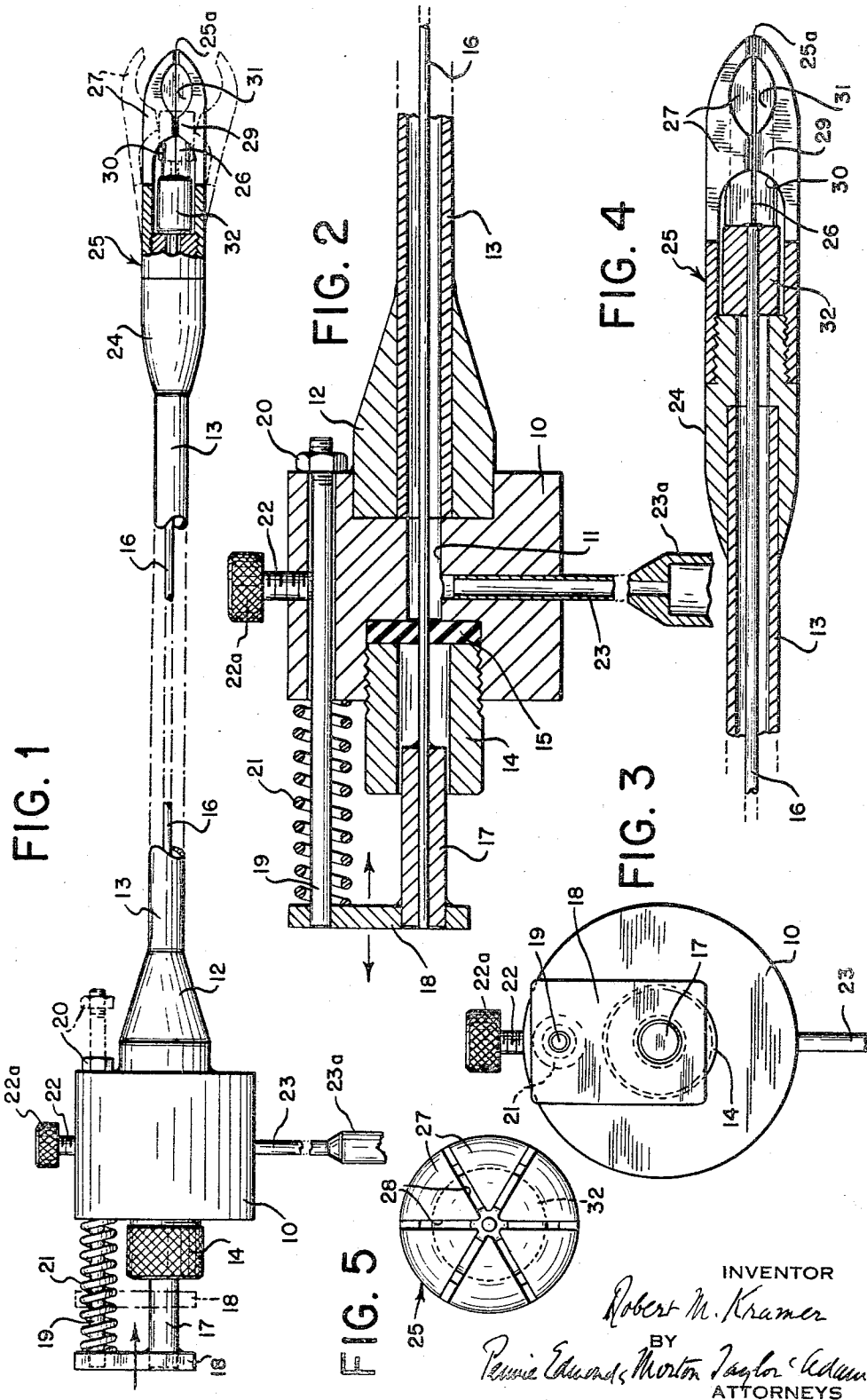
Aug. 8, 1967

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3,334,630

INSTRUMENT FOR THE EXTRACTION OF KIDNEY STONES

Filed April 3, 1964



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INSTRUMENT FOR THE EXTRACTION OF KIDNEY STONES

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Filed Apr. 3, 1964, Ser. No. 357,054

11 Claims. (Cl. 128—328)

This invention relates to instruments for the extraction of kidney stones and is concerned more particularly with a novel instrument for the purpose which is especially desirable in that it may be safely employed in the removal of a stone lodged in the upper region of the ureter.

A number of different types of instruments for the removal of kidney stones have heretofore been proposed and some of them are now in use but the available instruments have objectionable features. One instrument, which has been used to a considerable extent, traps the stone in such a way that thereafter the instrument cannot be made to release the stone within the ureter. As a result, if a stone being removed by the use of this instrument adheres firmly to the wall of the ureter or is too large to pass, the stone once trapped by the instrument must be torn free at the risk of serious injury to the patient or the patient must undergo immediate surgery. As the wall of the upper region of a ureter amounting to two-thirds the length of the tube is relatively weak, the danger of damage being done to the patient during extraction of a stone in that part of the ureter by one of the instruments now available is greatly increased and many members of the medical profession regard the use of such an instrument in the upper ureteral region as unsafe.

The present invention is directed to the provision of a novel instrument for kidney stone extraction which is easily manipulated and can be safely used in the upper ureter. The instrument enables its user to grasp a stone firmly and, if necessary, the instrument can be operated to release the stone. The user is thus not forced to extract a stone which has once been grasped by the instrument but cannot be removed without injury to the wall of the ureter.

For a better understanding of the invention, reference may be made to the accompanying drawing, in which:

FIG. 1 is a view of the new instrument in side elevation on an enlarged scale;

FIG. 2 is a longitudinal sectional view through the base of the instrument;

FIG. 3 is a rear end view of the instrument;

FIG. 4 is a longitudinal sectional view through the head of the instrument on an enlarged scale; and

FIG. 5 is a view of the head of the instrument in end elevation.

The instrument illustrated in the drawings comprises a base 10, which may conveniently be formed of a block of metal of cylindrical shape and is provided with an axial passage 11. At one end of the block, the passage is enlarged to receive a collar 12 permanently mounted in the enlargement and encircling and secured to the end section of a flexible metal tube 13. The tube is of small diameter, such as 1 mm. or less, and the collar makes it possible to secure the tube to the block and, at the same time, relieve stress on the tube where it enters the block. At its other end, the passage is enlarged and interiorly threaded to receive a sleeve screwed into the enlargement and seated upon a gasket 15 serving as a seal for the adjacent end of the passage and made of a material capable of being sterilized without injury.

A metal wire 16 extends through the tube 13, the passage 11, the gasket 15, and the collar 14 and, at one end, is secured in a collar 17 which is movable with

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a sliding fit within the sleeve 14. The exposed end of the collar 17 is permanently secured to a push-plate 18 which projects laterally from the collar and, near its outer end, the plate has an opening in which is rigidly mounted one end of a rod 19. The rod passes through a bore in the base 10 parallel to the passage 11 and carries a nut 20 threaded on the end of the rod beyond the base. Between the plate 18 and the adjacent face of the base, the rod is encircled by a spring 21 which tends to move the plate away from the base with such movement limited by the engagement of the nut 20 against the face of the base remote from the plate. The base is formed with a threaded opening intersecting the bore containing the rod 19 and a holding screw 22 is threaded in the opening and has a head 22a with a knurled surface, by which the screw can be turned into contact with the rod to hold the rod in any desired position of adjustment in relation to the base. If desired, the base may also be provided with an inlet tube 23 leading inward to the passage 11 for the introduction of liquid through the passage into the tube 13. The inlet tube conveniently may be the needle of a hypodermic syringe of a conventional form and provided with a head 23a, to which the barrel of the syringe may be attached.

A head 24 is rigidly mounted on the end of the tube remote from the base and a tip 25 is mounted on the outer end of the head, preferably detachably, as by being threaded in place. Adjacent to the end of the head, the tip is hollow to provide a chamber 26 and it terminates in a point 25a. The tip is subdivided into a plurality of jaws 27 by cuts 28 extending inwardly from the point 25a into the chamber 26 and lying in planes through the axis of the tip and, in the construction shown, there are six cuts defining jaws. Outwardly from the chamber, each jaw is formed with an internal projection 29 provided with a cam surface 30 partly defining the chamber 26. Beyond the projections 29, the tip has a chamber 31.

The wire 16 projects through the head 24 into the chamber 26 and carries a collar 32 within chamber 26. This collar has a diameter such that, upon endwise movement of the wire, the end of the collar engages the cam surfaces on all of the jaws and forces them apart. When the instrument is not in use, tension on the wire 16 is avoided by adjusting the nut 20 on the rod 19.

Prior to the use of the instrument in an operation for the removal of a kidney stone, an X-ray picture is made to locate the stone and inform the surgeon as to the approximate distance the head of the instrument must be inserted in order to engage the stone. Preferably, the tube 13 will be calibrated to enable the surgeon to approach the stone slowly and know when the tip of the instrument is close to it. When the instrument has been thus inserted and the tip is near or in contact with the stone, another X-ray picture may be taken to show the location of the stone and of the tip of the instrument in relation to it.

After insertion of the instrument, it may be desirable to introduce into the ureter a fluid containing an ingredient which will cause the wall of the ureter to swell and thus provide the largest passage possible for the extraction of the stone and limit the irritation of the ureter. When the tube 23 is the needle of a syringe, the liquid may be inserted by filling the barrel of the syringe, mounting it upon the end of the outer end of the tube 23, and manipulating the plunger to force the liquid through the tube for discharge at the tip.

When the fluid has been introduced, if such fluid is to be used, the jaws 27 are opened. For this purpose, the surgeon holds the block 10 and pushes the plate 18 toward it against the resistance of the spring 21. The movement of the plate moves the wire 16 and causes the

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collar 32 at the end of the wire to act on the cam surfaces 30 on the projections 29 and wedge the jaws 27 apart to the positions shown in broken lines in FIG. 1. The movement of the plate is limited by its engagement with the end of the sleeve 14 and, since such movement results in the opening of the jaws, the degree of opening of the jaws can be adjusted by varying the length of the movement by adjustment of the sleeve 14 in the block 10. The jaws may be held in open position by turning in the screw 22 to clamp the rod and hold it against movement by the spring. When the jaws of the instrument have thus been opened, the instrument is advanced slightly to permit the jaws to enclose the stone, although it may be necessary to open and close the jaws a number of times to loosen the stone before removing it. Such opening and closing is effected by backing off the screw 22 to release the rod 19, whereupon the spring 21 will force the plate 18 back to draw the wire 16 with it, until the collar 32 is free of the cam surfaces. When the stone has been loosened, the surgeon pushes inward upon the plate 18 to open the jaws and then moves the instrument sufficiently to cause the jaws to encircle the stone. Upon release of the jaws, the stone is either received within the cavity 31 defined by the jaws or is grasped by the parts of the jaws adjacent the tip 25a. With the stone thus secured, the instrument is withdrawn from the ureter and the operation is completed in such manner as the situation demands.

In the new instrument, the tip 25 is removable from the head 24 so that tips of different size may be employed, as may be required in different operations. The tip is made of resilient metal or alloy, such as beryllium copper appropriately plated for safe use, and the wall thickness of the tip at the roots of the jaws is such as to permit the jaws to be sprung apart by the cam action of the sleeve 32 without undue resistance. As the jaws may be opened and closed simultaneously by a single wire 16, the tube 13 and the head 25 may be of the small diameter required for easy insertion and movement through the ureter and the jaws are of such length that they can be opened wide to receive a stone into the space behind or between them.

I claim:

1. In an instrument for the extraction of kidney stones having a base, a flexible tube attached to the base, a single flexible wire extending through the tube, and means at the base for moving the wire endwise in both directions, the improvement in a tip assembly in combination therewith comprising a head mounted on an end of the tube remote from the base, a tip mounted on the outer end of said head and defining therein a first chamber adjacent said head and a second chamber at the endmost portion of the tip, said tip being formed from an integral piece of resilient metal such as beryllium copper and subdivided

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into a plurality of jaws by cuts extending inwardly from the endmost portion of the tip into the first chamber so that jaws can be sprung apart and will resiliently return to their closed position, internal projections on said jaws extending inwardly between the first and second chambers which are provided with a cam surface partly defining the first chamber, and means on the end of said wire positioned in the first chamber for contacting the cam surface on moving the wire toward the tip and spring the jaws apart by cam action.

2. The instrument of claim 1, in which the wire is moved endwise in a direction away from the tip and toward the base by a spring.

3. The instrument of claim 1, in which the tube is mounted in one end of a passage through the base and the wire extends into the passage.

4. The instrument of claim 3, in which the means for moving the wire to force the jaws apart includes a plate lying at the side of the base remote from the tube and attached to the wire.

5. The instrument of claim 4, in which a sleeve is mounted in the other end of the passage, a collar is mounted on the wire and is movable in the sleeve, and the plate is attached to the collar.

6. The instrument of claim 5, in which a gasket is mounted at the inner end of the sleeve and is compressible by the sleeve.

7. The instrument of claim 4, in which a rod attached to the plate is movable in a bore in the base parallel to the passage.

8. The instrument of claim 7, in which a spring encircling the rod bears against the base and the plate to urge them apart.

9. The instrument of claim 7, in which means are provided for holding the rod against movement by the spring.

10. The instrument of claim 3, in which means are provided for introducing a liquid into the passage and tube for discharge at the tip.

11. The instrument of claim 1, which includes means for relieving stress on the tube where it is attached to the base.

References Cited

UNITED STATES PATENTS

327,394	9/1885	Hemsley	128—354
1,127,948	2/1915	Wappler	128—311 X
1,627,941	5/1927	Wappler	128—7
2,113,246	4/1938	Wappler	128—321
3,074,408	1/1963	Chester	128—328
3,187,751	6/1965	Coren et al.	128—330

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