

M. SUSSMANN;
GASTROSCOPE.
APPLICATION FILED JUNE 2, 1909.

944,830.

Patented Dec. 28, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

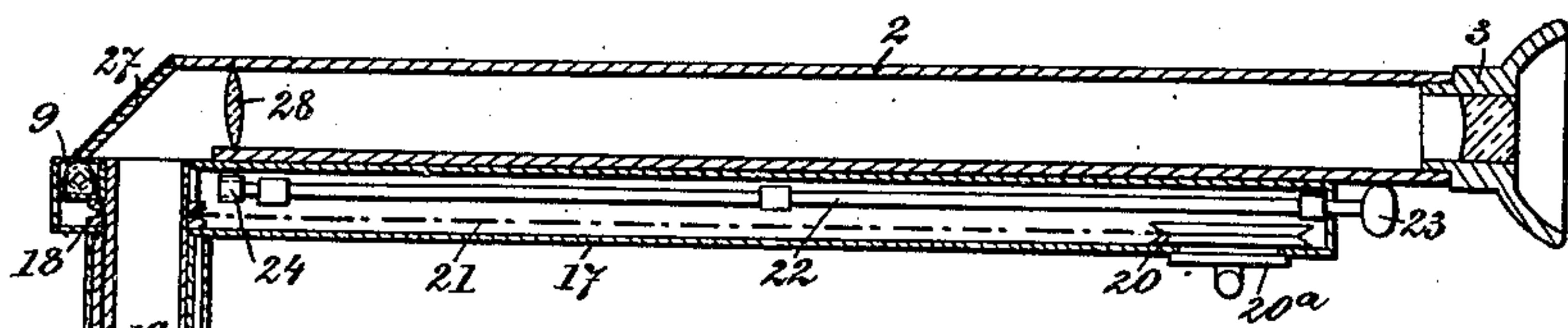


Fig. 2.



Fig. 3.

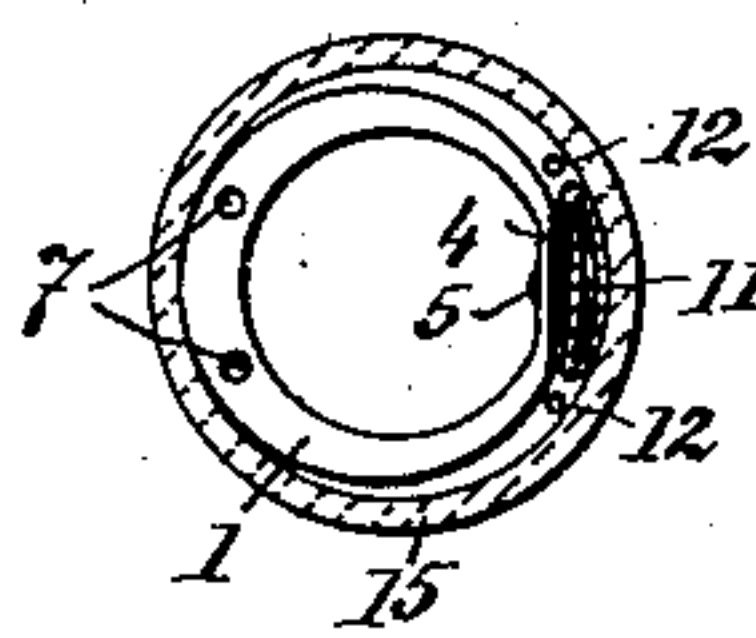


Fig. 8.

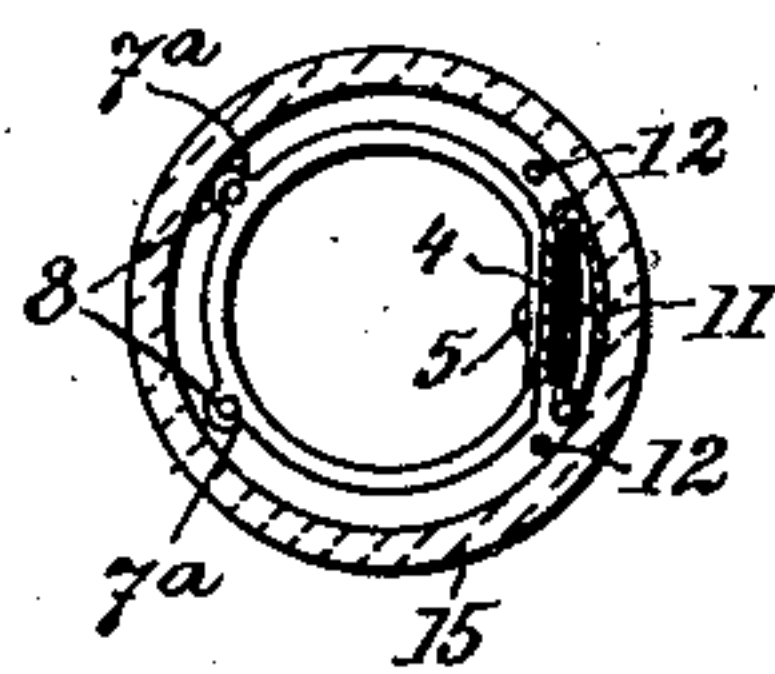


Fig. 4.

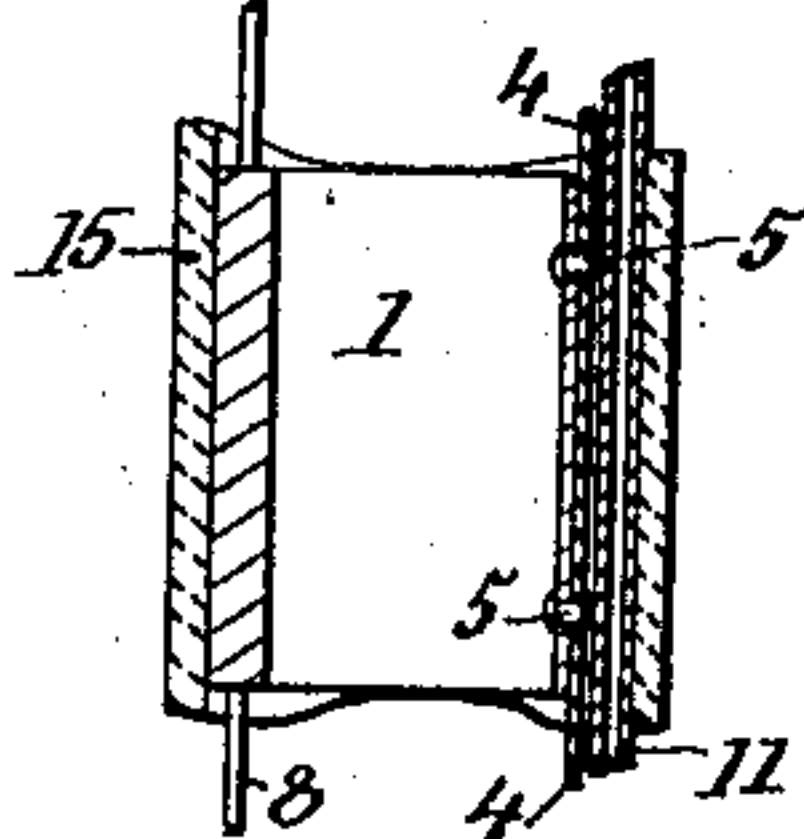


Fig. 9.

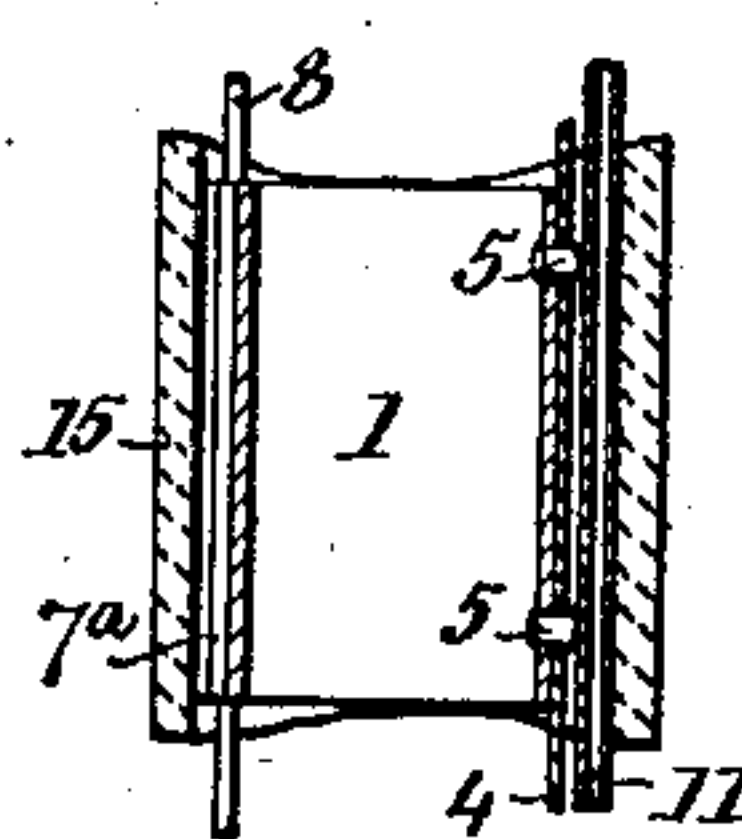


Fig. 5.

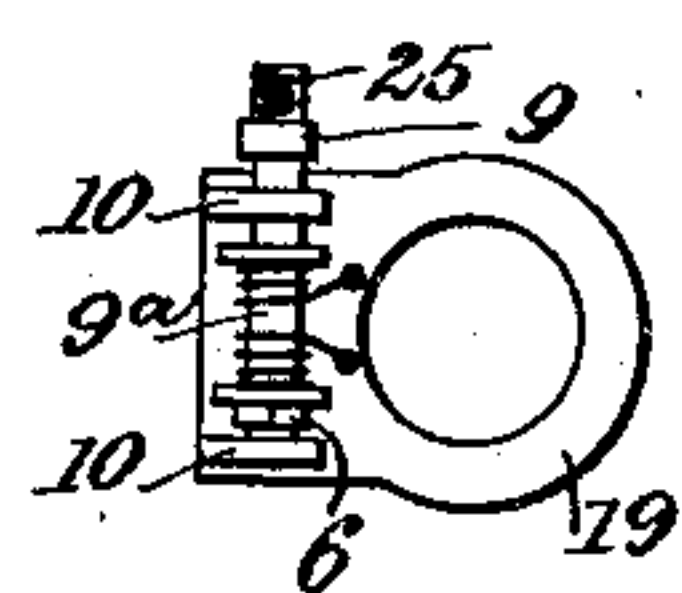


Fig. 6.

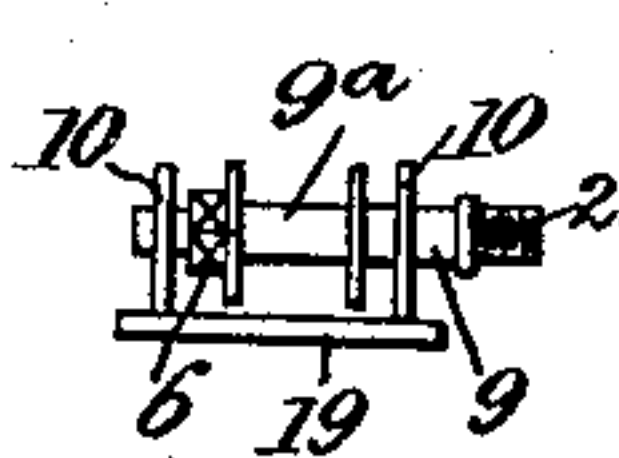


Fig. 7.

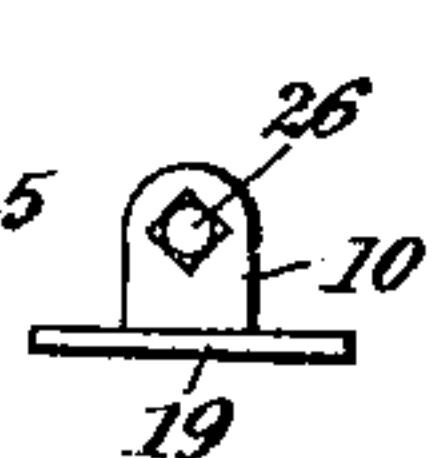
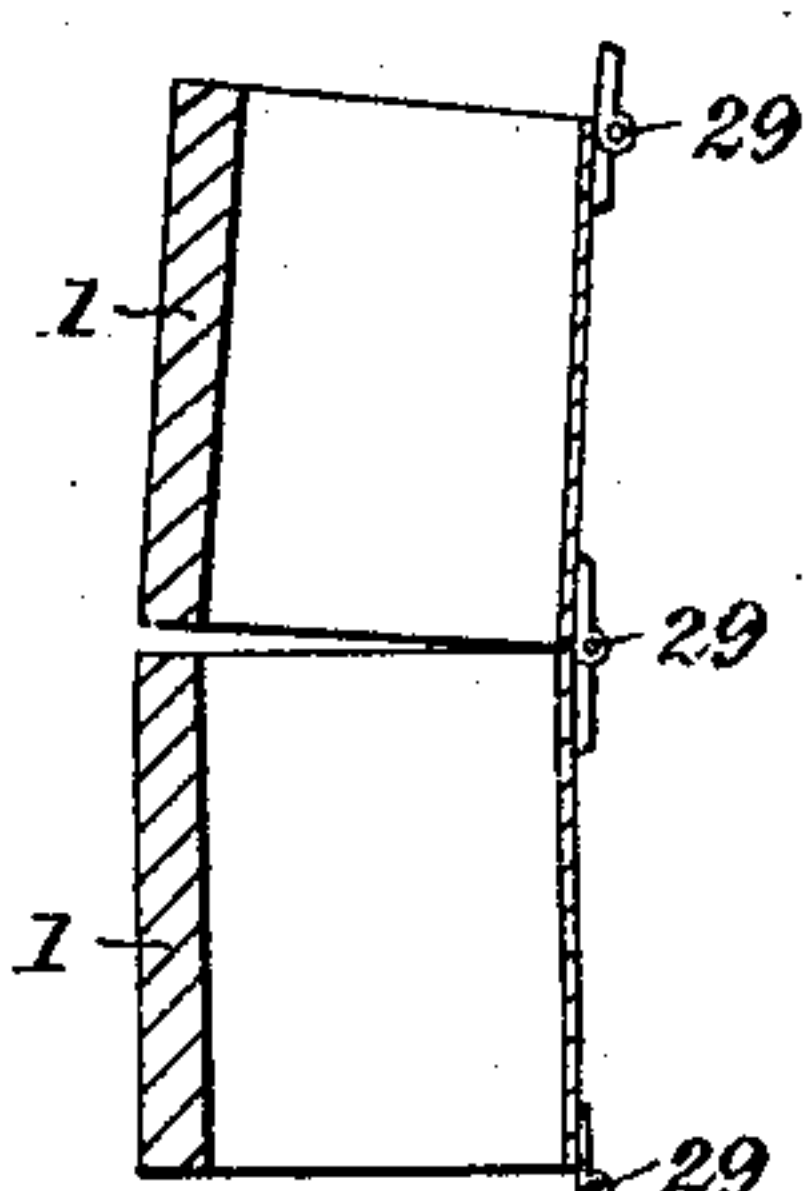


Fig. 10.



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2 SHEETS—SHEET 2.

Fig. 11.

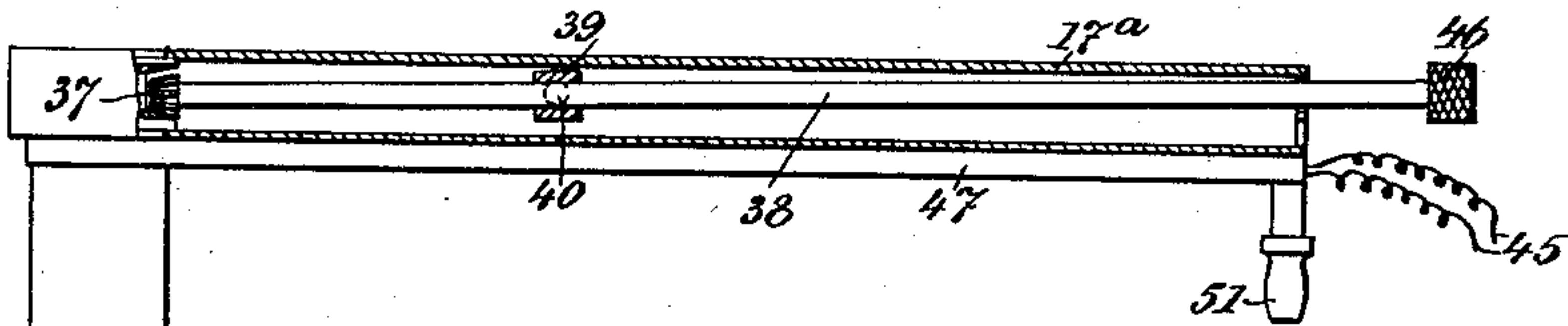
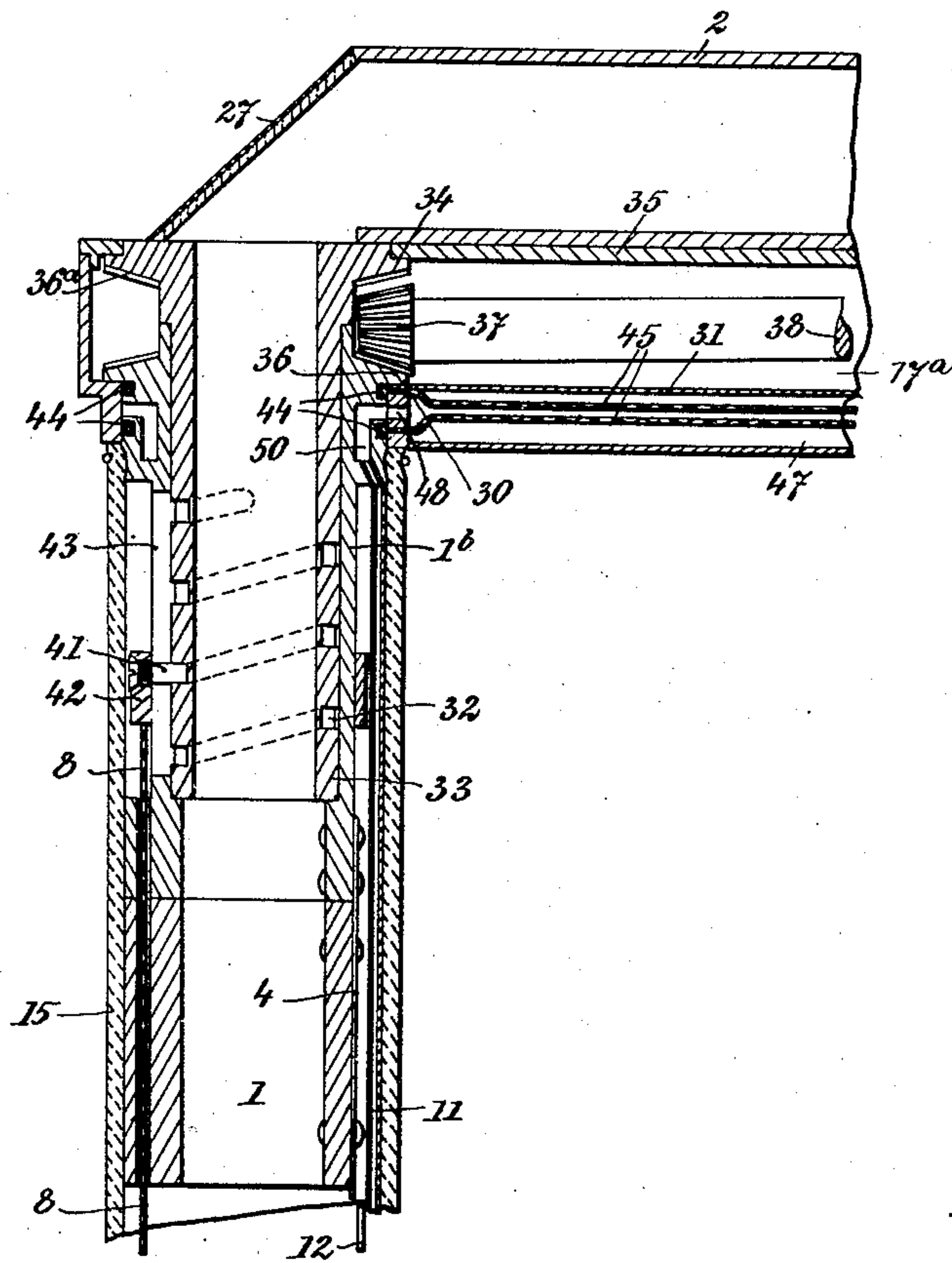


Fig. 12.



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Specification of Letters Patent.

Patented Dec. 28, 1909.

Application filed June 2, 1909. Serial No. 499,756.

To all whom it may concern:

Be it known that I, MARTIN SUSSMANN, a citizen of the Empire of Germany, residing at Berlin, in the Empire of Germany, have
5 invented a new and useful Gastroscope, of which the following is a specification.

My invention relates to improvements in gastroscopes comprising a horizontal part and a vertical part.

10 The chief improvement consists in the division of the tube contained in the vertical part into a tubular piece suspended from the horizontal part and a series of tubular links, which are on one side flexibly con-
15 nected with the tubular piece and with one another. The end faces of the tubular piece and tubular links are at right angles to their axes and are adapted to come in close contact with one another. On the other side
20 the tubular links are provided with longitudinal channels through which wires pass. Means are provided for stretching at will the wires so as to turn the tubular piece and the tubular links into a straight tube and
25 for releasing the wires. Further means are provided for turning the tubular piece and tubular links through any angle from the front end of the horizontal part.

30 Other improvements will be hereinafter explained and pointed out in the claims.

When the vertical part of the so improved gastroscope is flexible, it can be easily introduced through the feed pipe into the stomach, after which it is straightened for
35 rendering possible the examination. The vertical part can also be turned through any angle. After the examination of the stomach the vertical part of the gastroscope is turned into its flexible state, so that it
40 can be easily withdrawn.

I will now proceed to describe my invention with reference to the accompanying drawings, in which—

45 Figure 1 is a vertical longitudinal section through the gastroscope, the vertical part being in its flexible and bent state, Fig. 2 is an elevation of the vertical part in its straightened state and a cross section through the rear end of the supporting box
50 in the horizontal part, an intermediate portion of the vertical part being omitted and adjoining parts of the same being shown in section, Fig. 3 is a cross section on an enlarged scale through the vertical part and
55 shows a tubular link in its end view, Fig. 4 is a longitudinal section on the same en-

larged scale through a portion of the vertical part and shows a tubular link, Fig. 5 is a plan view of a plate at the upper end of the tubular piece and shows a device for
60 stretching and releasing the wires passing through the longitudinal channels of the tubular links, Fig. 6 is an elevation of the same, when looked at from right to left in Fig. 5, Fig. 7 is an end view of the same,
65 when looked at from below in Fig. 5, Fig. 8 is similar to Fig. 3 and shows a modified construction of the tubular link, Fig. 9 is similar to Fig. 4 and shows the modified tubular link, Fig. 10 shows in longitudinal
70 section two other modified tubular links hinged to one another, Fig. 11 shows mostly in longitudinal section a modified supporting box of the horizontal part and in elevation the upper portion of the vertical part,
75 and Fig. 12 is a vertical longitudinal section on an enlarged scale through the rear end of the horizontal part and the upper end of the vertical part of this modified gastroscope.
80

Similar characters of reference refer to similar parts throughout the several views.

In the gastroscope illustrated at Figs. 1 to 7 the reference character 17 denotes a horizontal supporting box provided with a cover,
85 on which a tube 2 is in any known manner longitudinally guided, so that it can be shifted and adjusted. The tube 2 is provided at the front end with an ocular 3 of any known construction and at the rear end
90 with an inclined mirror 27. It may contain a collective lens 28 of any known construction near the mirror 27. A tubular piece 1^a is mounted to turn in the box 17 at its rear end and is shown as made in one with a lace
95 pulley 18, which bears on the bottom of the box 17. Another lace pulley 20 is mounted to turn on the bottom of the box 17 at its front end and can be turned from without by means of a small handle 20^a or the like.
100 An endless lace 21 connects the two lace pulleys 18 and 20 and it will be understood, that the tubular piece 1^a can be turned through any angle from the front end of the supporting box 17. The tubular piece 1^a is
105 on one side connected with a series of tubular links 1, 1 by means of an elastic steel strip 4 (see Figs. 3 and 4). Each tubular link 1 is eccentric in cross section (see Fig. 3) and its thinnest vertical portion is shown
110 as flattened for facilitating the attachment of the steel strip 4. The latter may be con-

nected with the several links 1, 1 in any known manner, for example by means of the rivets 5, 5 shown. It is essential that the end faces of the tubular piece 1^a and the several links 1, 1 be at right angles to their axes and can come in close contact with one another. On the side opposite to the steel strip 4 each tubular link 1 is provided in its thickest part with two vertical channels 7, 7 which, when the end faces of the tubular piece 1^a and the several links 1, 1 are in close contact with one another, are made to register with one another, so that two wires 8, 8 can be passed through them. A plate 19 (see Figs. 5 to 7) is secured on the lace pulley 18 or may be made in one piece with the tubular piece 1^a. It carries two bearings 10, 10 for a short shaft 9, which can be turned and longitudinally shifted in them. The shaft 9 is provided with a drum 9^a in the middle, a square head 6 and a screw-threaded end 25. The upper ends of the two wires 8 are fastened on the drum 9^a and can be wound thereon or off. The square head 6 can engage in a square hole 26 (Fig. 7) in the one bearing 10 for preventing the drum 9^a from turning. As the shaft 9 requires to be longitudinally shifted for securing or releasing it, preferably a single wire is employed in place of the two wires 8 and is doubled at the end of the lowermost tubular link 1, where it preferably passes over small pulleys (not shown) therein provided or through eyes or rounded guides of any known construction. Then the two parallel parts of the doubled wire 8 can easily adjust themselves in the channels 7, 7 for equalizing their tension, when the shaft 9 is shifted in one or the other direction. An operating shaft 22 is mounted to turn and longitudinally shift in suitable bearings provided in the supporting box 17. This shaft 22 is provided at its front end with a handle 23 or other equivalent, for example a knurled knob and at its rear end with a nut 24, which can engage the screw-threaded end 25 of the short shaft 9.

When by the lace pulley 20 the other one 18 is turned in one direction, the screw-threaded end 25 of the shaft 9 at the tubular piece 1^a will strike the nut 24 and the square head 6 can engage in the square hole 26, whereupon the handle 25 or the like can be pushed inward and turned in one direction for screwing the nut 24 home on the screw 25 and thus connecting the two shafts 22 and 9. Then the handle 23 can be pulled forward for withdrawing the square head 6 from its hole 26, whereupon the handle 23 is further turned for winding the ends of the doubled wire 8 on the drum 9^a and thus straightening the whole series of tubular links 1, 1, which with the tubular piece 1^a will be converted into a straight vertical tube, through which rays of light can pass

for falling on the mirror 27 and passing therefrom through the collective lens 28 to the ocular 3.

A hose 15 is drawn over the series of tubular links 1, 1 and can be in any known manner fastened on the tubular piece 1^a. Later on I shall show an example of how this can be effected. The hose 15 leaves sufficient space for the known air tube 11 and two conductors 12, 12 disposed on the side of the steel strip 4. The air tube 11 serves for conducting compressed air to the stomach, which can be thereby blown in a known manner. The upper end of the air tube 11 is in any known manner connected with the interior of the supporting box 17. Later on I shall show an example of how this can be done. I have not shown how compressed air from a suitable source can be introduced into the front end of the box 17, as this is known. The air tube 11 terminates at its lower end in a checking valve 49 of any known construction. The lower end of the hose 15 is closed and is thickened and rounded off at 16, so as to save the stomach from injuries. An inclined mirror 14 and a small incandescent electric lamp 13 in conjunction with the lower end of the air tube 11 and its checking valve 49 are embedded in the lower end of the hose 15, an aperture 15' being left for the mirror 14 and another aperture 15'' for the lamp 13. The latter is connected with the two conductors 12, 12 already referred to above, while these conductors are in turn connected with a source of current through the supporting box 17 in any known manner. Later on I shall show an example of how this may be effected. In case the air tube 11 is a hose, preferably suitable projections or arms (not shown) are provided on the several tubular links 1, 1 for preventing the hose 11 from shifting to a side.

Where so preferred one or several collective or other lenses may be disposed in one or several of the tubular links 1, 1. The collective lens 28 may be omitted, or several lenses may be disposed in the horizontal tube 2.

Before the introduction of the gastroscope into the stomach, its vertical part requires to be in its flexible state, so that it can adapt itself to the feed pipe during the introduction. Afterward the vertical part is in the described manner straightened, whereupon the horizontal part is connected with the sources of current and compressed air and the instrument can be used.

Where so preferred, the tubular links 1, 1 may be made of uniform thickness and provided with longitudinal guides 7^a, 7^a for the wires 8, 8, as is clearly shown at Figs. 8 and 9. Of course the two wires 8, 8 or the doubled wire 8 may be replaced by a single wire, in which case the tubular links 1, 1 are each provided with a single hole 7 or a

single guide 7^a only. Where so preferred, the tubular links 1, 1 may be connected with one another by hinges 29, 29, as is shown at Fig. 10.

5 From the above description it will be seen, that the vertical part of the gastroscope can not be straightened in any position, but it requires to be first turned into the correct position, before it can be straightened.
10 This necessity is avoided with the modified construction illustrated at Figs. 11 and 12.

A tubular piece 1^b is made of the same eccentric cross section at its lower end as any tubular link 1 and is made cylindrical in its
15 middle part and therein provided with a longitudinal slot 43. A ring 42 is mounted to slide on the middle part of the tubular piece 1^b and is provided with a pin 41 engaging through the slot 43, whereby it is
20 prevented from turning. To the ring 42 are attached the two wires 8, 8 or the single wire 8, as the case may be. The tubular piece 1^b is made thick at the upper end and is made in one with a bevel wheel 36, which
25 bears on the bottom of the supporting box 17^a. The bore of the tubular piece 1^b is made a little larger in diameter for the middle part and the upper end. In this wider bore an operating tube 33 is mounted to
30 turn, which is on its outside provided with a helical groove 32 and the pin 41 is made to engage in this groove. At the upper end the tube 33 is made in one with an opposite bevel wheel 36^a, which bears with its rim 34
35 from below against the cover of the box 17^a, whereby the tube 33 is prevented from longitudinal motion. A shaft 38 provided with a knurled knob 46 at the front end and with a small bevel wheel 37 at the rear end is
40 mounted to turn in a bearing 39, which is mounted to rock with its two pivots 40 in the box 17^a. The small bevel wheel 37 can mesh with either of the two bevel wheels 36 and 36^a, which are made alike.

45 It will be understood, that on the knurled knob 46 being pressed upward and turned, the small bevel wheel 37 will engage the lower bevel wheel 36 and thereby turn the vertical part of the gastroscope, while on
50 the knob 46 being pressed downward and turned in either direction the small bevel wheel 37 will engage the upper bevel wheel 36^a and thereby turn the operating tube 33, so that the pin 41 engaging in its helical
55 groove 32 will be moved upward or downward, as the case may be, for straightening or releasing respectively the vertical part of the gastroscope by means of the wires 8, 8.

The hose 15 is shown as being fastened
60 with its upper end on the thicker end of the tubular piece 1^b, which is provided with a shallow groove. The upper end of the air tube 11 is shown as communicating with an inclined channel which leads into an annu-
65 lar chamber 50. A tube 47 of any known

cross section is shown as attached to the bottom of the box 17^a and communicating with the annular chamber 50 through an opening 48. Two insulated contact rings 44, 44 are shown as embedded in the upper end of the
70 tubular piece 1^b and are to be severally connected with the two conductors 12, 12 (Figs. 3 or 8), while two conductors 45, 45 are disposed in the tube 47 and are connected with
75 two contact springs (not shown) of any known construction, which are adapted to bear on the two contact rings 44, 44. It will be then seen, that for any position of the vertical part the current can be passed
80 through the incandescent electric lamp 13 and compressed air can also be introduced through the air tube 11 into the stomach, after a small hose has been put over the mouthpiece 51 (Fig. 11) at the tube 47.

The gastroscope can be varied in many
85 respects without departing from the spirit of my invention.

I claim:

1. In a gastroscope, the combination with a horizontal tube having an ocular at the
90 front end and a mirror at the rear end, of a vertical tubular piece mounted to turn in said horizontal tube at its rear end, a series of tubular links flexibly connected on one side with said vertical tubular piece and
95 with one another and having on the other side longitudinal channels, the end faces of said tubular piece and said tubular links being at right angles to their axes and adapted to come in close contact with one another,
100 wires passing through the longitudinal channels of said tubular links, means for stretching and releasing said wires so as to turn said tubular piece and said series of tubular links into a straight tube and to release same
105 at will, and means for turning the tubular piece and said series of tubular links through any angle.

2. In a gastroscope, the combination with a horizontal tube having an ocular at the
110 front end and a mirror at the rear end, of a tubular piece suspended from said horizontal tube at its rear end, a series of tubular links, an elastic steel strip connecting said tubular piece and said tubular links with
115 one another on one side, the end faces of said tubular piece and said tubular links being at right angles to their axes and adapted to come in close contact with one another and the tubular links having on the side oppo-
120 site to the steel strip longitudinal channels, wires passing through the longitudinal channels of said tubular links, and means for stretching and releasing said wires so as to turn said tubular piece and said series of
125 tubular links into a straight tube and to release same at will.

3. In a gastroscope, the combination with a horizontal tube having an ocular at the
130 front end and a mirror at the rear end, of a

tubular piece suspended from said horizontal tube at its rear end, a series of tubular links hinged to said tubular piece and to one another on one side and having on the other side longitudinal channels, the end faces of said tubular piece and said tubular links being at right angles to their axes and adapted to come in close contact with one another, wires passing through the longitudinal channels of said tubular links, and means for stretching and releasing said wires so as to turn the tubular piece and the series of tubular links into a straight tube and to release same at will.

4. In a gastroscope, the combination with a supporting box, of a horizontal tube longitudinally shiftable on said supporting box and having an ocular at the front end and a mirror at the rear end, a vertical tubular piece mounted to turn in said supporting box at its rear end, a series of tubular links flexibly connected with said tubular piece and with one another on one side and having on the other side longitudinal channels, the end faces of said tubular piece and said tubular links being at right angles to their axes and adapted to come in close contact with one another, wires passing through the longitudinal channels of said tubular links, a horizontal short shaft mounted to turn at said tubular piece and adapted to wind on and off the ends of said wires, a shaft longitudinally shiftable and turnable in said supporting box and adapted to be turned from without at the front end, means for coupling said horizontal short shaft with said shaft and securing them at will after turning, a lace pulley at said tubular piece, a second lace pulley mounted to turn in said supporting box at its front end, an endless

lace connecting said lace pulley with said second lace pulley, and means for turning said second lace pulley from without.

5. In a gastroscope, the combination with a supporting box, of a horizontal tube longitudinally shiftable on said supporting box and having an ocular at the front end and a mirror at the rear end, a vertical tubular piece mounted to turn in said supporting box at its rear end and having a longitudinal slot below and a bevel wheel above, a series of tubular links flexibly connected with said tubular piece and with one another on one side and having on the other side longitudinal channels, the end faces of said tubular piece and said tubular links being at right angles to their axes and adapted to come in close contact with one another, wires passing through the longitudinal channels of said tubular links, a ring longitudinally movable on said tubular piece and connected with the upper ends of said wires, an operating tube turnable in said tubular piece and having an opposite bevel wheel above and an external helical groove below, a pin in said ring and adapted to engage through the longitudinal slot of said tubular piece into the helical groove of said operating tube, a rocking bearing in said supporting box, and an operating shaft mounted to turn in said rocking bearing and having at the front end a knob adapted to be turned from without and at the rear end a small bevel wheel which can mesh at will with said bevel wheel or said second bevel wheel.

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