

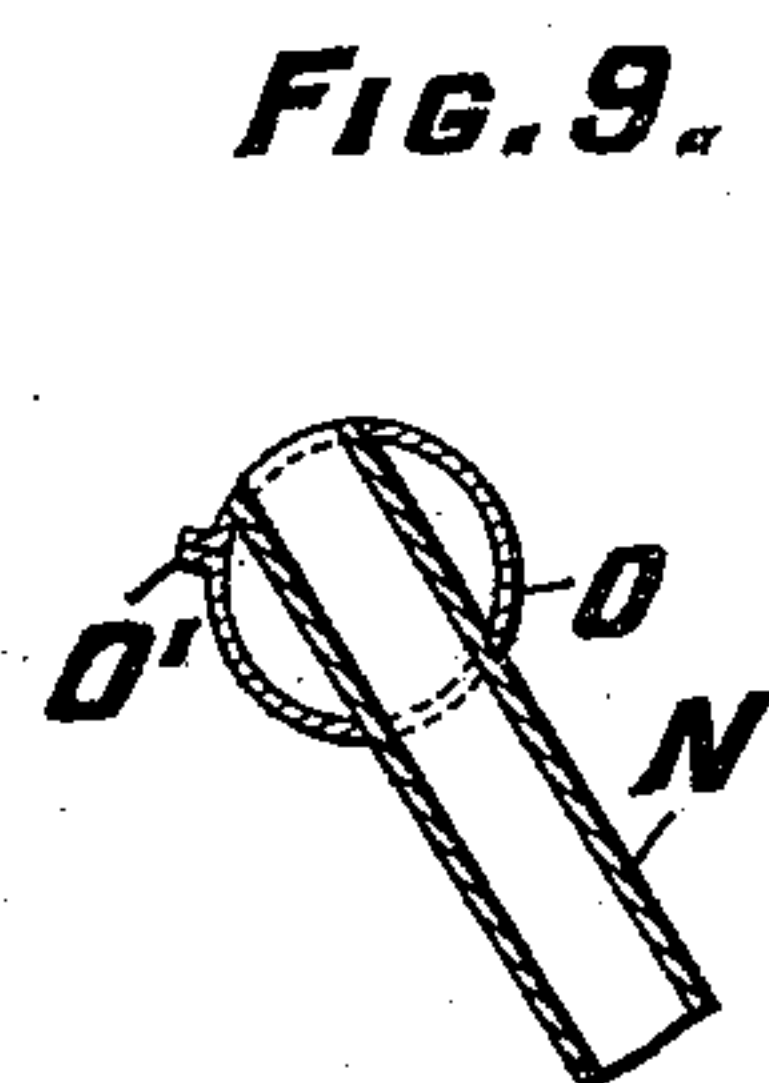
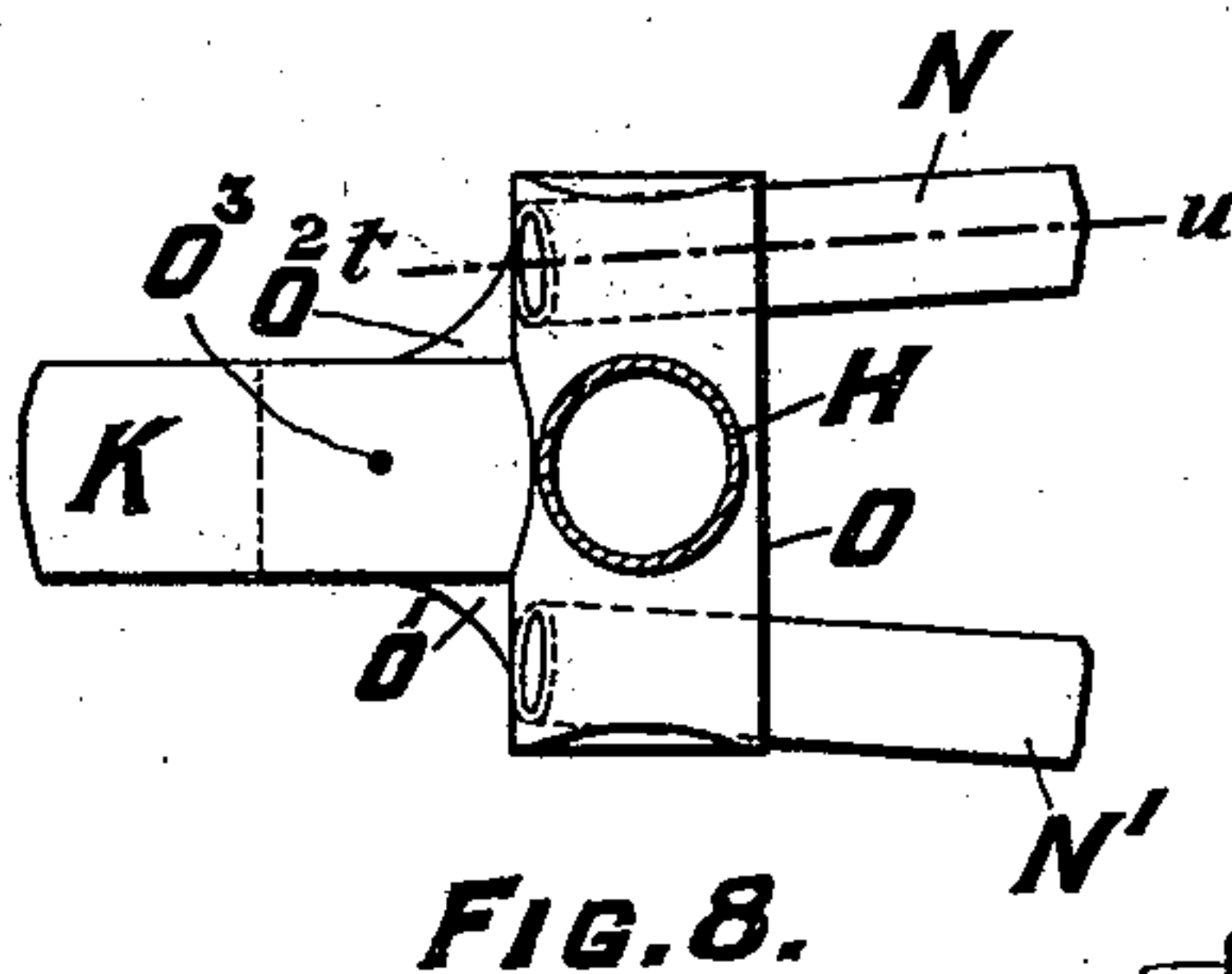
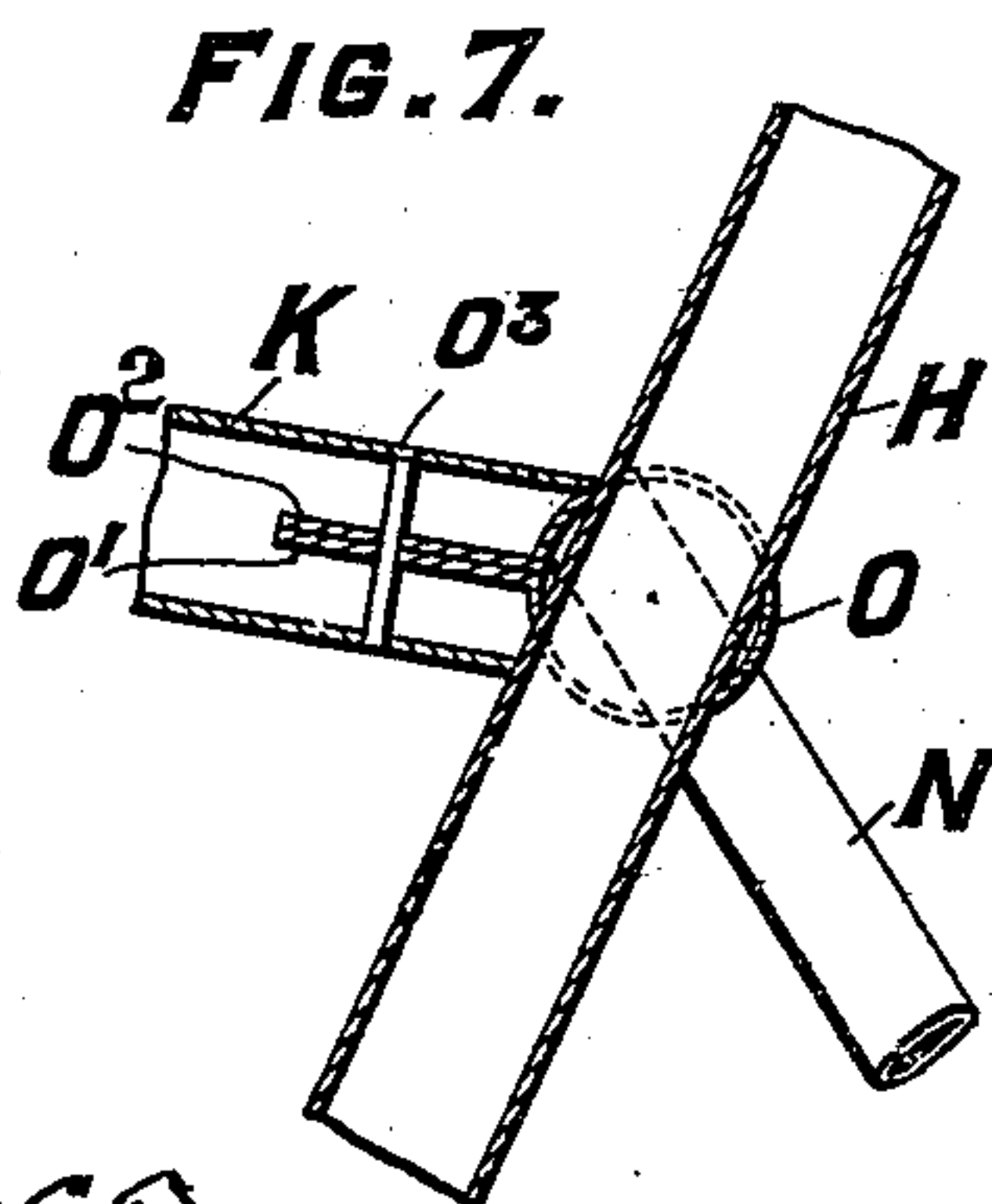
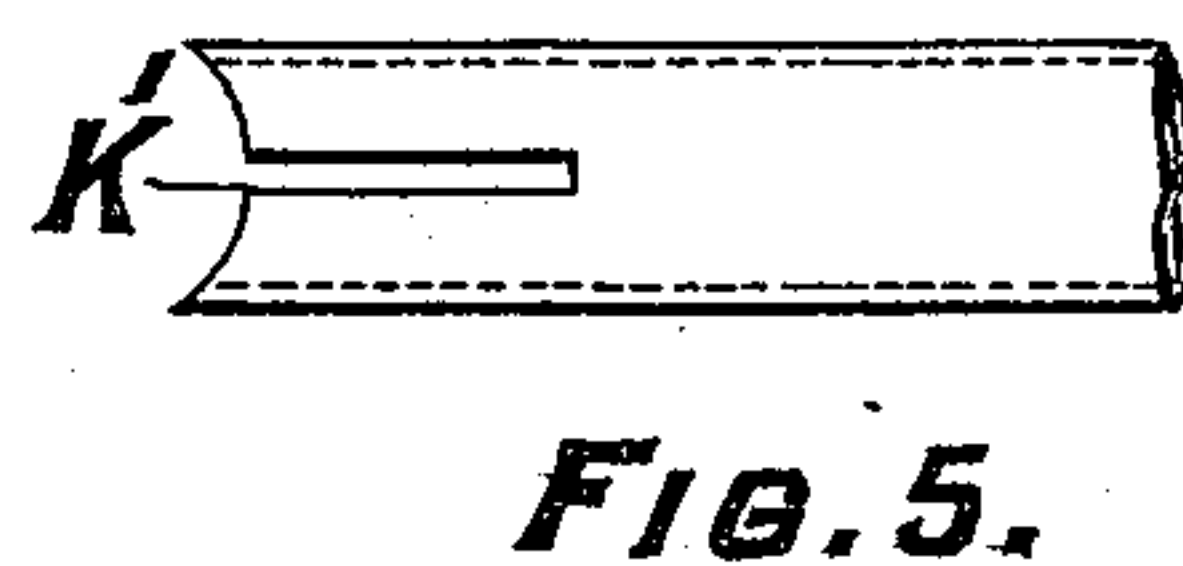
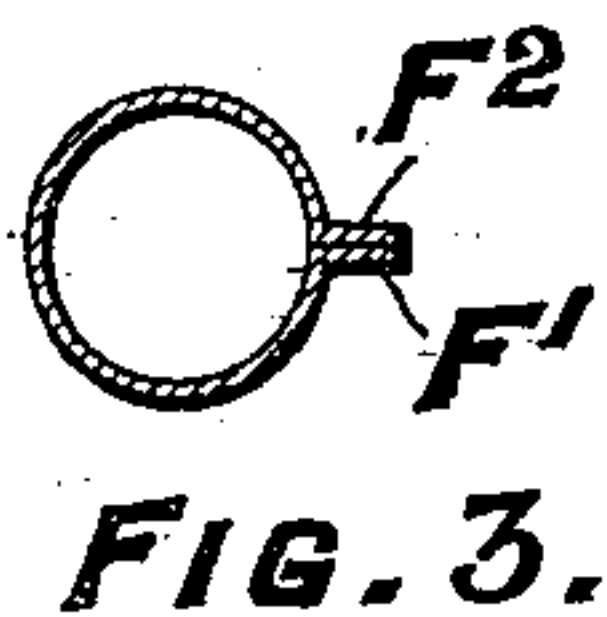
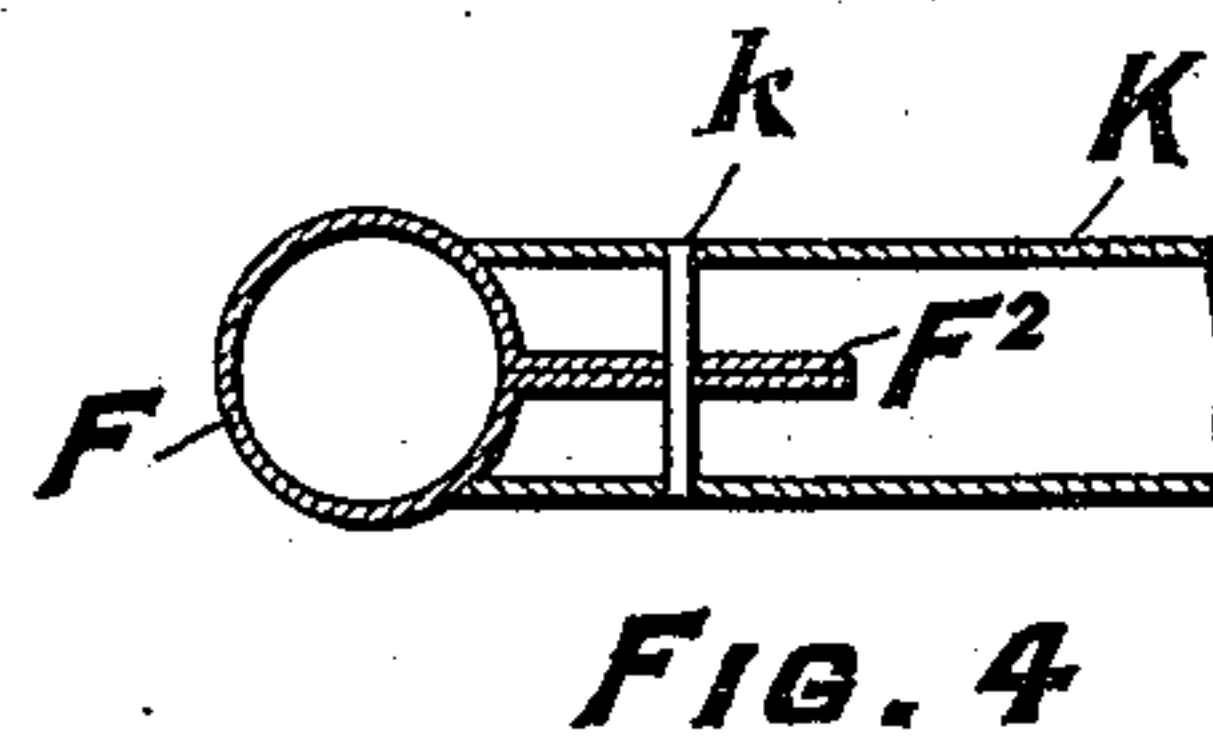
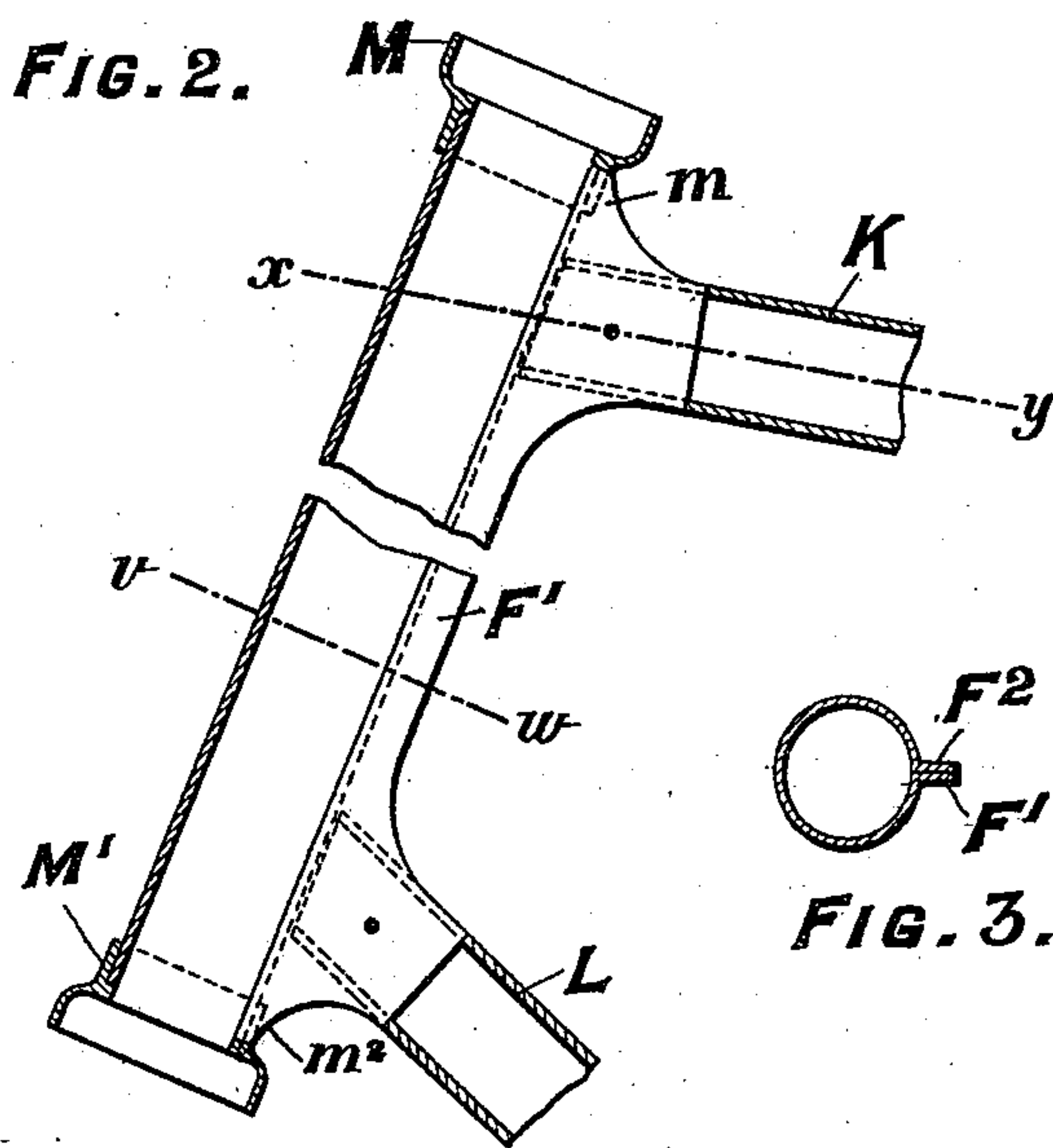
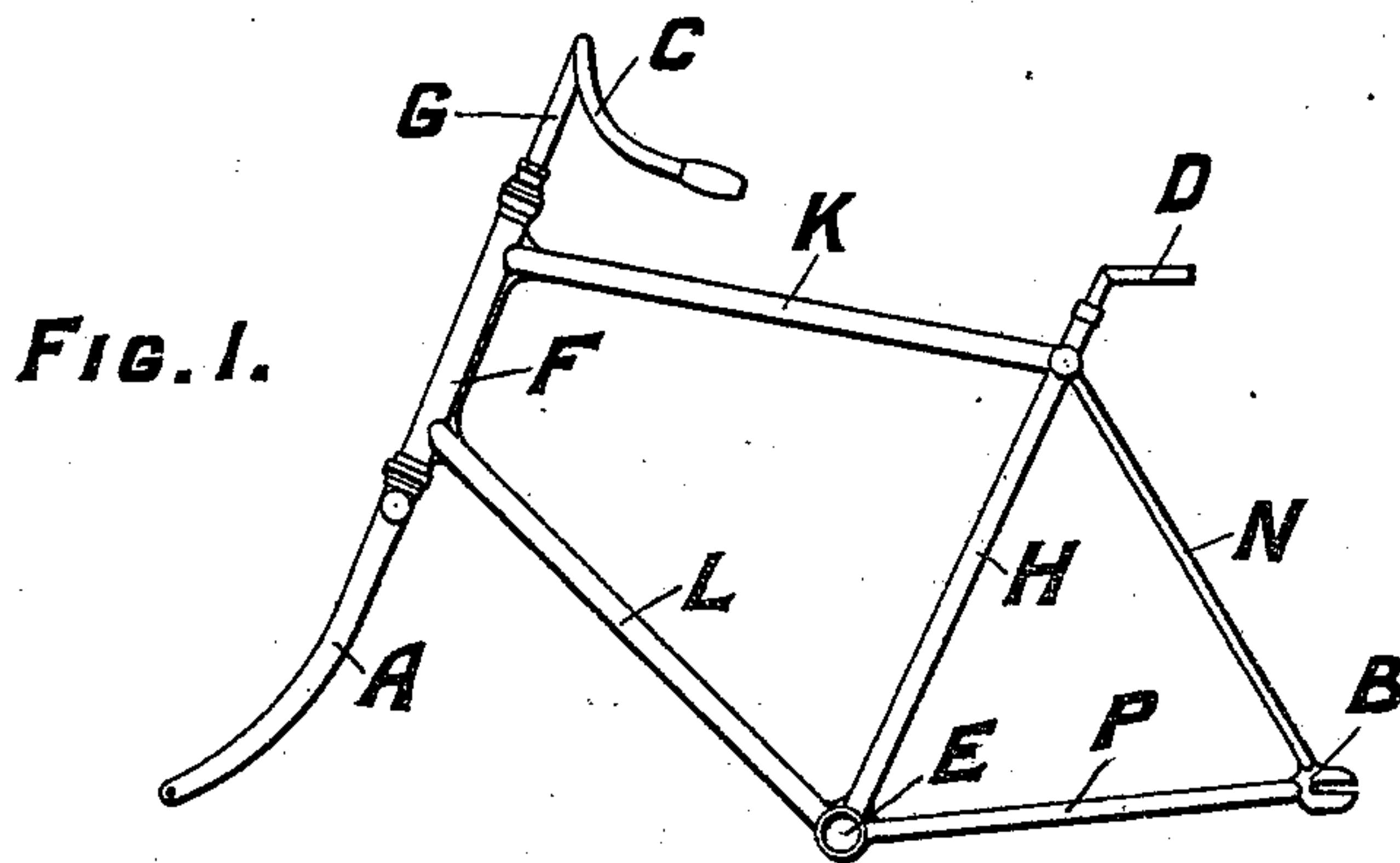
(No Model.)

2 Sheets—Sheet 1.

J. M. & W. STARLEY.  
CONSTRUCTION OF CYCLES.

No. 500,971.

Patented July 4, 1893.



Witnesses:  
J. A. Rutherford.  
Robert Bennett.

Inventors:  
John M. Starley & William Starley.  
By *James L. Norris*,  
Attorney.

(No Model.)

2 Sheets—Sheet 2.

J. M. & W. STARLEY.  
CONSTRUCTION OF CYCLES.

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Patented July 4, 1893.

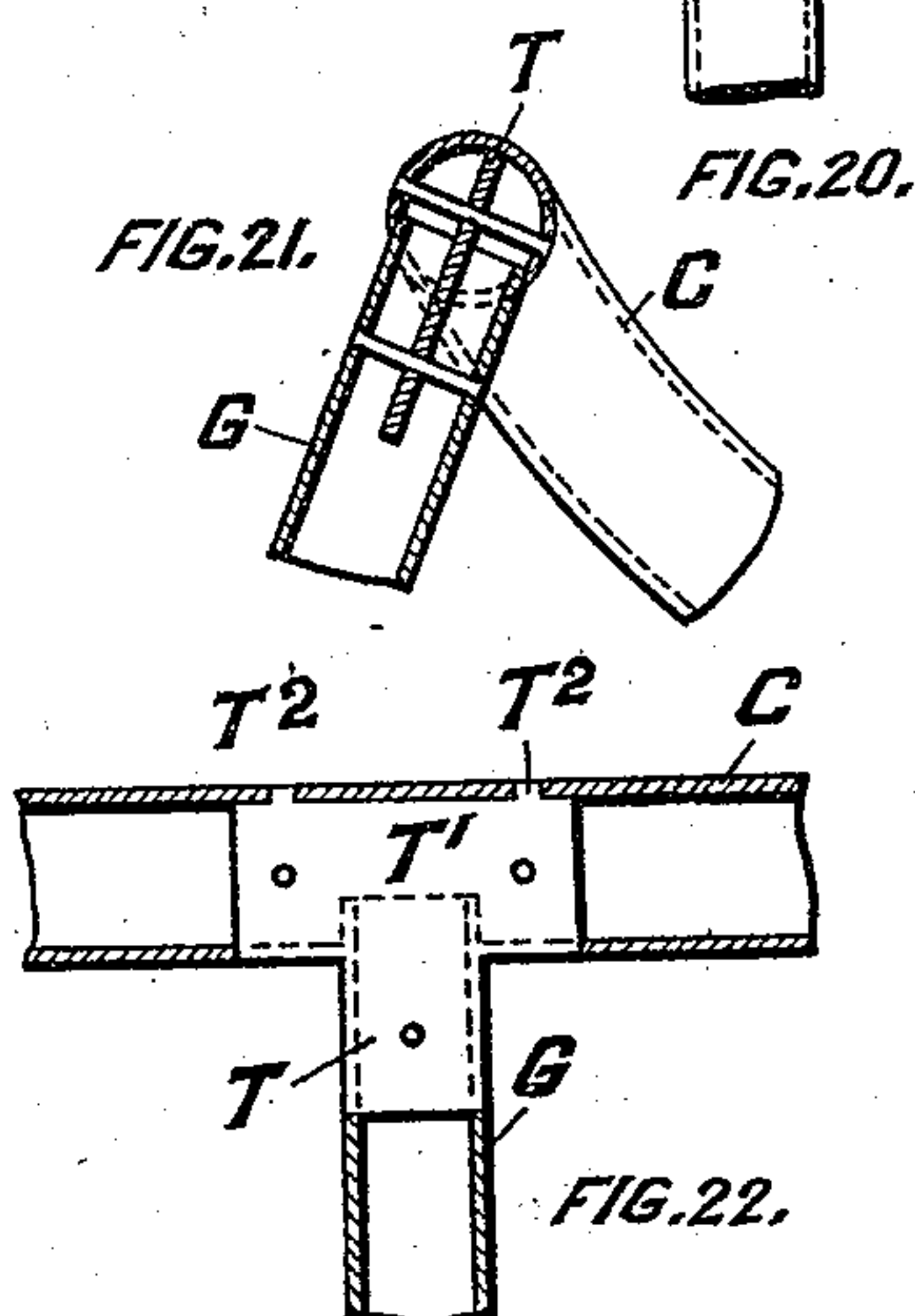
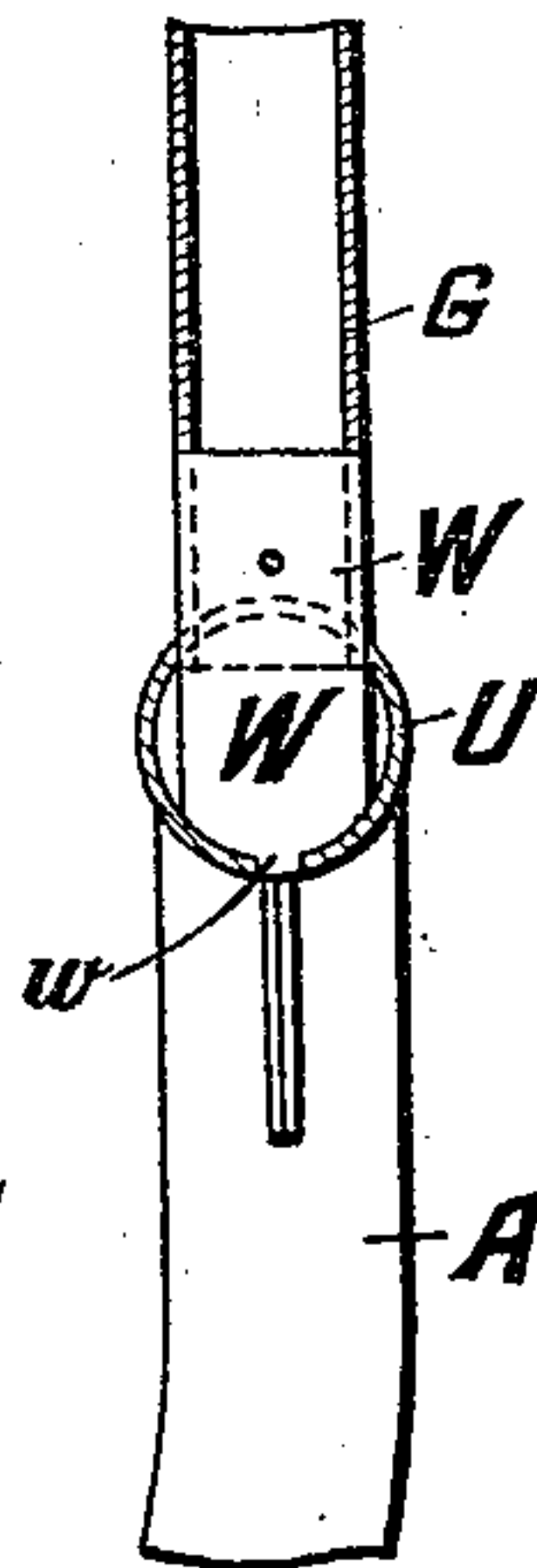
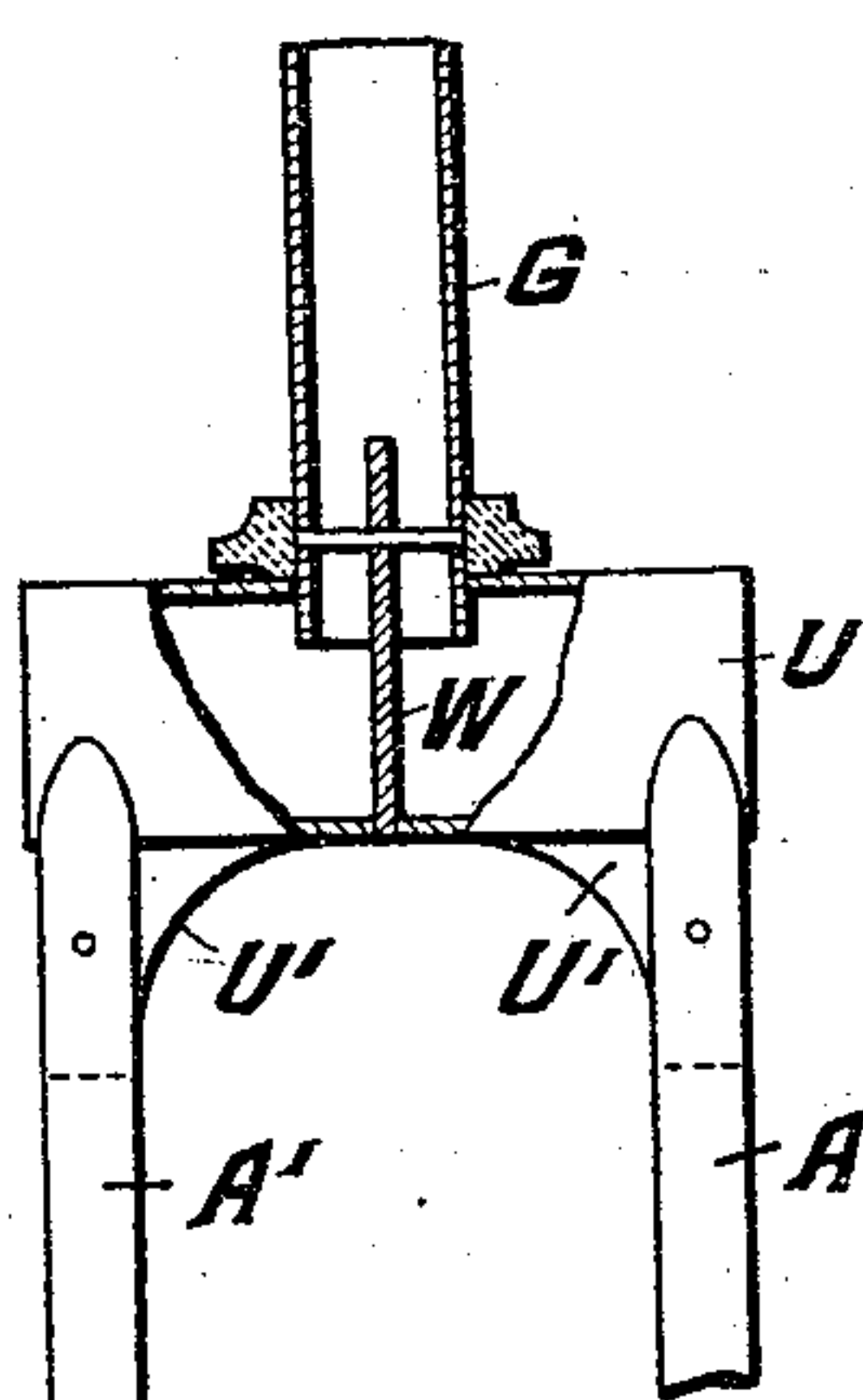
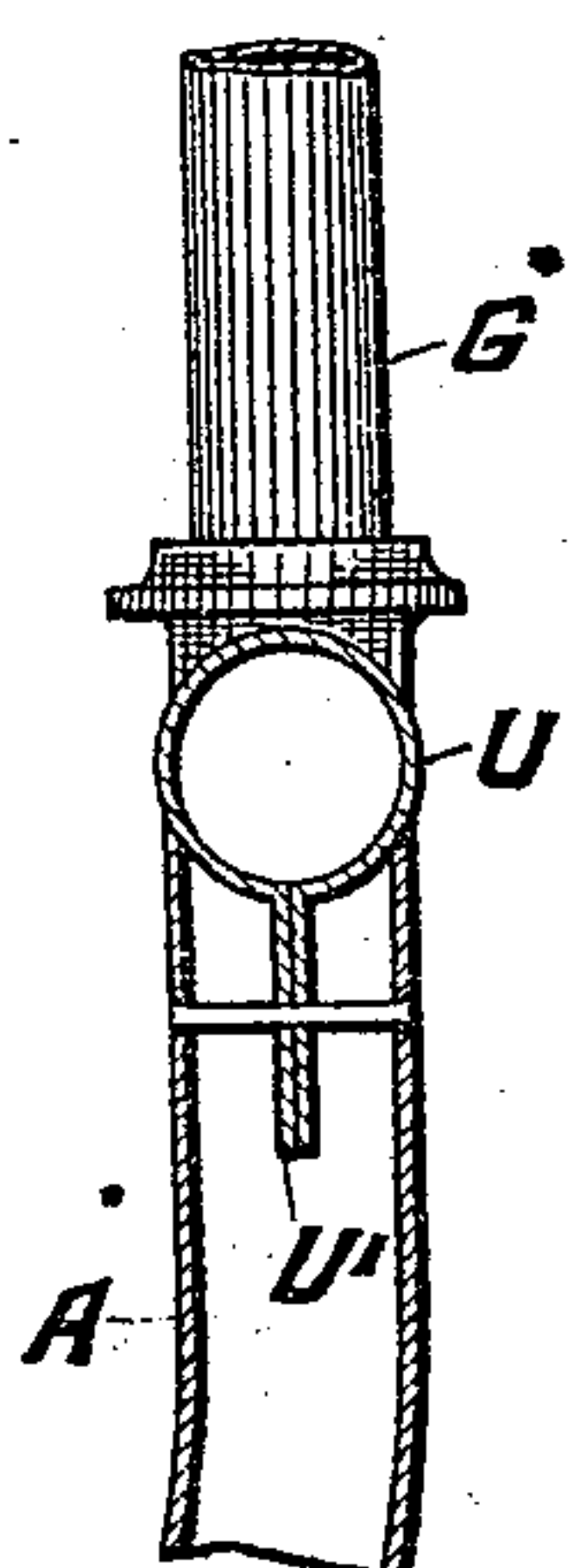
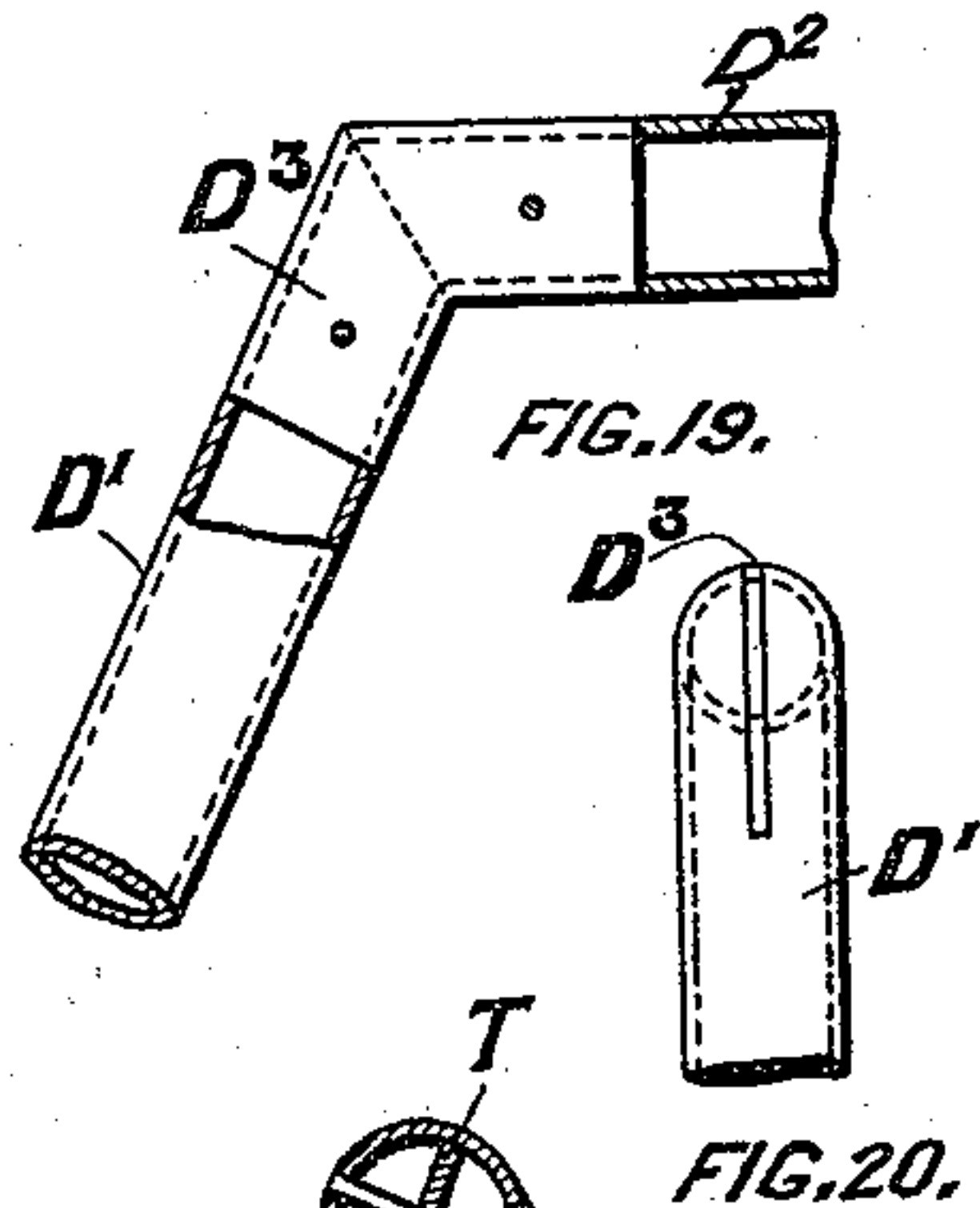
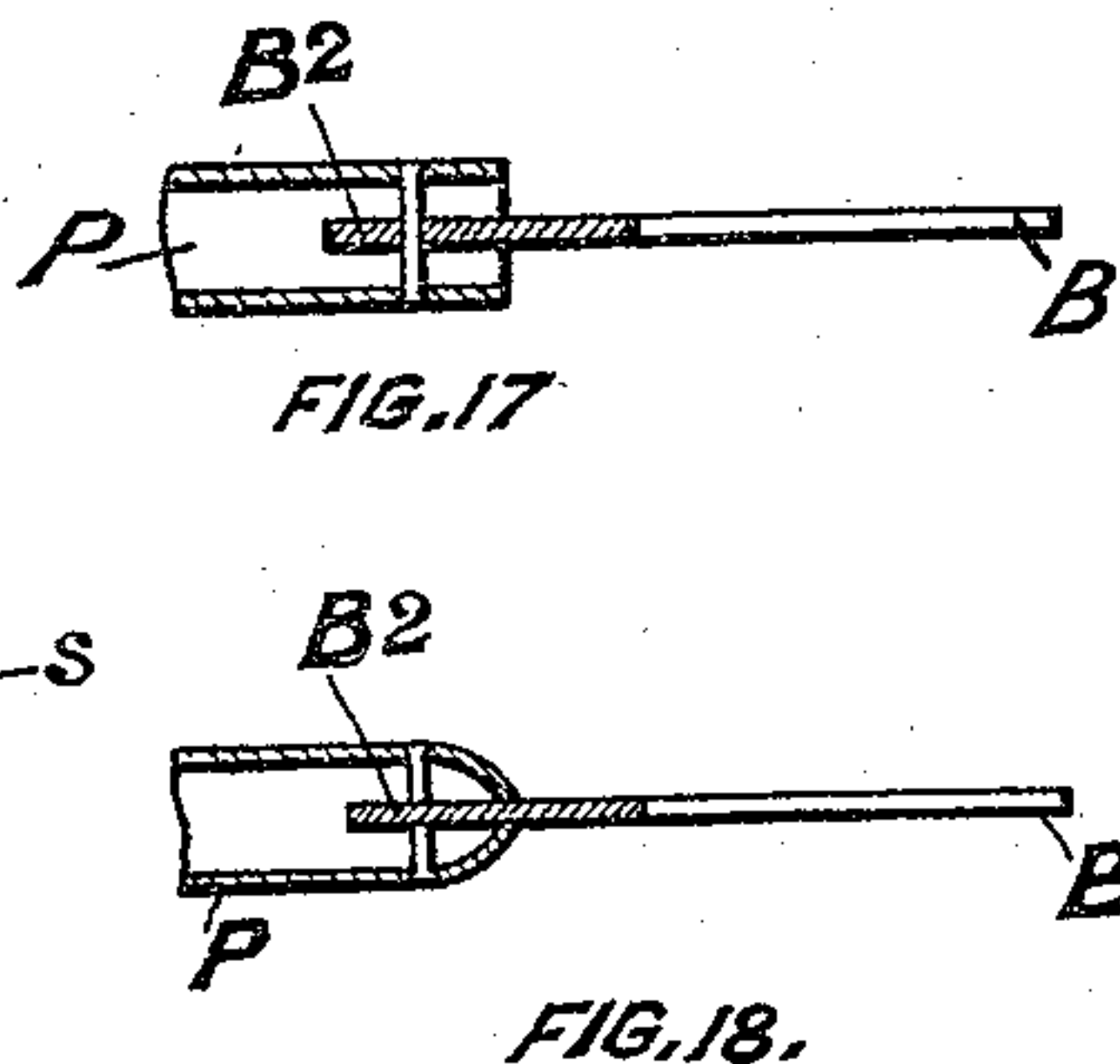
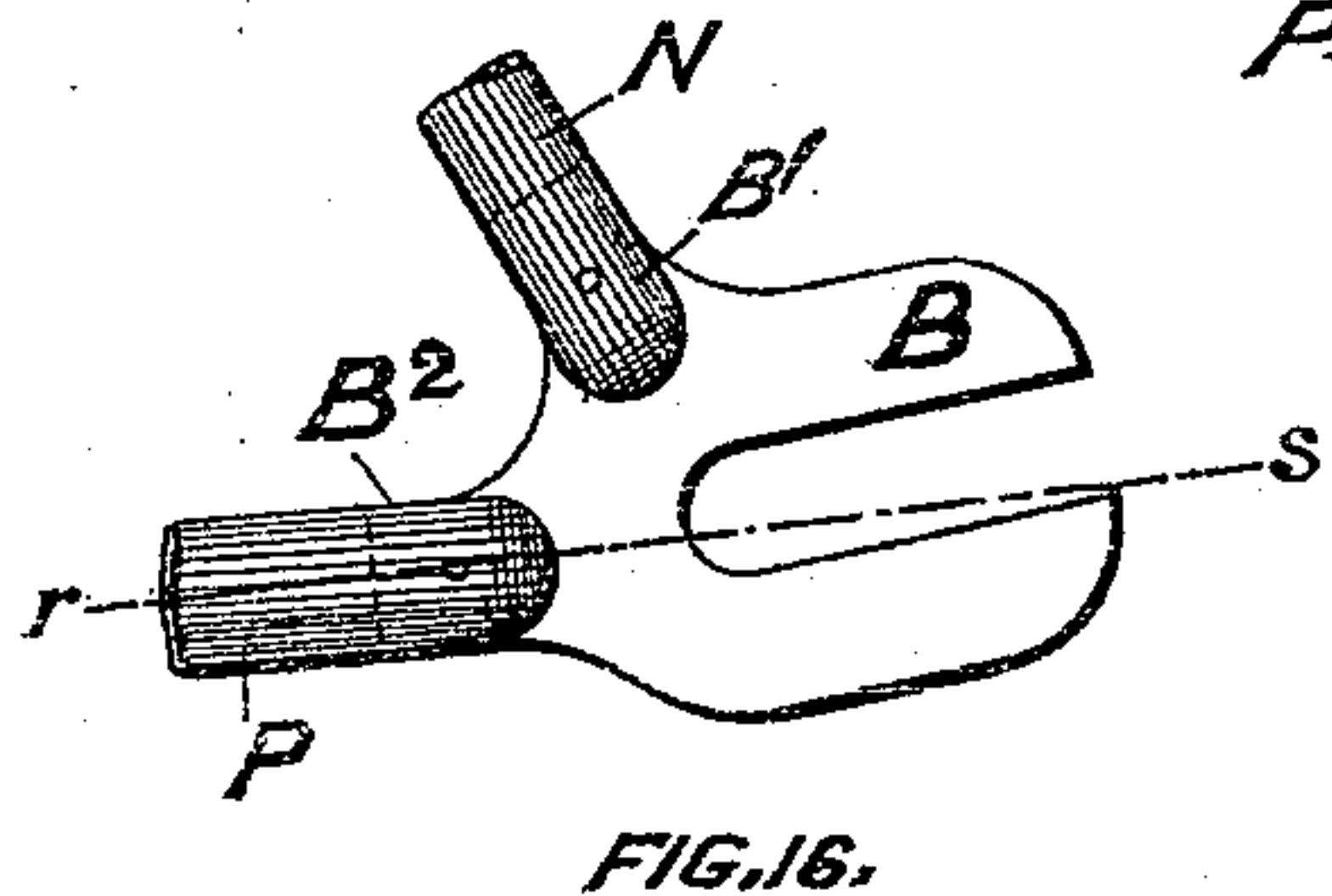
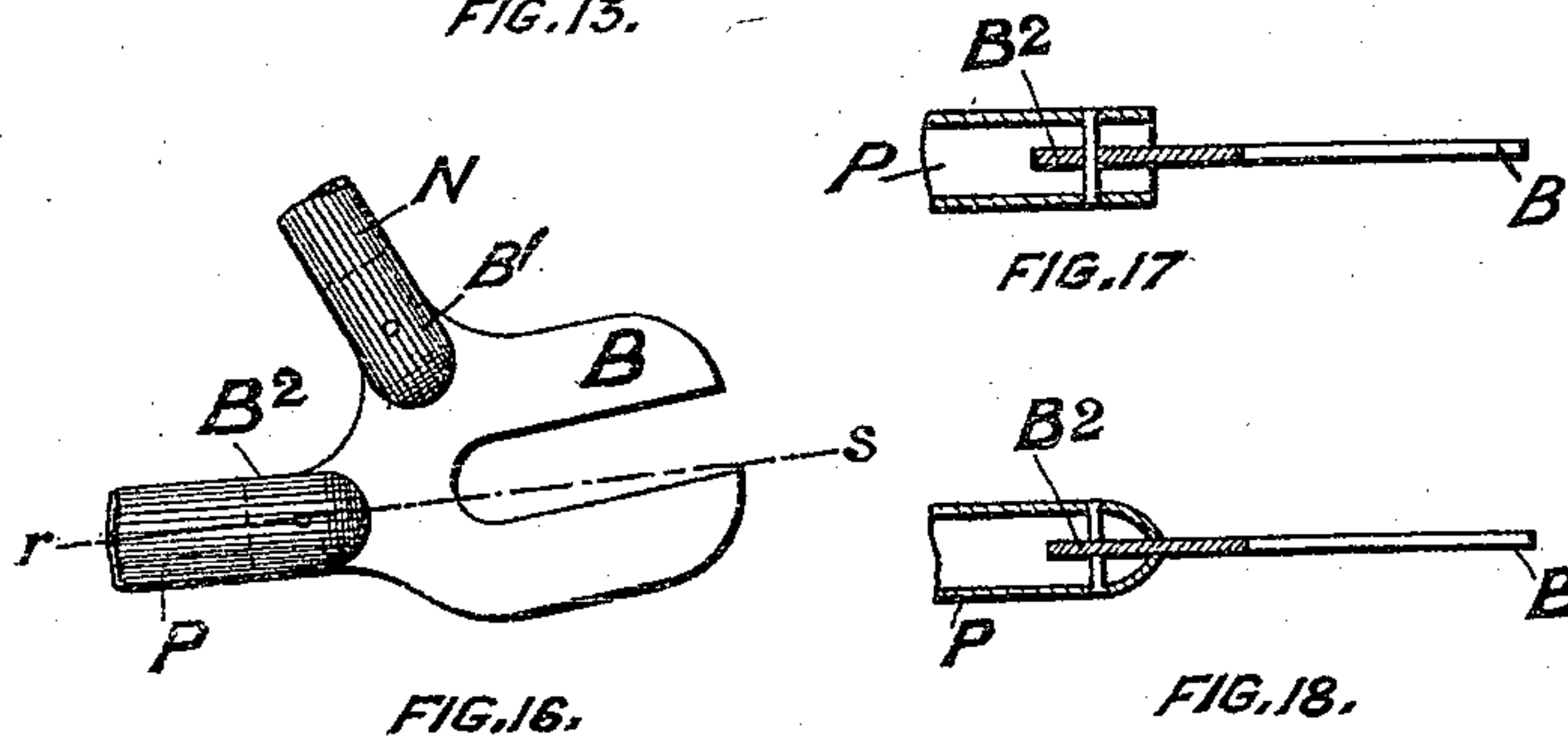
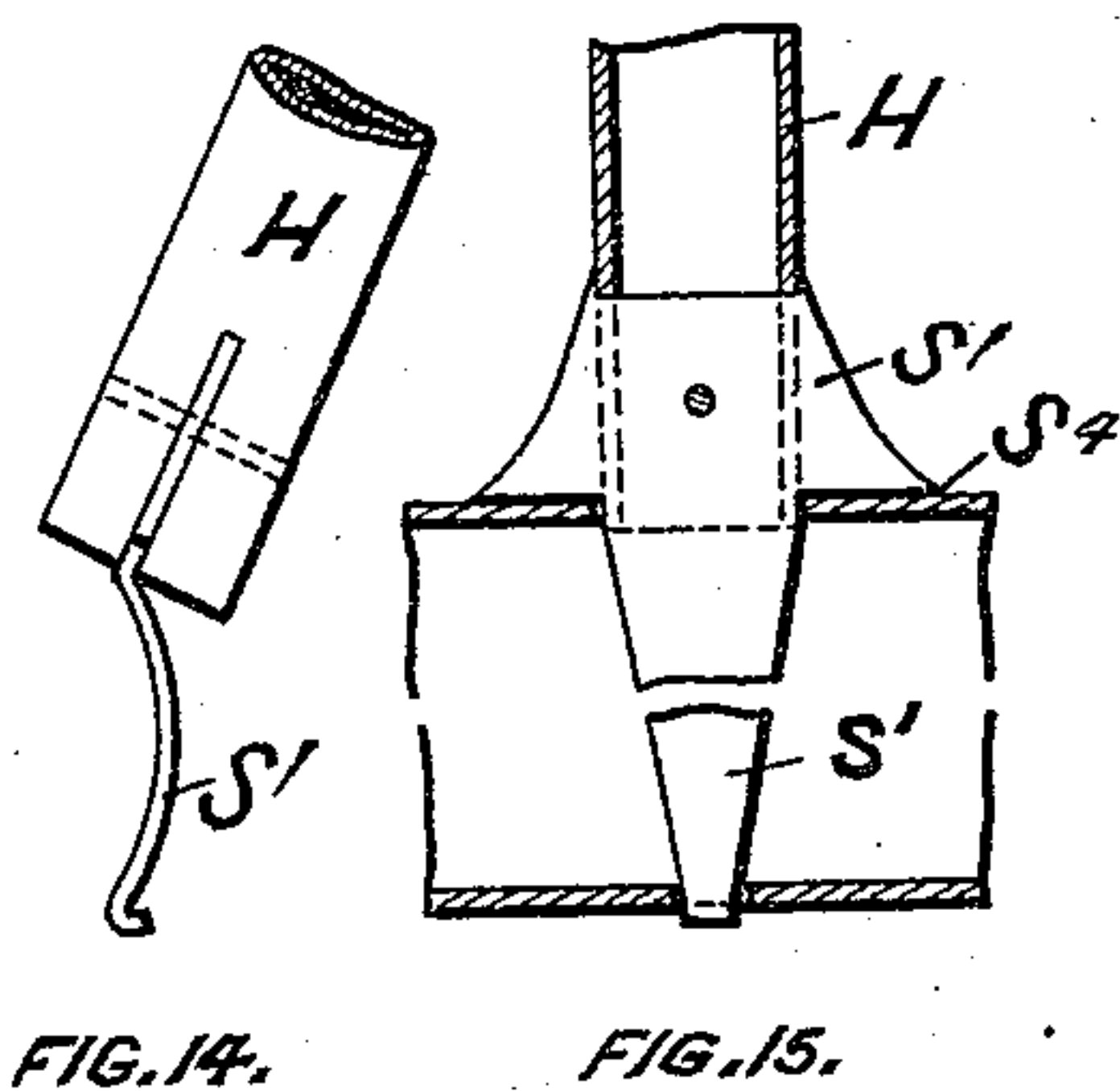
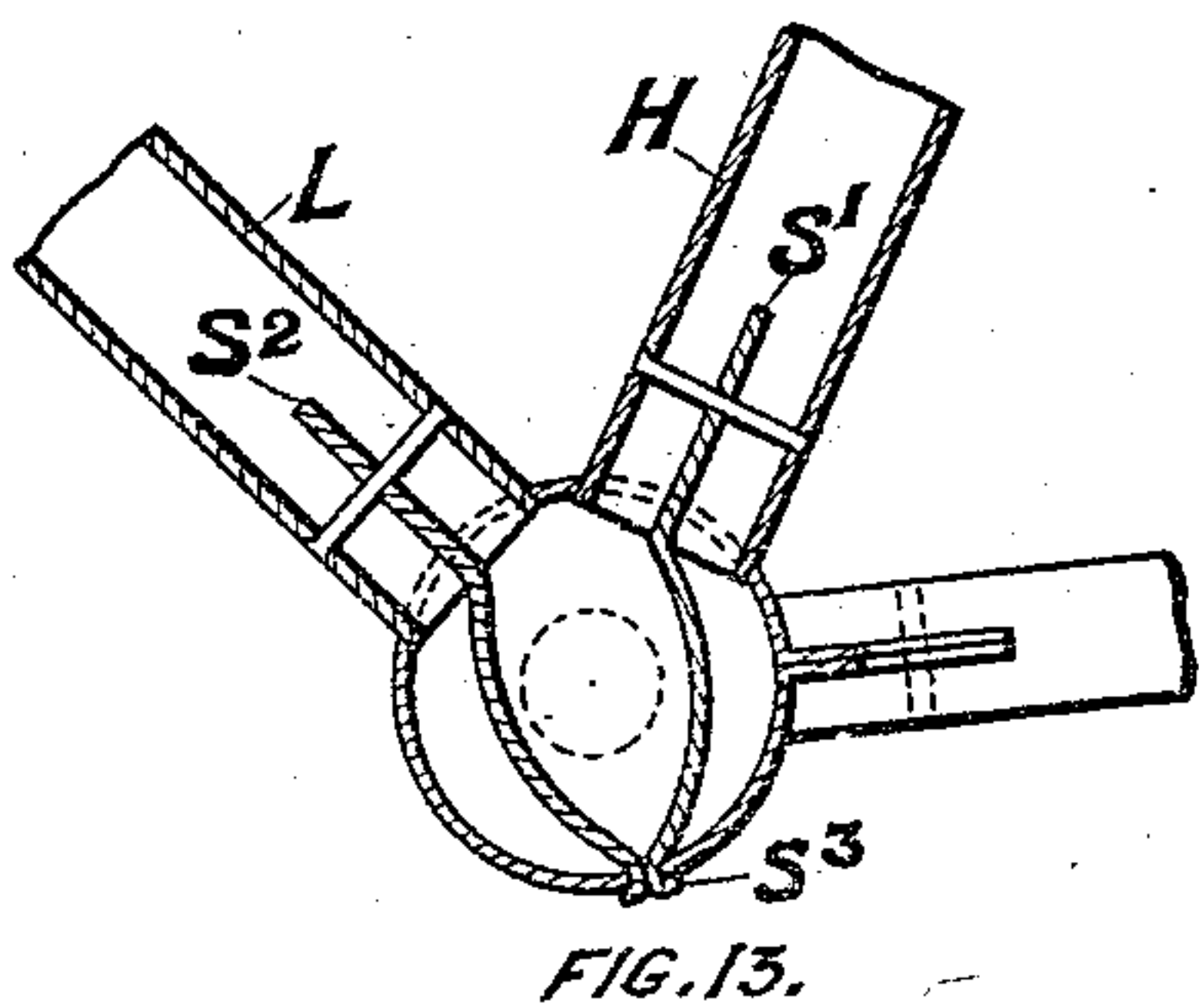
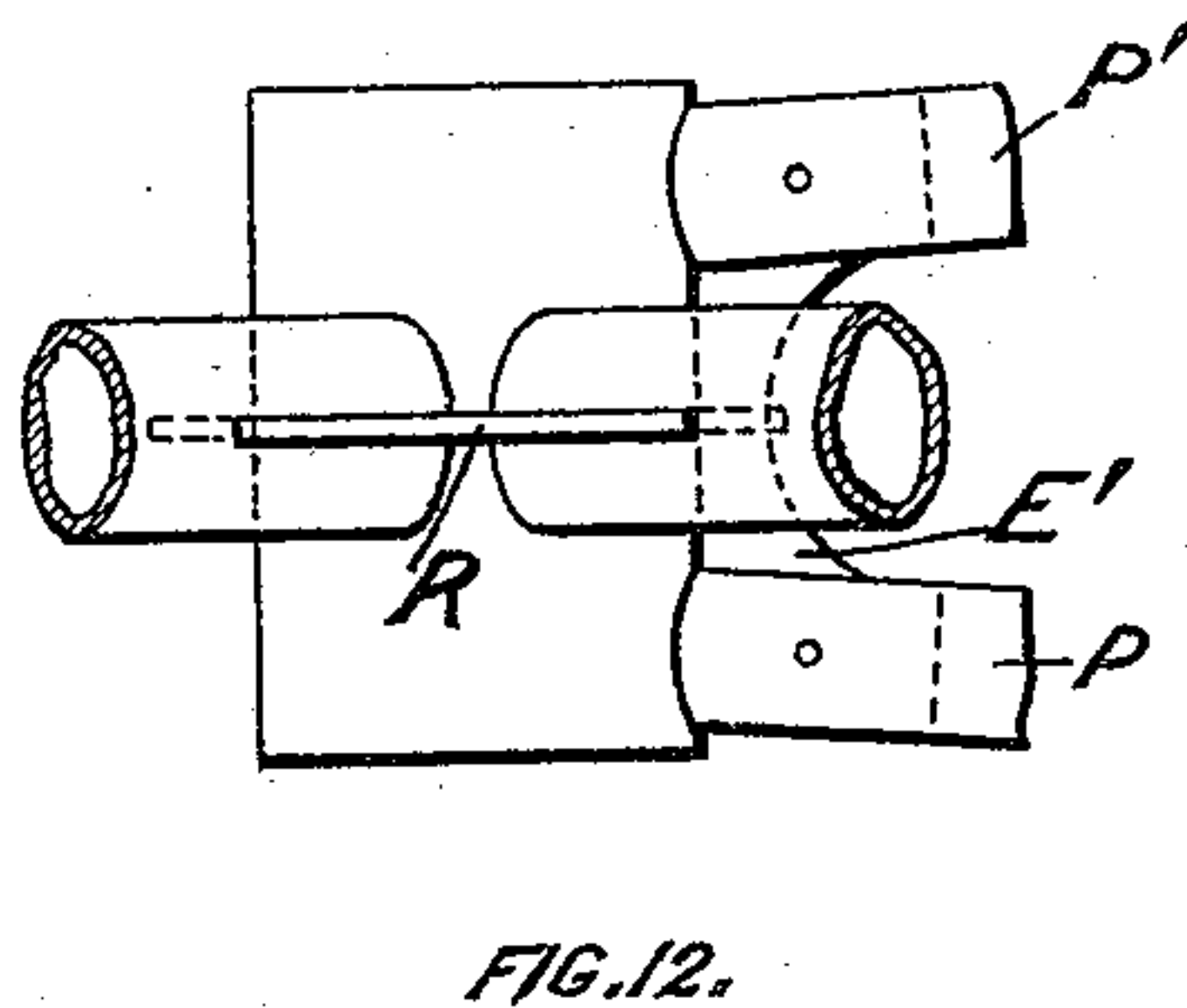
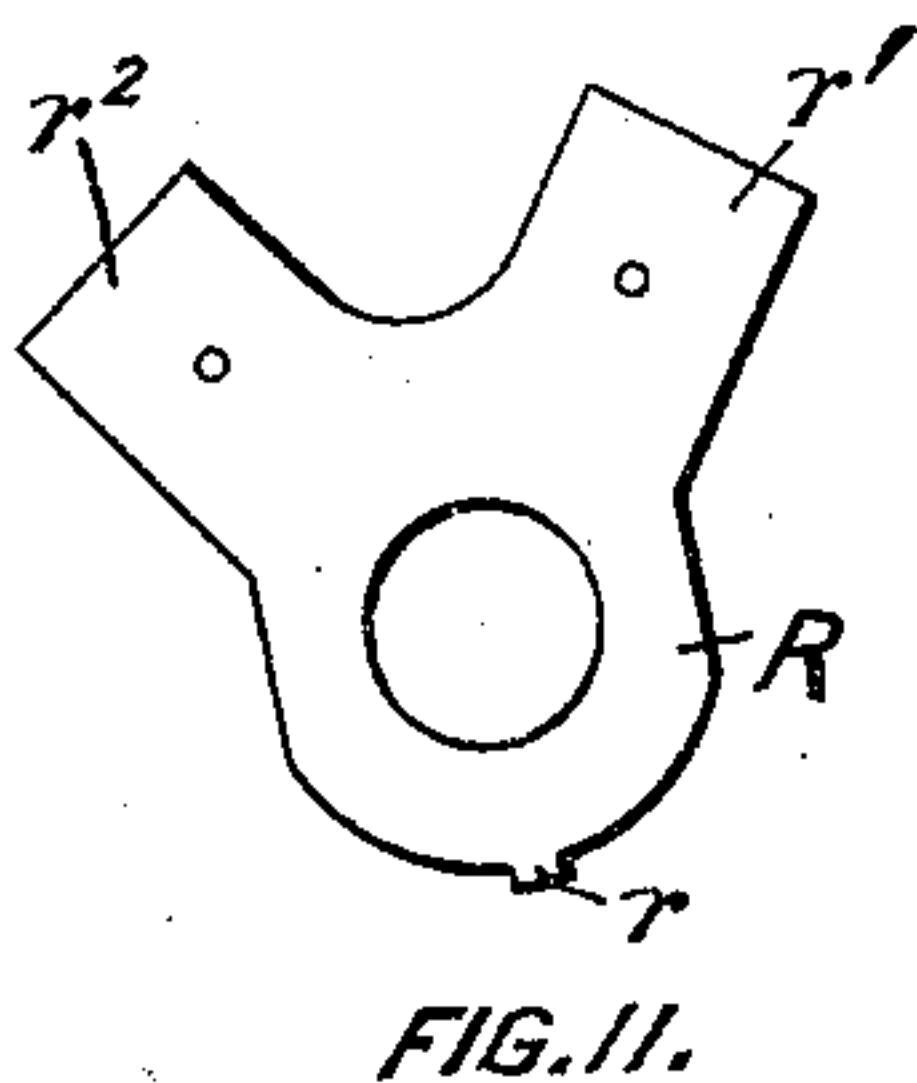
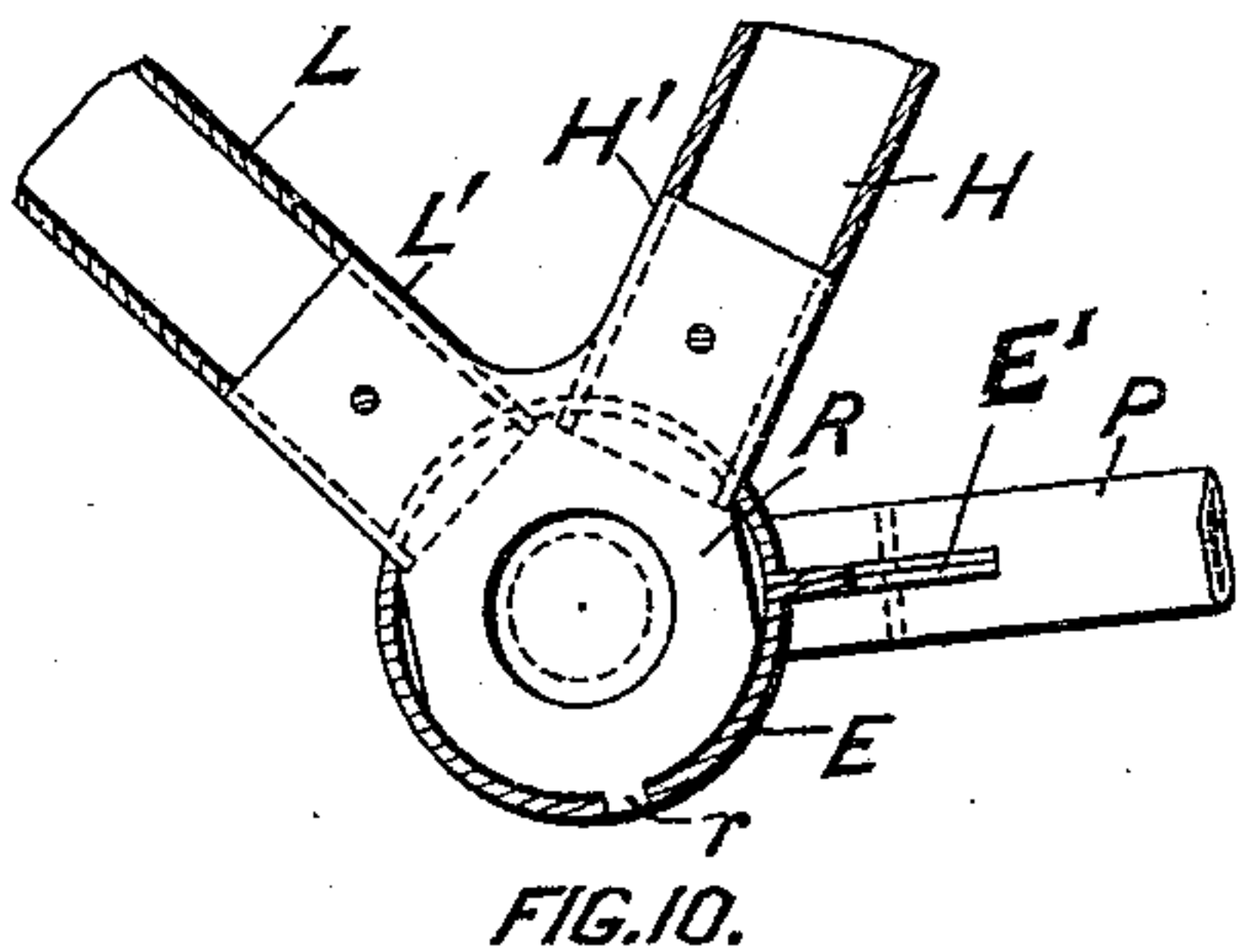


FIG. 24.

FIG. 23.

FIG. 25.

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# UNITED STATES PATENT OFFICE.

JOHN M. STARLEY AND WILLIAM STARLEY, OF COVENTRY, ENGLAND.

## CONSTRUCTION OF CYCLES.

SPECIFICATION forming part of Letters Patent No. 500,971, dated July 4, 1893.

Application filed September 26, 1892. Serial No. 446,923. (No model.)

*To all whom it may concern:*

Be it known that we, JOHN MARSHALL STARLEY and WILLIAM STARLEY, citizens of Great Britain, residing at Coventry, in the county of Warwick, England, have invented new and useful Improvements in the Construction of Cycles, of which the following is a specification.

This invention relates to the method of manufacture which we employ in constructing bicycles, and tricycles, whereby we are enabled to effect neat and simple connecting joints of one portion of the metal frame to another, and to reduce the weight of the machine by dispensing with the usual castings, or forgings, and employing instead wrought or sheet metal for the framework connections, and for the boxes and bearing cases of the machines.

In the two accompanying sheets of explanatory drawings we illustrate the details of our present invention when applied to the construction of a bicycle but it will be readily understood that the same essential features of our invention are employed when we construct a tricycle, or cycle, of any peculiar or special form for any particular requirement.

On Sheet 1, Figure 1 is an elevation of a bicycle frame showing the same of the usual form but having our improved joints and fittings arranged thereupon, as detailed and particularly set forth in Figs. 2 to 25 of the drawings to be hereinafter referred to.

The frame Fig. 1 is provided with the front fork or steering fork A, the tail piece B, the handle bar and handle C, the saddle seat rod D, the crank axle bearing box E, the steering socket F, the steering rod G, and the cross stay H. The whole of the joints of the said parts one with the other, together with the cases and bearing boxes being formed in accordance with our present invention.

In carrying our invention into effect when constructing a steering socket out of sheet instead of stamped or cast metal, we form the case or socket out of sheet or plate metal, and we wrap or bend the strip or plate to form a circular barrel or tube, the ends of the plate being nipped together at the completion or joining of the cylindrical surfaces as shown at F' (Fig. 2) and at F', F<sup>2</sup> (Fig. 3) which is a

cross section on the line *vw* (Fig. 2), and then bent out to form a projecting web comprising a pair of jointing plates or ears F', F<sup>2</sup> capable of being attached by our improved method hereinafter described to the frame tubes or members K, L. We join the tubes K, L to the web F', F<sup>2</sup> by cutting or piercing the tubes in the form of a saw cut, or slit, such as K' (Fig. 5) having a width equal to the thickness of the web F', F<sup>2</sup> and a depth equal to the depth of the latter, so that when the webs are passed into the tubes, the slits or saw cuts are thus completely filled.

Fig. 4 is a cross sectional plan through *x, y*, showing the socket and tube joined together, and Fig. 5 is a detailed plan of the tube showing the slot or saw cut K' for receiving the projecting web. The meeting or joining surfaces of the metal we braze together, and we prefer to pass a pin or rivet through the tube and its web to further secure them together. The central portion of the projecting plate, or web, between the joint projection, we cut away or shape to suit any particular requirement.

In the ball cup M, M' (Figs. 2 and 6), we cut a slit, groove, or recess, to receive the end of the web or joint plate at *m, m<sup>2</sup>*. These grooves also prevent the movement of the cups.

Figs. 7, 8 and 9 are detail illustrations of our improved method of jointing at the saddle pillar, the tubes or members K, H, N being connected together by the joint casing or joint piece O which we form out of sheet metal.

Fig. 8 is a plan of the joint piece. Fig. 9 is a sectional elevation on the line *t, u*, and Fig. 7 is a sectional elevation through the center of the joint piece O and the tube K. The case or joint piece O we bend into the circular form and allow the ends O', O<sup>2</sup> to be pressed together to serve as the projecting web for entering a slot, or saw cut, made within the tube K. We braze the meeting surfaces together and prefer to pass a pin or rivet O<sup>3</sup> through the tube and web piece for greater security. The ends of the tube we cut to fit against the circular barrel of the joint piece and also against the tube H. The tubes N, N' we attach to the joint piece by



drilling holes through it, and then passing the tubes therein, afterward brazing the meeting surfaces of the tubes and joint piece together. The tube H we secure to the same joint piece by passing it through a hole in the joint piece and then brazing the meeting surfaces together; the end of the tube K being also brazed thereto for greater security and rigidity of the frame.

10 We construct our improved crank bearing boxes and their jointing arrangements as set forth in Figs. 10, 11 and 12, Fig. 10 being a sectional elevation of the sheet metal crank bearing box E showing its projecting web joint E', connected to the tube P, and showing also our improved method of jointing the other tubes H, L to the same bearing box by means of the flat joint plate R which we employ for this purpose.

20 We construct the bearing box in the manner hereinbefore described when constructing our steering socket, and we attach the tubes P, P' to it by means of its projecting web joint E'.

25 To connect the tube members H, L we cut or pierce the bearing box to receive a joint plate or flat strip R; this strip we arrange with projections  $r'$ ,  $r^2$  for entering into saw cuts H', L' cut in the tubes H, L; and we provide also a small projecting lug  $r$  for entering a small hole formed within the bearing box for retaining the joint plate R correctly in position. We braze the joint plate to the surfaces of the bearing box and the meeting surfaces of the tubes, and we pass pins through the tubes and the plate horns  $r'$ ,  $r^2$  for further security. We cut a hole within the center of the plate to permit the crank axle passing freely through.

40 Instead of cutting a hole through one central joint plate R we sometimes employ separate joint plates S', S<sup>2</sup> for each tube, in which arrangement we cause the ends of each strip or plate to enter into a common hole or slot S<sup>3</sup> formed within the bearing box to receive them; the plates being bent or curved as shown in Fig. 14 to escape the axle. We cause the joint strip to project beyond the length of the slot which it enters so that good brazing surfaces may be obtained as shown at S<sup>4</sup> Fig. 15.

Figs. 16, 17 and 18 show our improved method of uniting the lug B to the tube members N, P. We employ a plate B with projecting horns B', B<sup>2</sup> for entering saw cuts within N, P as hereinbefore described for the other tubes H, L, and we finish off the end of the tube from the ordinary open end as shown at Fig. 17 to the closed or rounded end as shown at Fig. 18, the end being pressed or knocked down by any ordinary appliance before the meeting or joining surfaces are brazed together.

We unite two plain tubes together in the manner shown in Figs. 19 and 20 illustrating the arrangement of our saddle seat rod D.

The two tubes D', D<sup>2</sup> we pierce to receive the jointing plate D<sup>3</sup> which plate we braze and pin to the tubes in the manner hereinbefore described, we shape the joint plate D<sup>3</sup> to suit the angle of the tubes and we cut away the tube ends that they may butt together in the ordinary manner for brazing. When uniting one tube to another in the form of a T joint as in the handle bar C and the steering rod G shown at Figs. 21 and 22, we form a joint plate T to enter a slot or saw cut in each tube; the plate being secured by horns T', T<sup>2</sup> pinned and brazed to the tubes as before described. The ends of one tube G we sometimes shape to meet the circular portion of the tube C, or we fit it into a hole drilled within the tube C, afterward well brazing all the meeting surfaces together. The front fork sides A, A' shown in Figs. 23, 24 and 25, we connect to the steering rod G by means of a joint web plate U', formed upon the case or joint piece U; this circular joint piece being constructed from sheet metal as hereinbefore described. Within and through the steering rod G we pass a joint strip or plate W having a horn  $w$  for entering within a slot hole provided in the joint case U as shown at Figs. 23 and 25. The tube G we prefer to cause to enter within the joint case U as well as to have its joint plate W therein; and we braze all the meeting surfaces together as before set forth.

We modify the form of our joint strips or plates to suit the sizes, diameters and inclinations of the tubes which have to be joined together for cycle manufacturing purposes, and we effect a joint from a solid bar or rod to a tube by providing the strip or plate as a portion of the rod or bar or by piercing it and passing the plate through as hereinbefore described when joining two tubes together. The strip of metal we prefer to make of a width slightly in excess of the diameter of the tube in order to permit of a good surface being obtained for brazing purposes; the projecting portion of the joint strip being filed, cut or ground away at the finish of the operation.

We do not limit the application of our invention to the manufacture of metal cases from strip or sheet metal to the particular shapes or articles hereinbefore described, but we employ the same essential features herein set forth when constructing any shaped box or case for cycle purposes and when joining one portion of the machine to another.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In a cycle frame, the combination with a tubular part having a kerf or slot in one end, of a plate bent into a tube and provided with a projecting web inserted and secured within said kerf or slot, substantially as described.

2. In a cycle frame, the combination of



tubes, each having a kerf or slot in one end, of a flat web inserted and secured within the kerfs or slots for connecting the tubes, substantially as described.

- 5 3. In a cycle frame, the combination of a tubular member having a projecting web, with a slotted tube abutting said member and in the slot of which the web projects and is secured, substantially as described.

In testimony whereof we have hereunto set our hands and affixed our seals in presence of two subscribing witnesses.

JOHN M. STARLEY. [L. S.]  
WILLIAM STARLEY. [L. S.]

Witnesses:

EDWARD C. R. MARKS,  
WILLIAM EVANS.