

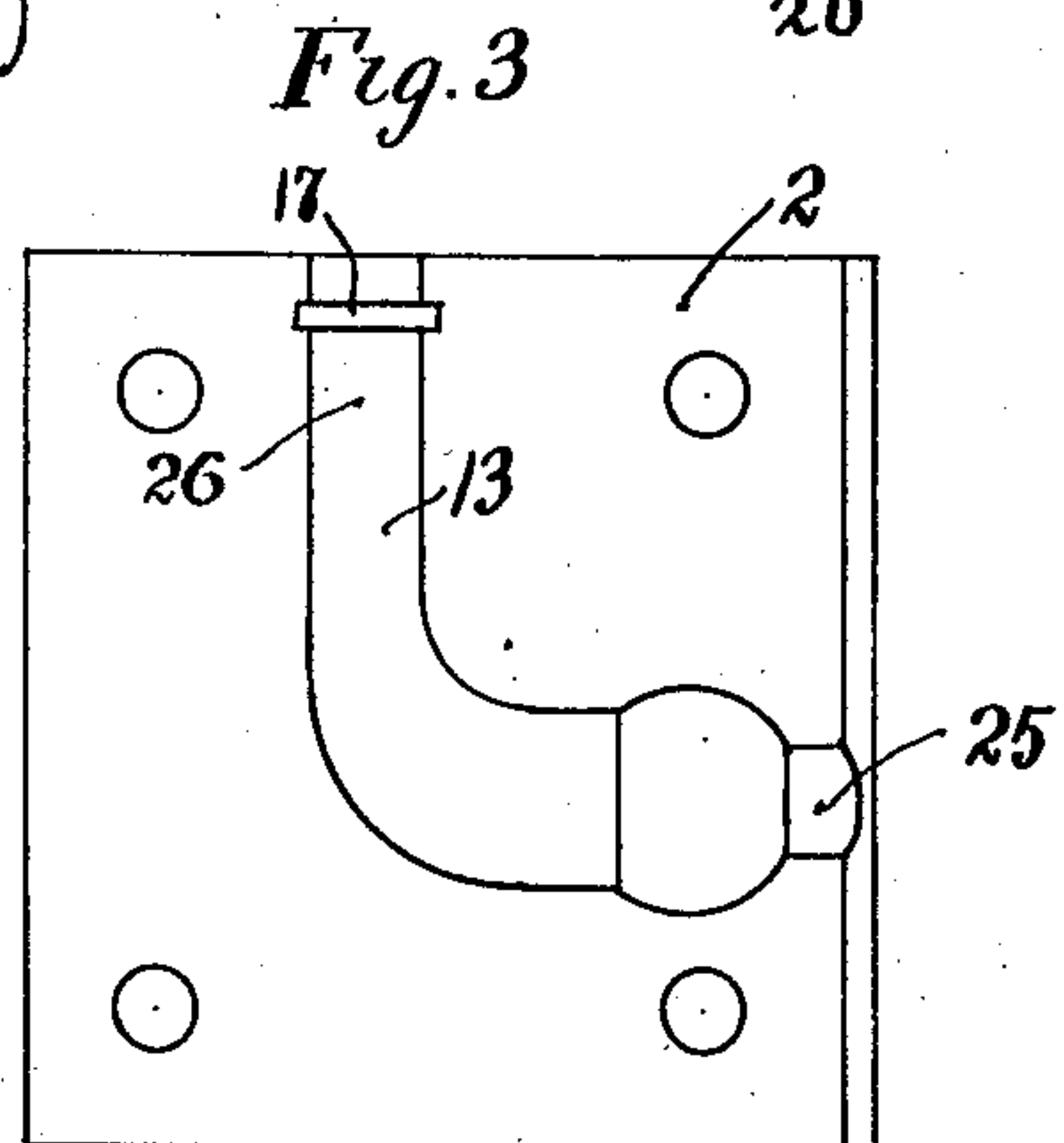
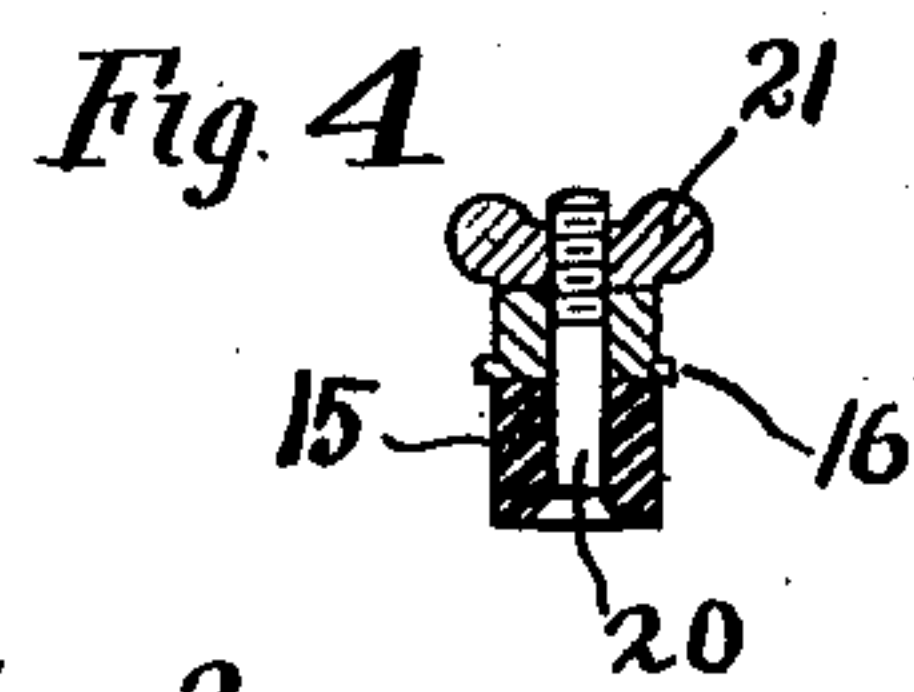
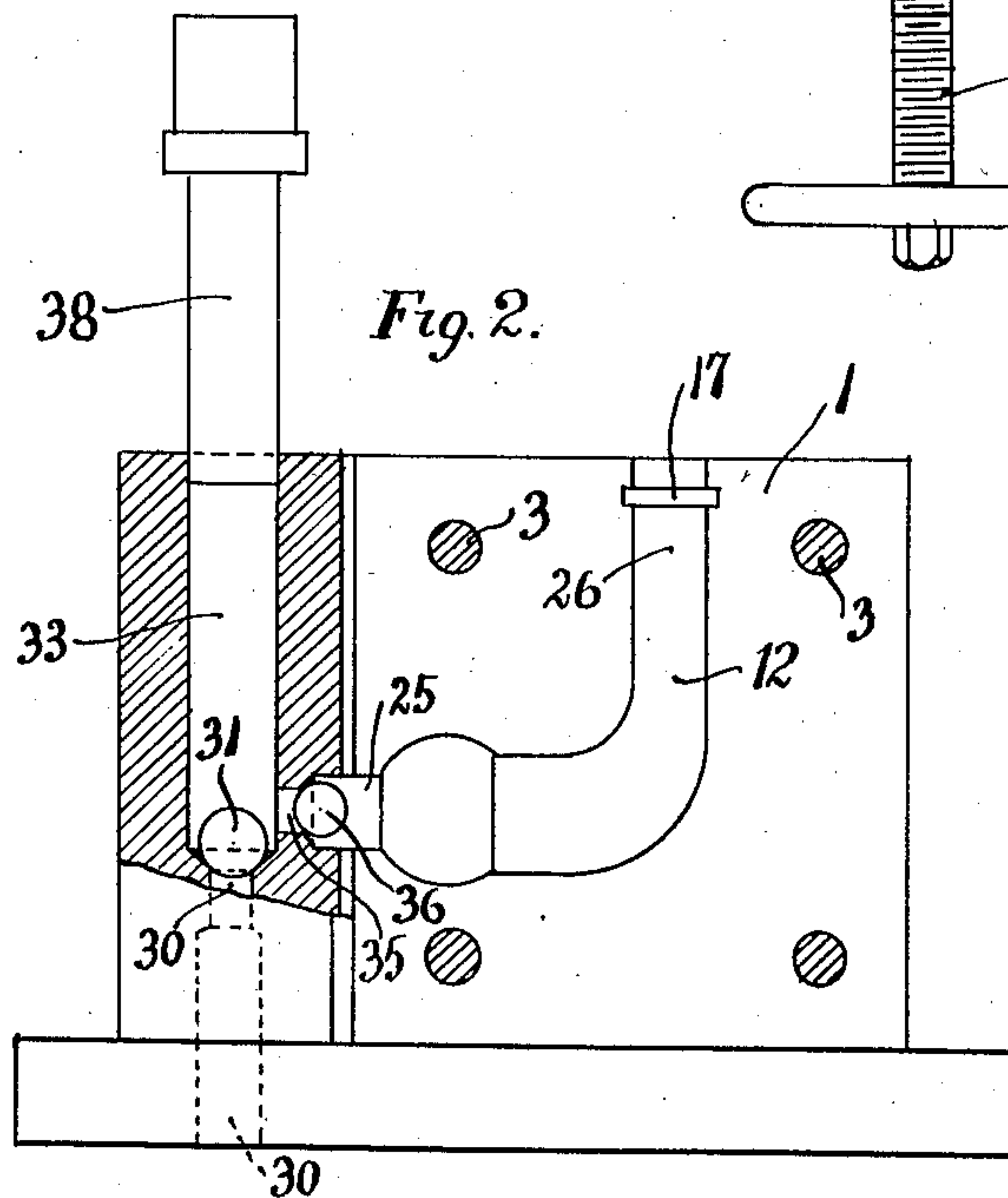
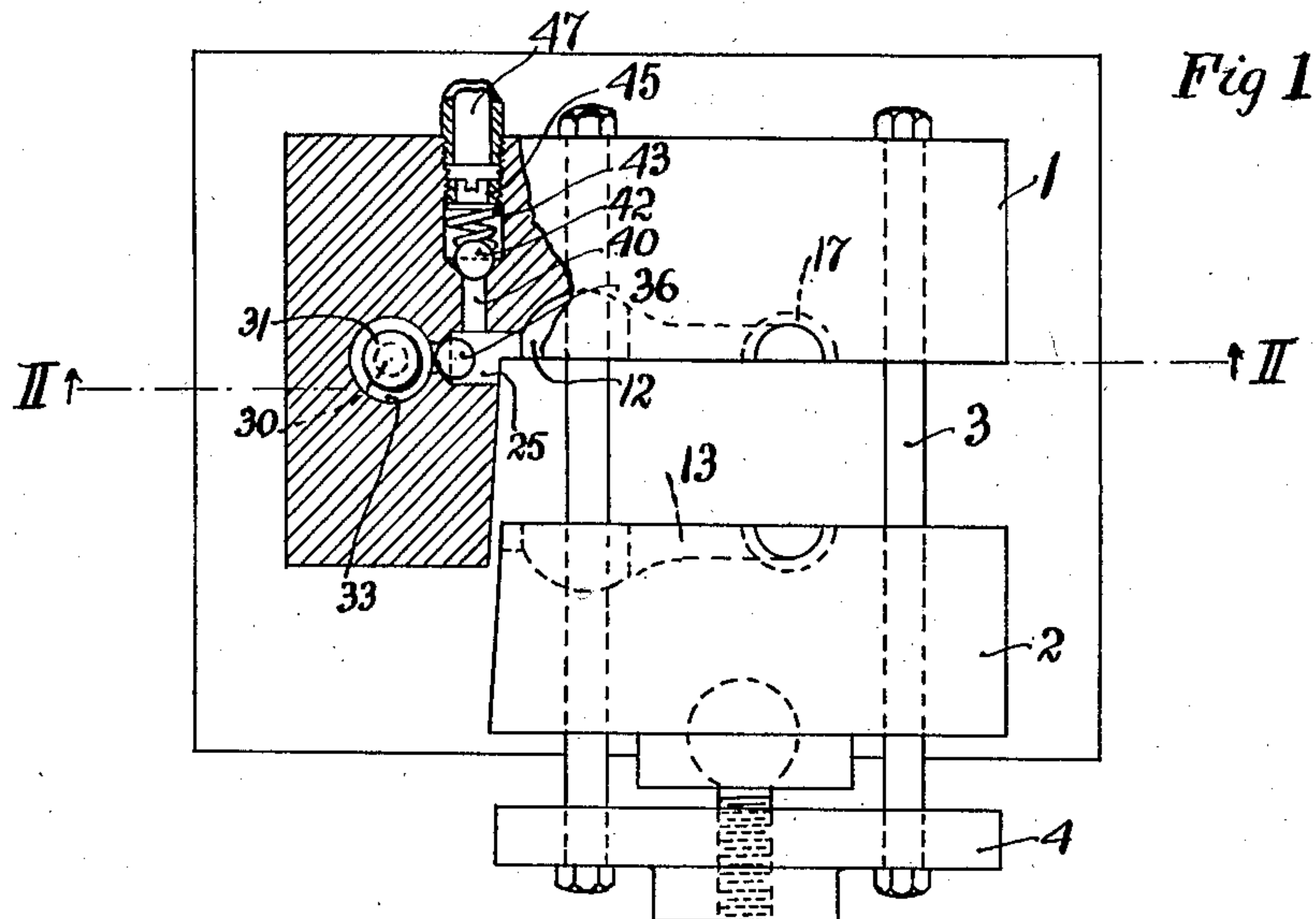
**Sept. 4, 1928.**

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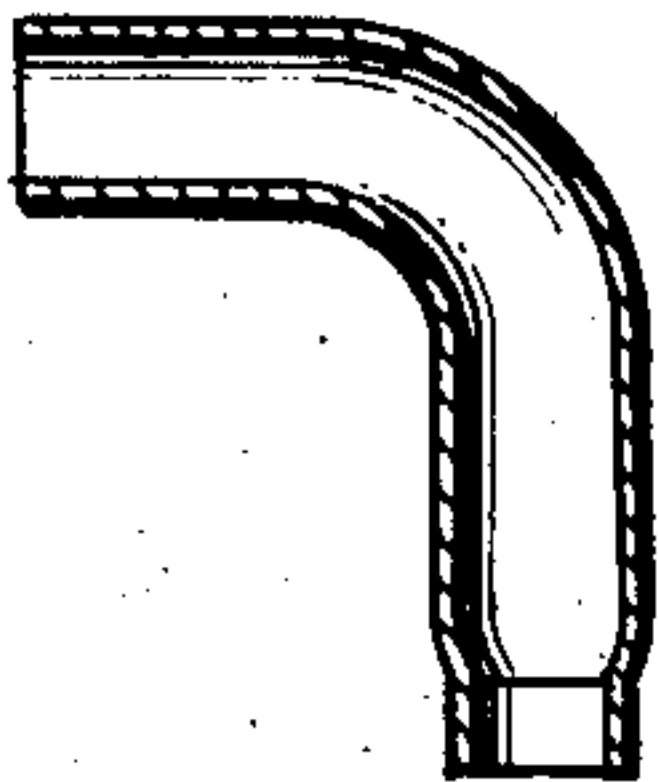
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# APPARATUS FOR DRAWING METAL

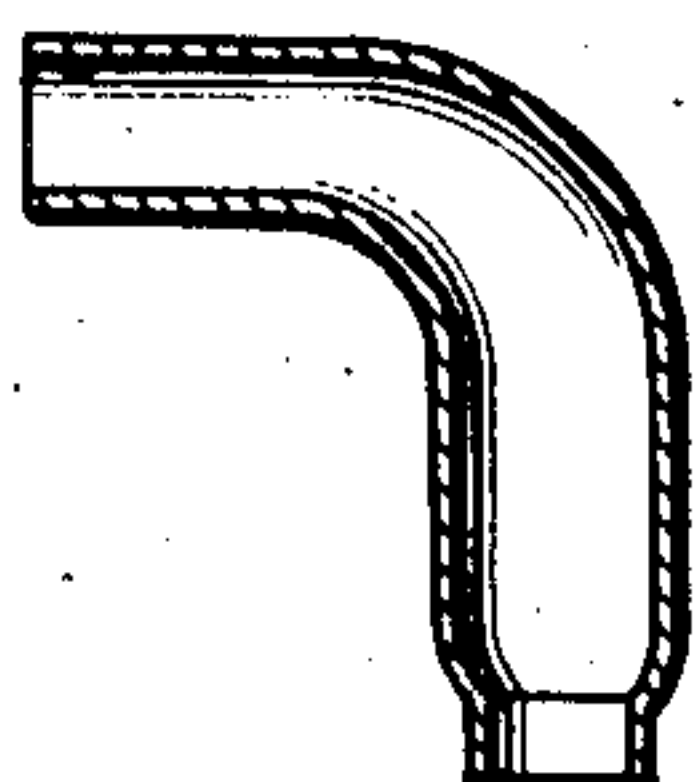
Filed April 18, 1925



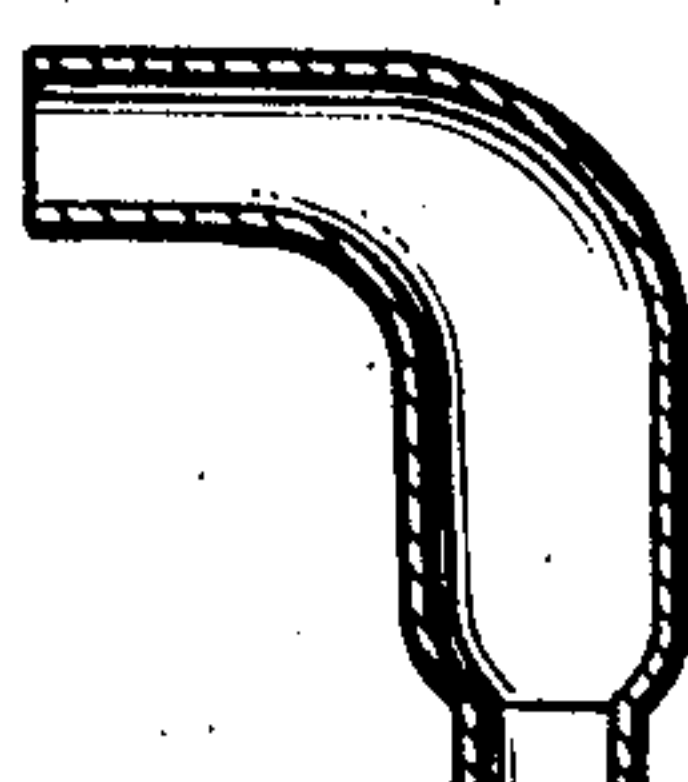
*Fig. 5.*



*Fig. 6.*



*Fig. 7.*



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## UNITED STATES PATENT OFFICE.

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## APPARATUS FOR DRAWING METAL.

Original application filed May 18, 1920, Serial No. 382,372. Divided and this application filed April 18, 1925. Serial No. 24,055.

This invention relates to apparatus for drawing metal tubes and provides a new and improved apparatus for forming tapered, tubular, bent articles, such as sound-conveying tubes for talking machines and the like.

The tubular articles, and the method of making the same, are described and claimed in my application Serial No. 382,372, filed May 18th, 1920. The subject-matter of the present application also formed a part of said application, and the present application is a division of said application.

An embodiment of said apparatus is illustrated in the accompanying drawings, wherein,

Fig. 1 is a top plan view of the forming apparatus;

Fig. 2 is a sectional view on the line II—II Fig. 1 looking in the direction of the arrows;

Fig. 3 is a face view of the die-part opposite to that shown in Fig. 2;

Fig. 4 is a sectional view of a tampion or plug for closing the end of a tube which is to be expanded or drawn in the dies.

Figs. 5, 6 and 7 are views of the outlines or contours of dies similar to those shown in Figs. 1-3, in which successive drawing of the article is performed preliminary to effecting the drawing in said die of Figs. 1-3.

The apparatus comprises a series of dies of successively larger sizes, corresponding to the degree to which the partially formed article is to be drawn or stretched at each stage. One of this succession of dies is shown in Figs. 1-3, the die in this instance being the one in which the final drawing is effected, the contours of the preceding dies of the succession being substantially as illustrated in Figs. 5-7.

The die preferably comprises two sections or parts 1 and 2, having formed therein the bent and tapered recesses 12 and 13, corresponding (together) to the form to which the article is to be drawn therein. The die-sections 1 and 2 preferably slide toward and from one another on bolts or tie-rods 3. The article to be drawn is placed between the die-parts and the die-parts brought together and held together by suitable means, as for example, a clamp-screw 5 threaded in a yoke 4 fastened at one end of the bolts or tie-rods 3, and bearing at its end against the die-part

2. A hand-wheel 6 serves for manipulating the clamp-screw.

When the article is placed in the die one end thereof is closed, the means for this purpose being conveniently a separate plug or tampion 15. This plug conveniently comprises a disk having a shoulder 16 adapted to fit within a recess 17 in the die-parts 1 and 2. It also comprises an expansible portion 19, adapted to fit within the end of a tube, and be expanded therein, to tightly close the same, by means of a taper-headed-bolt 20 and wing-nut 21.

The other end of the article in the die is open and in communication with a passage 25, the walls of which closely engage the outer surface of the contiguous portion of the article or elbow, so as to provide a tight, or substantially tight joint between the article and the walls of the die around the passage 25. The parts 26 of the walls of the series, at the ends opposite the ends 25 are preferably of the same size as the parts 25, and hence fit tightly against the opposite ends of the tube from which the article is to be made.

Fluid (water or oil for example) previously compressed, or not, as may be preferred, is then admitted to the interior of the article in the die, through the passage 25 and the open end of the article. The pressure of the fluid, or pressure applied thereto, if not previously compressed, expands the tubular article and draws or presses the walls of the articles against the walls of the die, and makes it conform to the size and shape of the die.

As shown, water is admitted through a pipe 30 and outwardly opening valve 31 to a cylinder 33 in communication with the passage 25 of the die through a part 35 and an outwardly opening valve 36. Water is admitted into the cylinder 33 and compressed therein and forced into the interior of the article in the die by means of a piston 38 conveniently mounted on the reciprocating slide of an ordinary power press. The water compressed in the article is or may be held therein between strokes by the valve 36.

Means are preferably provided for relieving the die from increases of pressure after the article has been expanded or drawn



therein due to continued action of the piston 38. These means conveniently comprise a vent passage 40 communicating with the passage 25, and normally closed by a valve 42, pressed by a spring 43, the compression of which serves to keep the valve closed under normal working pressures, but yields under excessive pressures to vent the liquid flowing through the valve 36. A sleeve 45 serves for adjusting the compression of the spring 43, and a pipe 47 serves for carrying off the vented liquid.

After the drawing is completed in one die, the die-parts are separated and the article removed and placed in another or other successive dies, and expanded or drawn therein to final form, in a manner similar to that described.

After each drawing operation the article is preferably annealed.

The final form of the article is usually produced as a result of several acts of drawing in a corresponding number of dies. The extent to which the material will draw at each stage depends on the material and is ascertained by experiment, guided of course by intelligent assumptions based on knowledge of the ductile properties of the material, etc.

The inventive ideas herein set forth may receive other embodiments and forms than those herein specifically illustrated and described.

What is claimed is:

1. An apparatus for making seamless, tapered, bent drawn articles, comprising a series of dies adapted to successively receive a bent tube or shell therein, each die having a tapered bent form, and being made in parts adapted to be separated and closed to admit and hold the tube or shell, means for holding the die parts together, and fluid pressure means for expanding said tube or shell in said series of dies, each of said dies having at one end parts of uniform size throughout the series adapted to fit closely around one

end of the tube or shell to be expanded therein.

2. An apparatus for making seamless, tapered, bent drawn articles, comprising a series of dies adapted to successively receive a bent tube or shell therein, each die having a tapered bent form, and being made in parts adapted to be separated and closed to admit and hold the tube or shell, means for holding the die parts together, and fluid pressure means for expanding said tube or shell in said series of dies, each of said dies having at both ends thereof parts of uniform size throughout the series adapted to fit closely around the ends of the tube or shell to be expanded therein.

3. An apparatus for making seamless, tapered, bent drawn articles, comprising a series of dies adapted to successively receive a bent tube or shell therein, each die having a tapered bent form, and being made in parts adapted to be separated and closed to admit and hold the tube or shell, means for holding the die parts together, means for closing one end of said tube or shell, and fluid pressure means for expanding said tube or shell in said series of dies.

4. An apparatus for making seamless, tapered, bent, drawn articles, comprising a die, adapted to receive a bent tube or shell therein, said die having a tapered form with a bend therein, and being made in parts adapted to be separated and closed to admit and hold the tube or shell, means for holding the die parts together and said die parts in closed position being adapted to clamp the ends of the tube or shell, means for closing one end of the tube or shell, means for admitting fluid to the interior of said tube or shell, and means for compressing said fluid to cause it to expand said tube or shell against the sides of said die.

In witness whereof, I have hereunto signed my name.

CARL BERGMANN, JR.