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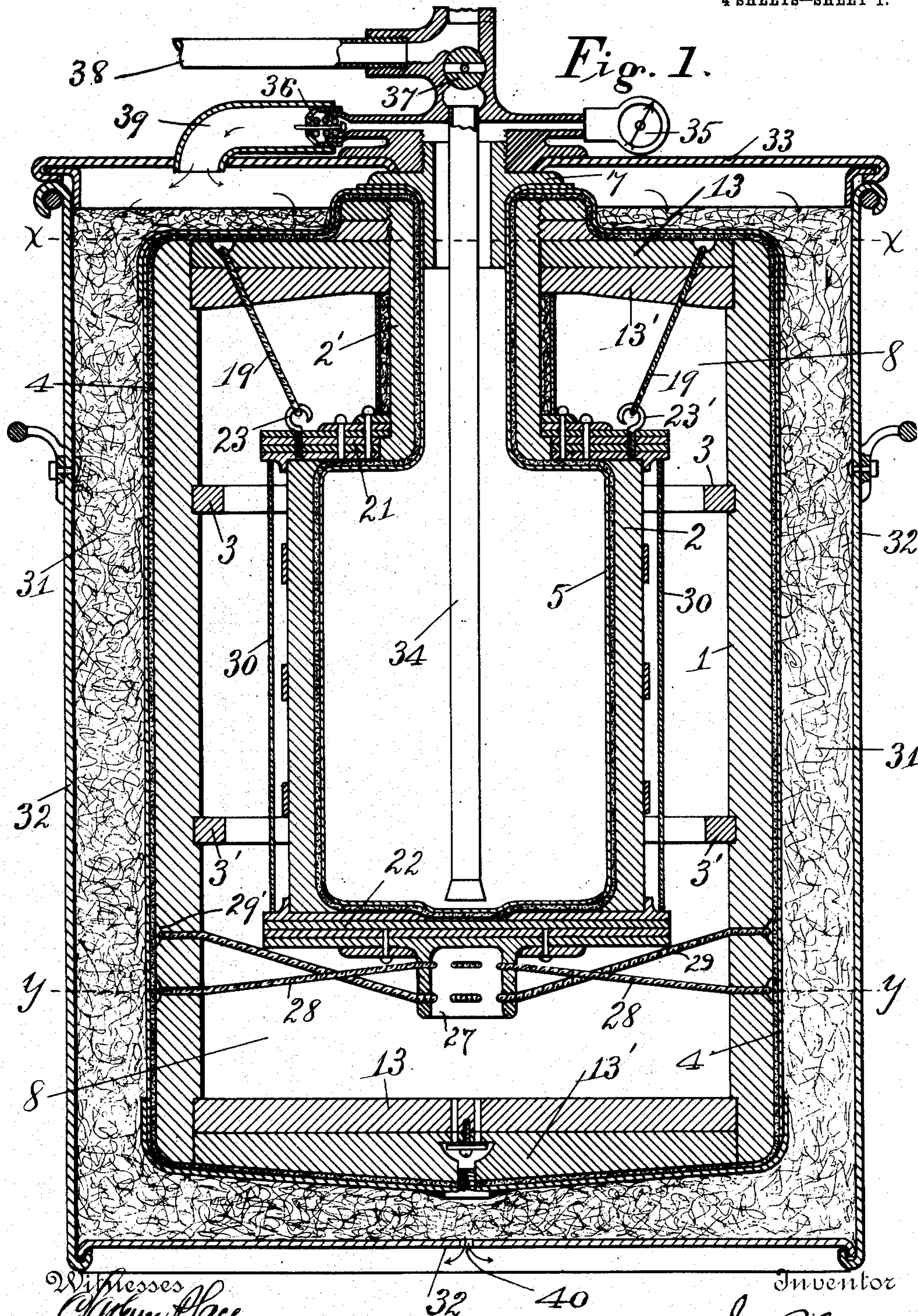
PATENTED MAR. 31, 1908.

J. F. PLACE.

INSULATED CONTAINER FOR LIQUID AIR, &c.

APPLICATION FILED APR. 28, 1905.

4 SHEETS—SHEET 1.



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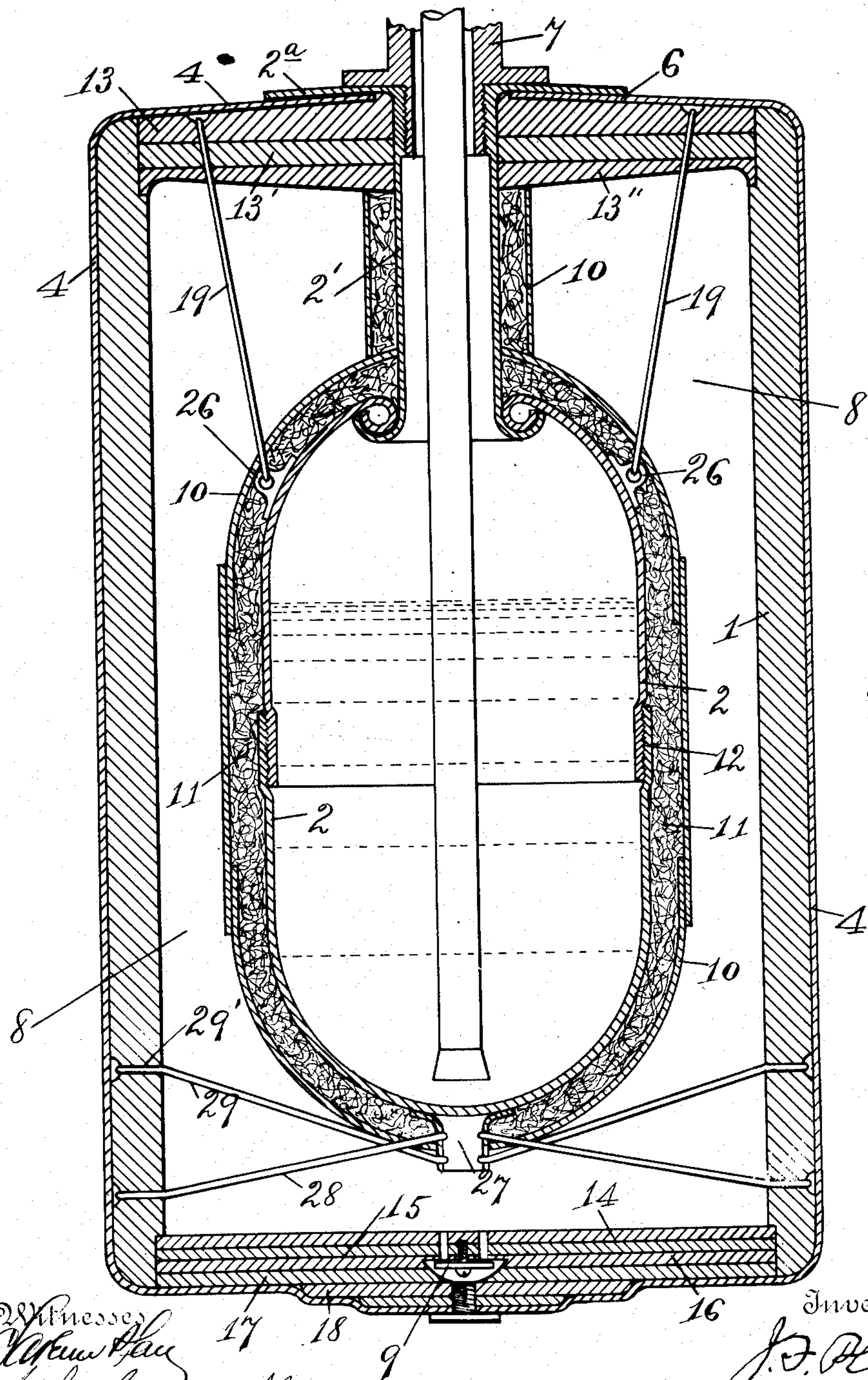
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4 SHEETS—SHEET 2.

*Fig. 2.*



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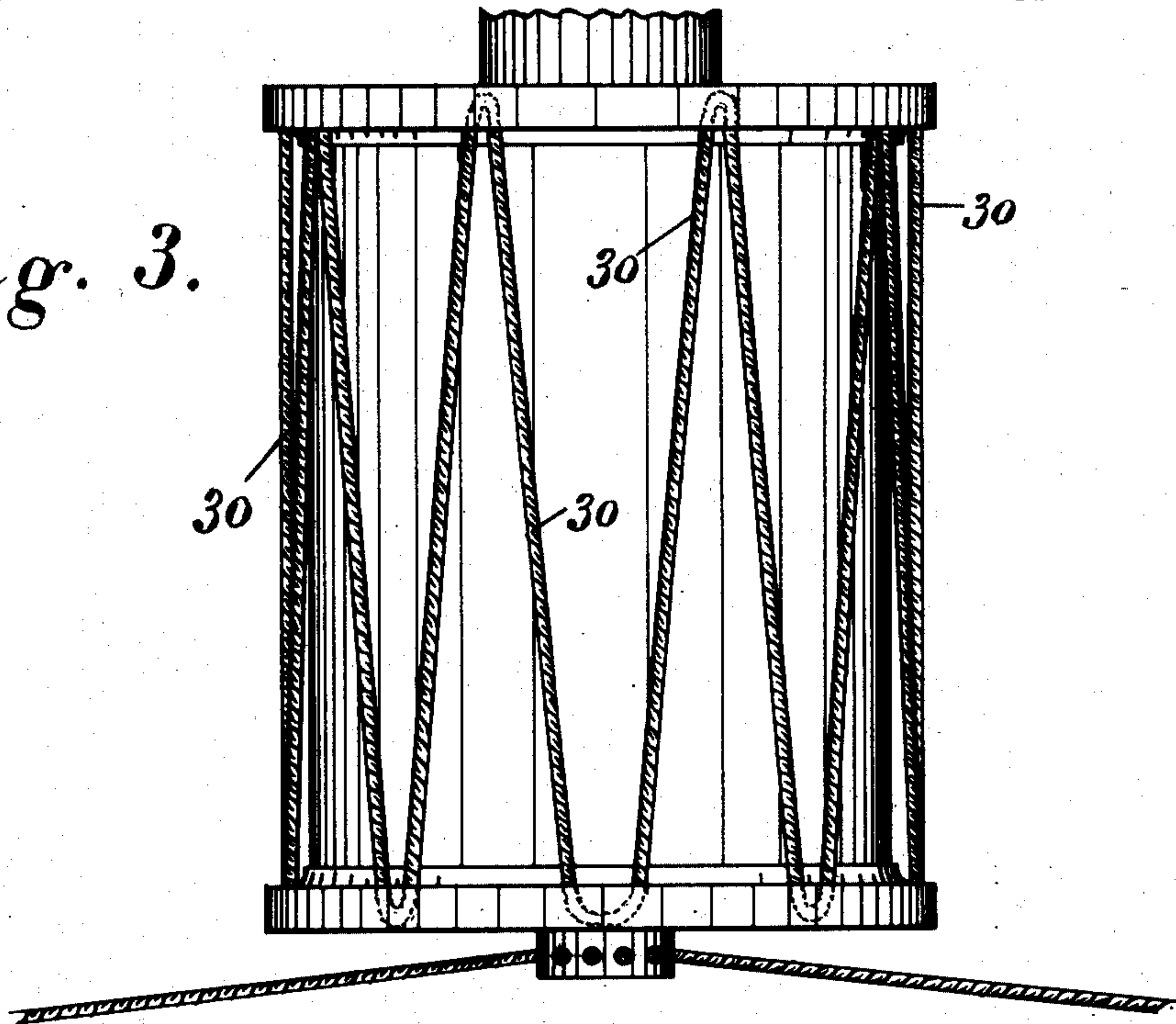
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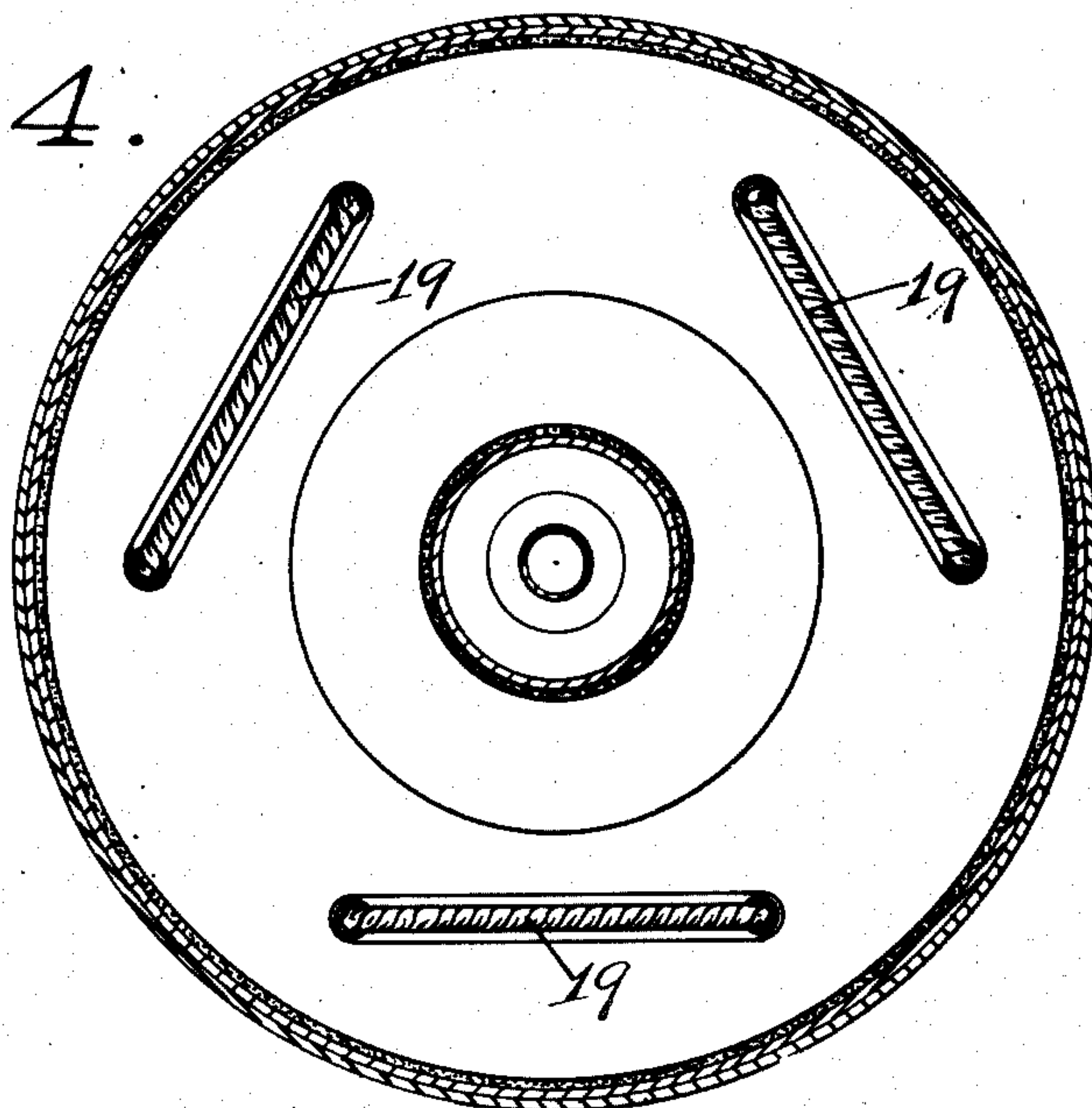
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4 SHEETS—SHEET 3.

*Fig. 3.*



*Fig. 4.*



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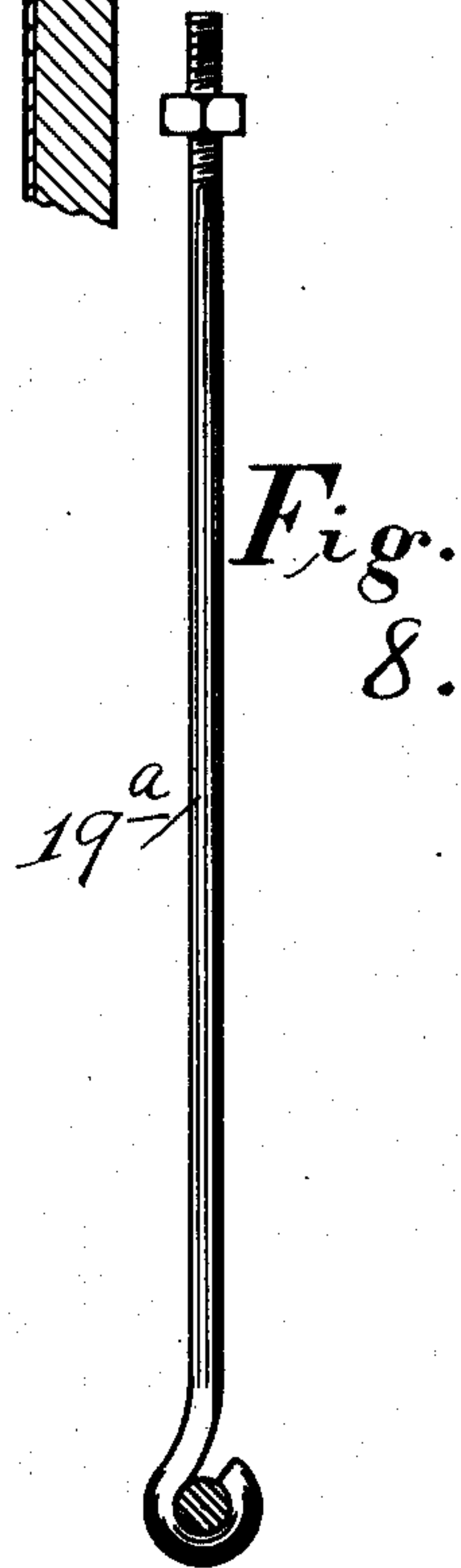
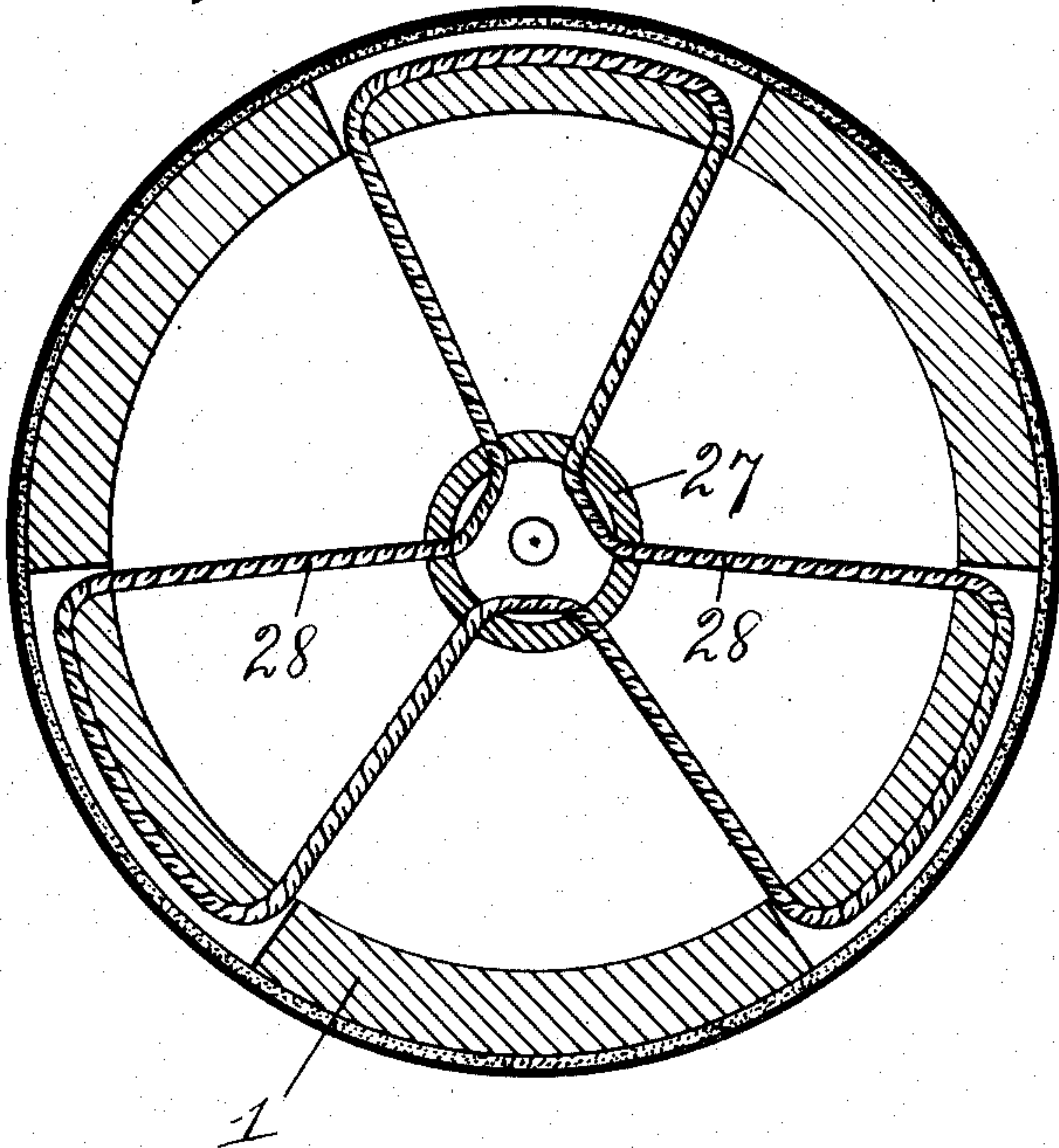
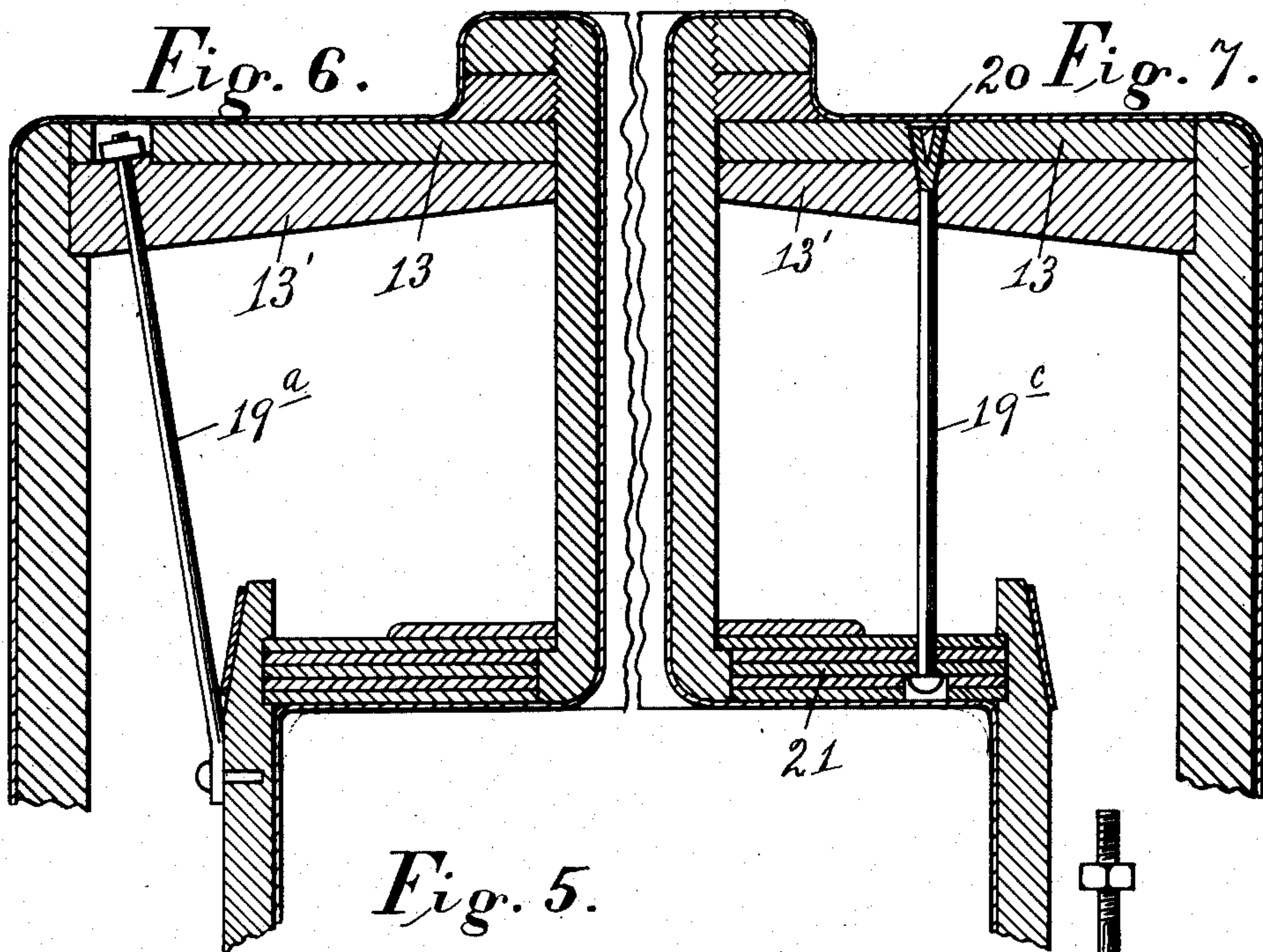
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4 SHEETS—SHEET 4.



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# UNITED STATES PATENT OFFICE.

JAMES F. PLACE, OF GLENRIDGE, NEW JERSEY, ASSIGNOR TO AMERICAN AIR LIQUEFY-  
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## INSULATED CONTAINER FOR LIQUID AIR, &c.

No. 883,479.

Specification of Letters Patent.

Patented March 31, 1908.

Application filed April 23, 1905. Serial No. 257,844.

*To all whom it may concern:*

Be it known that I, JAMES F. PLACE, a citizen of the United States, and a resident of Glenridge, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Insulated Containers for Liquid Air, &c., of which the following is a specification.

This invention relates to vessels, bottles or receptacles, either portable or stationary, for preserving, carrying or storing liquid air or other liquefied gases, or liquids or substances of any kind which it is desirable to insulate from heat or cold; and may be considered as an improvement on my inventions shown in U. S. Patents Nos. 646,459 and 707,634.

The object of the invention is to preserve or maintain the fixed temperature of the substance sought to be preserved, by insulating same from the temperature of its environments, so that no heat will pass or as little as possible can pass either from or to the substance contained in or held by the vessel.

I will now proceed to describe my invention by help of the accompanying drawings, in which

Figure 1 is a vertical section of an insulated vessel as at present constructed with some parts of my invention adapted thereto. Fig. 2 is a vertical section of the inner bottle or container constructed in accordance with my present invention, the outer protecting case and reinforced insulation being omitted, said figure showing a modification of Fig. 1, or the inner bottle constructed and connected to the outer impervious inclosure in accordance with my present improvements. Fig. 3 is a detail in elevation of the inner bottle of Fig. 1, showing the preferred construction of holding together the heads. Fig. 4 is a plan view on the line  $x x$  of Fig. 1, looking down on the top of the head of the outer case or receptacle, and showing the preferred manner of fixing to the head of such outer case or receptacle the suspending cords, ropes or rods from which is suspended the inner bottle. Fig. 5 is a cross section of the outer case or receptacle shown in Fig. 1, on the line  $y y$  of Fig. 1, looking upward, showing the preferred manner of fixing the stays, guy rods or lateral cords, which prevent the lateral movement of the inner bottle. These lateral cords or guy rods may be so arranged in double sets as shown in

Figs. 1 and 2 so as to support the inner bottle from the side walls of the outer case, as well as to prevent lateral movement of the same. Figs. 6 and 7 are vertical sectional views, showing a modification in construction of the inner bottle, and different ways of suspending the same to the head of the outer case or receptacle. Fig. 8 is a mere detail of the suspending rod shown in Fig. 6.

Similar reference marks refer to similar parts throughout the several drawings.

In Figs. 1 and 2, the numeral 1 refers to the outer case or outer receptacle, within which is suspended the inner bottle, or insulated container 2. At 2' is shown the neck of this inner bottle. The outer case 1 is preferably made of wood or indurated fiber, or some other material of strength and yet of a relatively low heat-conductivity. At 3 and 3' (Fig. 1) I show inwardly projecting ribs to give strength against outside pressure to the outer case 1. At 4 is shown the impervious or air-tight sack, envelop or inclosure which is around the outer case 1. In Fig. 1 this air-tight inclosure is shown soldered, or made fast to the lining 5 of the inner bottle 2; this is in accordance with my invention covered by U. S. Patent 707,634, which is shown here for the purpose of comparison. But in Fig. 2 the inner bottle itself (2) is soldered, brazed or fixed with an air-tight joint to the sack inclosure 4. This joint is shown at 6 (see Fig. 2) where the neck or mouth (2') of the inner bottle is expanded preferably into a flange 2<sup>a</sup>, and which flange is tightly connected with the sack-inclosure 4. The neck (2') of the inner bottle itself (and not the lining thereof) is here connected with or fixed to the mouth of said sack or inclosure 4, so as to leave the mouth or neck (2') of said bottle (2) open, in which is inserted from the outside the stopper 7; and so as to close the mouth of said sack or outer-case covering 4, and thus the two together (the inner bottle 2 and the sack or impervious covering 4) are made to form one complete air-tight inclosure around said outer case 1. Thus at 8 (see Fig. 2) is provided a vacuum space, which vacuum is produced preferably by attaching a vacuum pump to the outlet of the check valve 9. This form of construction of making the air-tight sheet metal inclosure (4) around the outer case and the inner bottle (2) itself, one and the same complete inclosure (see Fig. 2), is an improve-



ment on the construction shown in my U. S. Patent 707,634, wherein the-outer-case inclosure is combined with the lining of the inner bottle to form the one complete air-tight inclosure.

The inner bottle 2 when made substantially in accordance with my present invention or the construction shown in Fig. 2, is covered preferably by the paper inclosure 10 and the hair felt packing 11; but this paper covering and this hair-felt packing are not essential, the vacuum 8 being depended on entirely to insulate the bottle or suspended vessel 2 against the outside temperatures. The bottle may be made in two parts of any suitable material such as copper, brass or German silver, and screwed together as at the joint 12, and reinforced by soldering or brazing so as to make it perfectly air-tight. When made substantially in accordance with my present invention, the heads (top and bottom) of the outer case (1) are made of wood or some other similar material in several thin disks glued or otherwise closely held together, the grains crossed, as shown at 13, 13' and 13'' or 14, 15, 16, 17 and 18 (see Figs. 1 and 2). At 19 in Figs. 1, 2 and 4 I show supporting cords, cables, strands, rods or wires which are preferably passed through the head 13 and 13' of the outer case, and fixed to the top of this inner bottle as shown in Figs. 1, 2 and 4, and by which the inner bottle (2) is suspended within the vacuum space 8. These suspending cords may be in form of rods, as shown at 19<sup>a</sup> in Figs. 6 and 8, or of catgut or strong twisted fiber, such as silk, linen or hemp, as shown at 19 in Figs. 1, 2 and 4. At 19<sup>c</sup> (Fig. 7) a modification is shown in which the suspending rod is made of wood, the upper end being held in the head 13 by the wedge 20. The heads (top and bottom) of the inner bottle, when constructed as shown in Fig. 1, are made preferably of wood or fiber disks, as shown at 21 and 22; and the suspending cords may be fastened to hooks 23 and 23', or may be attached to wood pins, as shown in Fig. 6; or the rods may have heads as shown in Fig. 7.

When the inner bottle 2 is constructed substantially in accordance with my present invention, as shown in Fig. 2, the suspending supports, cords or rods, may be attached to the outside of the bottle by the eyes 26. Any other suitable manner of attaching these suspending ropes, wires or rods to the top head of the outer case 1 and the inner bottle 2, will answer; the preferred construction is to have the supports fixed to the outer case head 13, underneath the sack inclosure 4 as shown in Figs. 1 and 2, and to the inner bottle outside the lining 5 in Fig. 1; or outside the shell of the inner bottle as in Fig. 2—being within or passing through the vacuum space 8.

At 27 in Figs. 1 and 2 I show an annular projection, extending downwardly outside

from the bottom of the inner bottle, and to this is attached the guy ropes or rods 28, which pass through the walls of the outer case 1 as shown in Fig. 5, and are drawn taut so as to prevent any lateral movement of the inner bottle. These lateral guys, rods or wires may be of any suitable material, but are preferably of cat-gut, silk, linen, hemp or some other material of relatively low heat-conductivity; and the suspending cords or rods 19 are preferably of similar material of relatively low heat-conductivity, so that in each case it will be more difficult for heat to pass in to or out from the contents of the outer bottle 2.

At 29 (Figs. 1 and 2) I have guys similar to 28 and of similar materials but which are fixed to the walls of the outer case at a point higher up as shown at 29', so that they serve also to support the inner bottle 2 in position within the vacuum space 8 in the outer case 1. All of these guys, ropes or rods are located preferably all within the vacuum space surrounded by or inclosed in the inclosure 4.

I am aware that in insulated receptacles of this class, cords of fiber and lateral stays have been used; but I make use of such in a new and novel manner so as to relieve the strain on the neck of the insulated container, and to virtually take and sustain fully the weight of the substance being insulated. In order to prevent heat from passing through said neck, either in or out, and to properly insulate the contents of the container it is essential that the sectional area of the tube of the neck should be very small; and the smaller it is the less weight it will carry. If the neck is made of sufficient thickness of shell to sustain alone the weight of the substance being insulated, the insulation will be imperfect and unsatisfactory.

When the inner bottle is made with a lining as shown in Fig. 1, I prefer that the heads 21 and 22 (top and bottom) should be held together by an endless cord or wire as shown at 30 in Fig. 3, which is drawn taut, very similar to the well known manner in which the heads of a drum are held to the cylinder thereof. In this way metal screws or materials which conduct heat are avoided.

The outer case 1 is preferably inclosed by hair-felt packings 31 (see Fig. 1) and the outside protecting case 32, having a cover 33; the inner bottle being provided with a paper or glass siphon tube 34, gage 35, safety valve 36 and discharge cock 37, when such bottle is used for holding or preserving liquid air or other liquid gases connecting with the discharge pipe 38. At 39 (Fig. 1) I have a removable discharge tube, of suitable non-conducting material, which incloses the mouth of the safety valve 36, and delivers to the inside of the case 32, so that any vapor that escapes from the inner liquid-holding bottle 2, passes down through the insulating pack-



ings 31, and out through the hole 40 in the bottom of the case 31—thus serving to insulate the case 1 from heat and keep it cool.

Having thus described my invention what I claim as new and original and desire to secure by Letters Patent, is:—

1. A vessel for holding and preserving liquid air or other liquid gases, comprising in operative combination, an outer rigid case of wood or other material of relatively low thermal conductivity, inclosing a vacuum space; an impervious air-tight sheet metal envelop around said outer case; and an inner bottle made of impervious sheet metal suspended from said outer case within said vacuum space by non-conducting cords of silk or other fibrous material, said bottle having a long neck which is soldered or brazed to said air-tight envelop around said outer case—said envelop and said neck and bottle forming one complete air-tight inclosure, which incloses said outer case and the vacuum space therein.

2. A container for holding liquid air or other substances and insulating the same against the normal heat of its environments, comprising in operative combination an outer rigid case having or surrounding therein a vacuum space; an impervious sheet metal envelop around and completely inclosing said outer case; and an inner insulating vessel within the vacuum space in said outer case, having a long tubular neck soldered or brazed air-tight to said impervious inclosure—said inner vessel being hung from said outer case by a plurality of pendent supports of fiber or other material of low thermal conductivity inside of said impervious inclosure.

3. A container for holding liquid air, or other substances and insulating the same against the normal heat of its environments, comprising in operative combination an outer rigid case of wood or other material of relatively low thermal conductivity, having

or surrounding therein a vacuum space; an impervious sheet metal envelop around or inclosing said outer case; an inner insulating vessel within the vacuum space in said outer case, having a tubular neck connected or joined air-tight to said impervious envelop,—said inner vessel being hung from said outer case by a plurality of pendent supports of fiber or other material of low thermal conductivity, and forming with said tubular neck and said sheet-metal envelop one complete air-tight inclosure around said outer case and the vacuum space therein; and guys or lateral stays of low thermal conductivity fixed radially to said inner insulating vessel and to the walls of said outer rigid case.

4. A container for holding liquid air or other substances, and insulating the same against circumambient temperatures, comprising in operative combination an outer rigid case of wood or other material of relatively low thermal conductivity, having or surrounding therein a vacuum space; an impervious envelop around or inclosing said outer case; an inner insulating vessel within the vacuum space in said outer case, having a tubular neck connected or joined air-tight to said impervious envelop—said inner vessel being hung from said outer case by a plurality of pendent supports of fiber or other material of relatively low thermal conductivity, and forming with said tubular neck and said impervious envelop one complete air-tight inclosure around said outer case and the vacuum space therein; and guys or lateral stays of low thermal conductivity fixed radially to said inner insulating vessel and to the walls of said outer rigid case.

Signed at New York in the county of New York and State of New York this 13th day of June A. D. 1904.

JAMES F. PLACE.

Witnesses:

M. L. CORNWELL,  
A. CORBY.