

D. McF. MOORE.
VACUUM TUBE.
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984,016.

Patented Feb. 14, 1911.

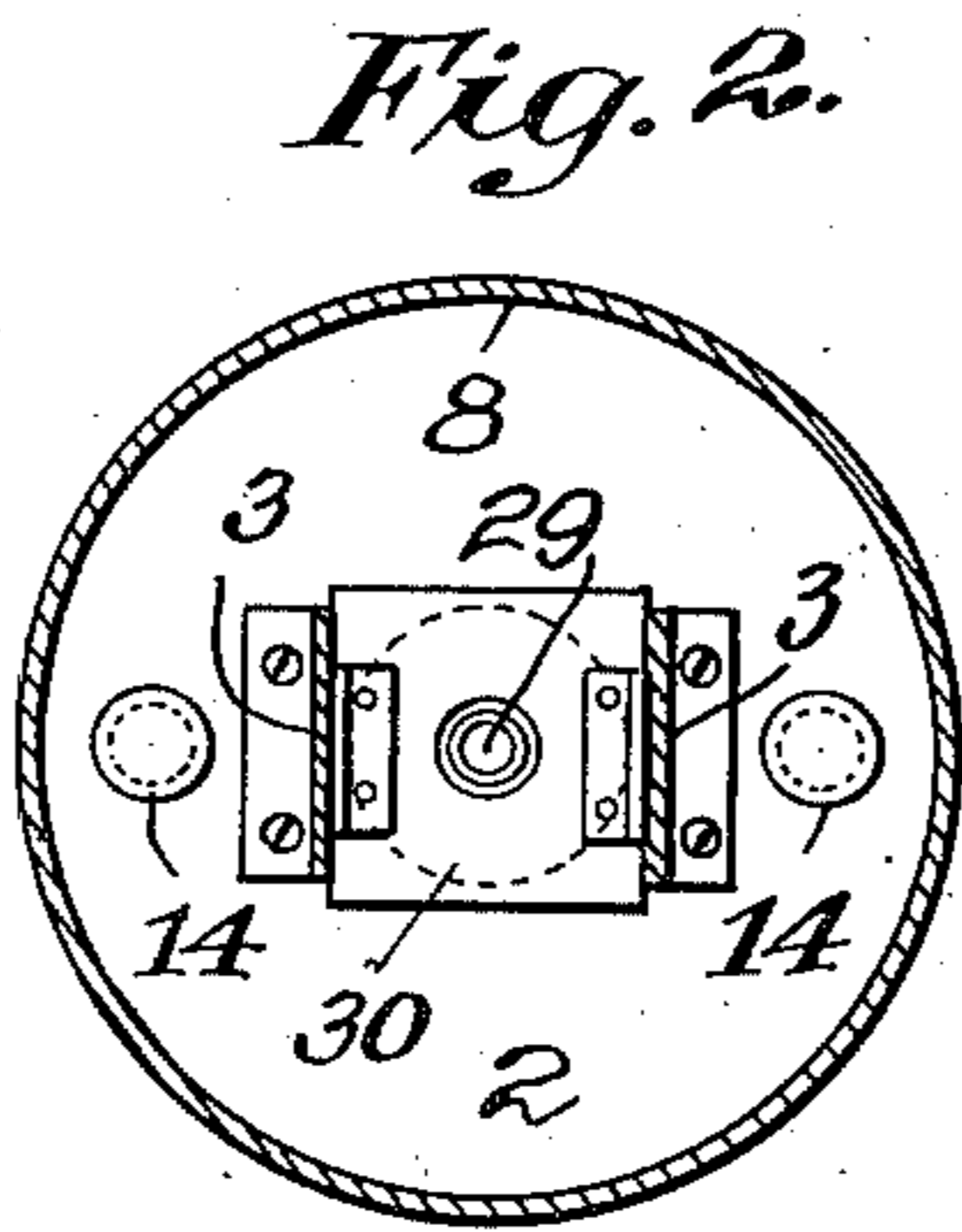
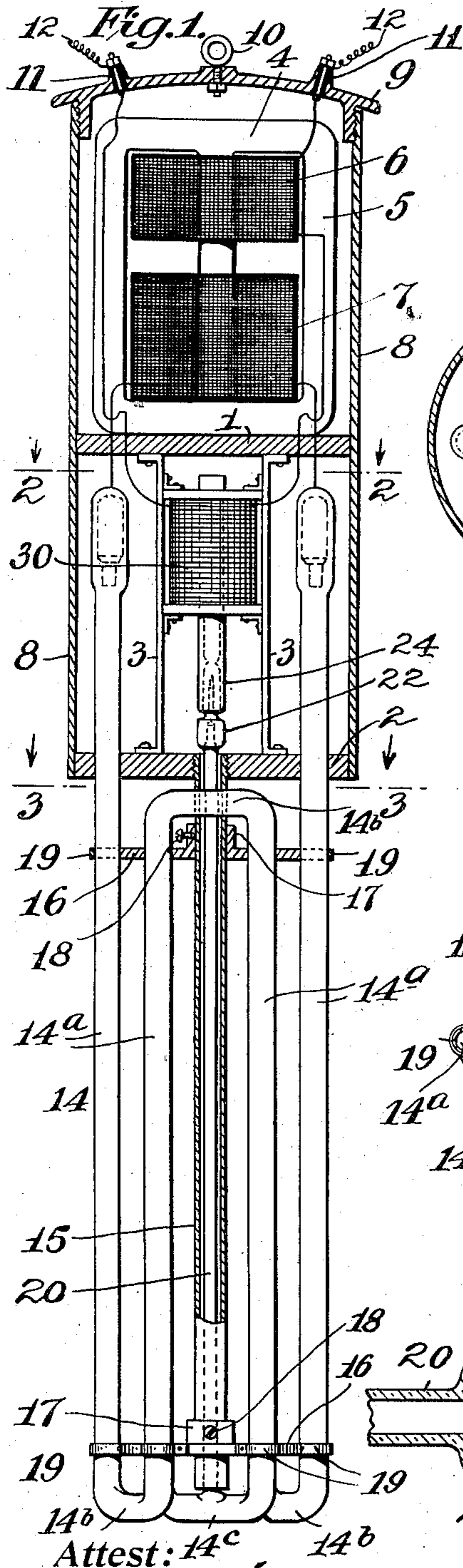


Fig. 4.

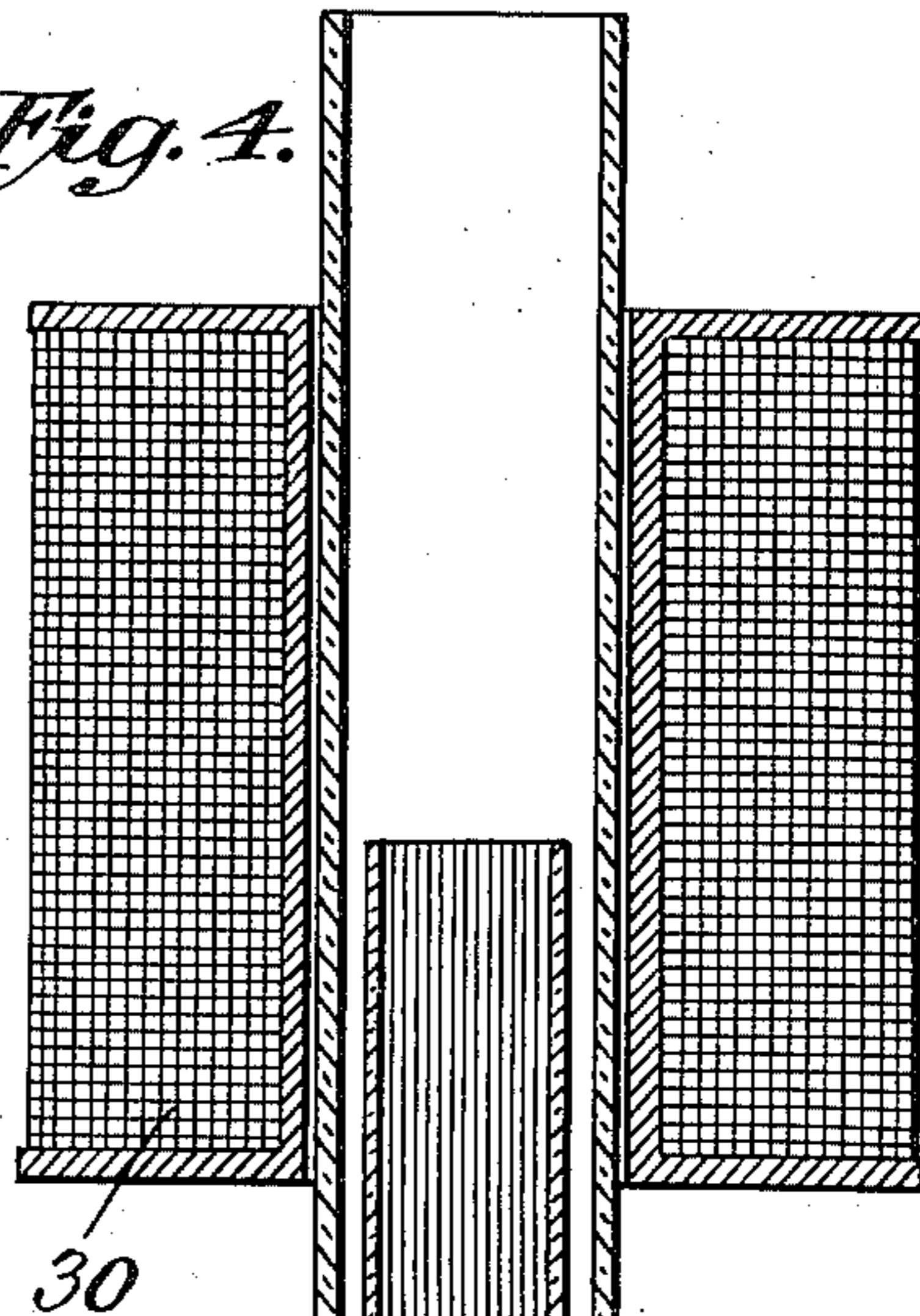


Fig. 3.

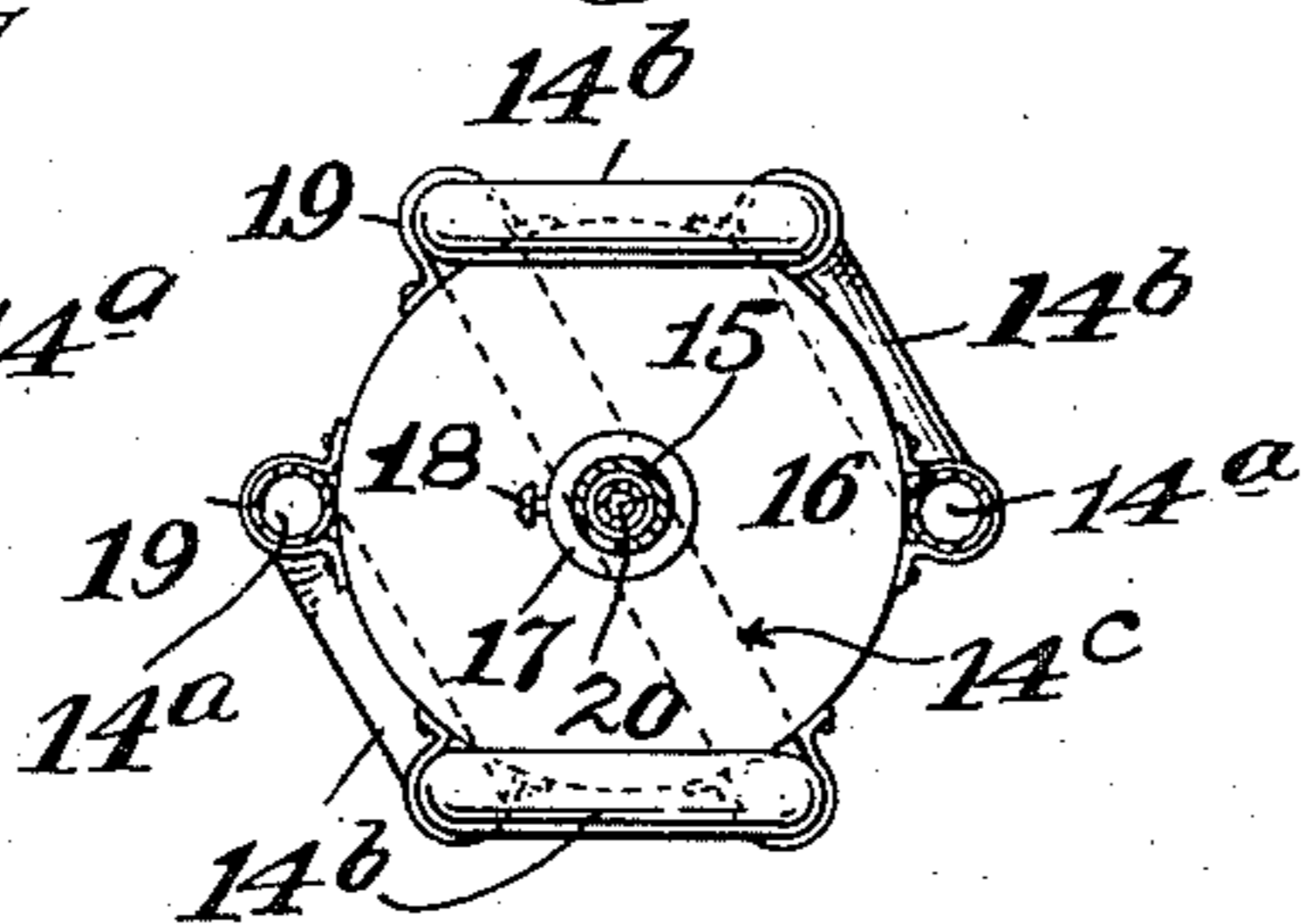
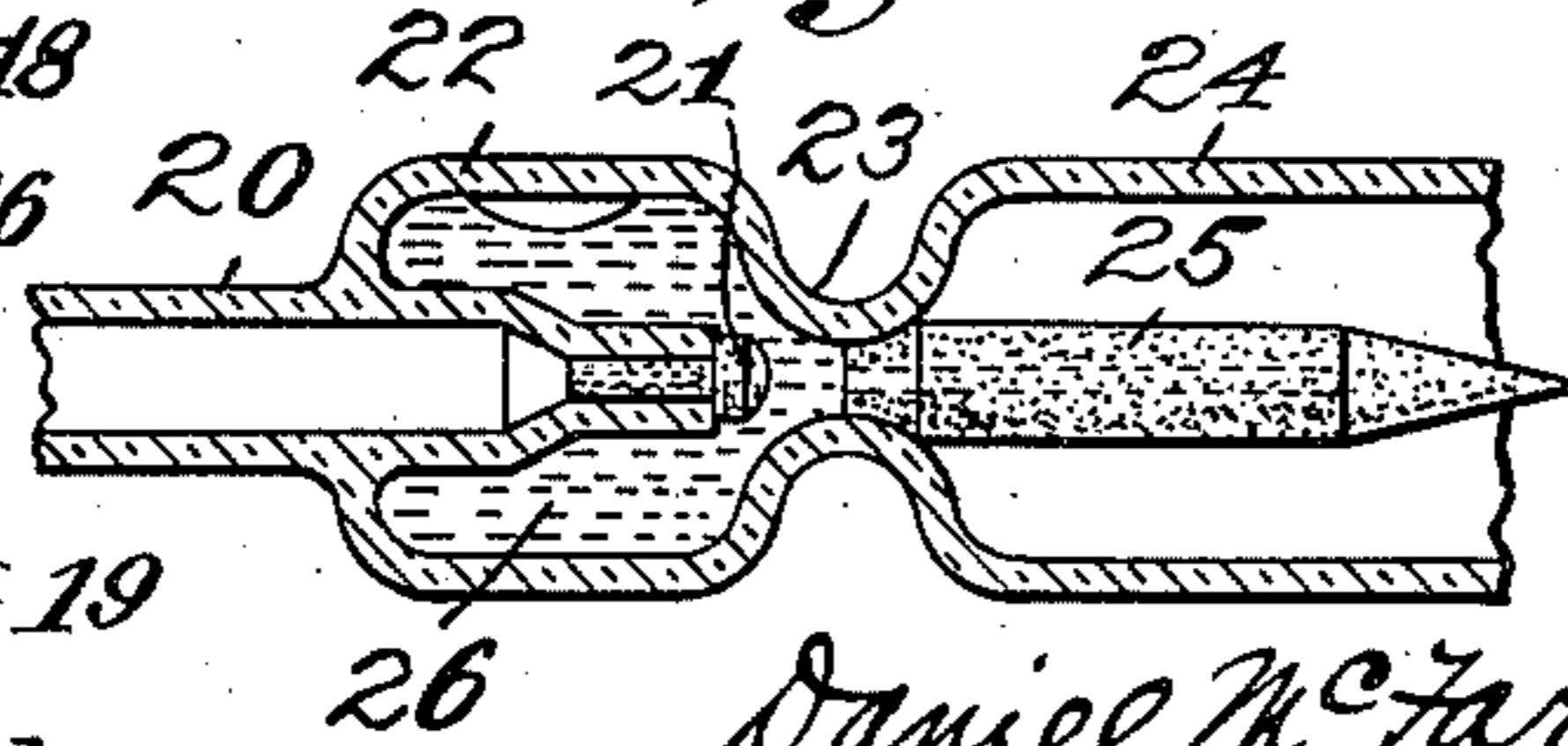


Fig. 5.



Attest: 14c
W. McGinnis
W. C. Thompson

Daniel McFarlan Moore
Inventor:
by *E. Scherr Jr* his Atty.

UNITED STATES PATENT OFFICE.

DANIEL McFARLAN MOORE, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO MOORE ELECTRICAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

VACUUM-TUBE.

984,016.

Specification of Letters Patent.

Patented Feb. 14, 1911.

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To all whom it may concern:

Be it known that I, DANIEL McFARLAN MOORE, a citizen of the United States, and resident of East Orange, New Jersey, have
5 invented certain new and useful Improvements in Vacuum-Tubes, of which the following is a specification.

My present invention solves the problem and meets the demand for a vacuum tube
10 lighting apparatus which can be constructed and evacuated at the factory and shipped like any ordinary article of merchandise ready for operation upon its arrival at destination by merely connecting it with the current source.
15

Heretofore it has been necessary to construct vacuum tube lighting apparatus at the premises where it is intended to be used and to evacuate it there; or it has been necessary if the apparatus were factory constructed and evacuated, or to carry it to the place of installation under a supervisor's care to keep the apparatus at all times in its operating position since, otherwise, the gas
20 feeding valve would unseal the vacuum and the apparatus would arrive with the vacuum in the tube vitiated, and the apparatus worthless until reëxhausted. These difficulties have obviously made it impracticable to
30 install vacuum tube lighting apparatus of the character above described except in locations near the factory.

My present improvements now for the first time make it possible to ship vacuum
35 tube lighting apparatus from the factory as an ordinary article of merchandise ready for operation and which will arrive at its destination wherever that may be ready for immediate use.

My improvements comprise a gas feeding valve which is an improvement upon the valve of my United States Letters Patent, No. 820,364, and which has the marked advantage above referred to, that the apparatus embodying the improved valve may
45 be shipped without loss of vacuum, whereas the valve of my earlier patent seals the vacuum only when the apparatus is maintained in its operating position.

Another feature of my present improvements is the conformation of the vacuum tube and the adaptation of the tube to the operating mechanism to make up a lamp

which is a compact unit as easily handled and installed as an ordinary arc lamp. 55

The precise nature of my improvement will appear from the annexed description and drawings, wherein, however, only one of the forms which my improvement may take, is shown. 60

In the drawings, Figure 1 is a front elevation partly in vertical section of a portable apparatus within my invention; Fig. 2 is a horizontal section partly in elevation on the line 2—2 in Fig. 1 looking in the direction of the arrows; Fig. 3 is the same on the line 3—3 in Fig. 1; Fig. 4 is an enlarged view of the valve and related parts detached; and Fig. 5 shows a portion of said valve in horizontal position to illustrate
70 how it seals the vacuum.

I will now describe the devices of the drawings, reserving it to the claims to point out the novel features and to indicate scope of the invention, it being understood that
75 the claims will be given due range of equivalents.

Referring to Fig. 1 it will be seen that the apparatus there shown has all of the compactness and portable character of the ordinary swinging arc light. 1 and 2 are a pair of disks secured together by spaced apart central strips 3 so as to make of the whole a sort of spool. Supported on the upper disk 1 is a transformer 4 which may be of any
80 suitable construction, that shown being of the shell-type with closed magnetic circuit 5 and its primary winding located at 6 and its secondary at 7.

The transformer and the above referred to
85 spool are surrounded by a cylindrical housing or housings 8 which serve to inclose and protect the operating parts of the lamp.

9 is a cover secured over the top of the housing and having an eye 10 for suspending the lamp, and insulating bushing 11 through which pass the leads 12. 95

14 designates the vacuum tube, the middle portion of which is bent upon itself so as to form a series of vertical lengths 14^a joined by connecting loops 14^b and 14^c. The particular conformation shown provides six upright lengths of tube disposed at the points of a hexagon (compare Fig. 3). The bottom cross-loop 14^c is at approximately the
105 center of the tube and, as will later be

seen, is the point at which the valve connects with the tube. The tube is supported vertically under the housing with its free ends projecting up through the disk 2 into the spool space within the housing. The vacuum tube is supported in this position from a vertical metal tube 15 which in turn is supported from the lower disk 2 by being tapped into a central opening therein.

16 designates a pair of disks having hubs 17 provided with set screws for securing them on the metal tube 15. The vertical lengths of the vacuum tube are adjacent to the periphery of these disks 16 and are secured thereto by bands or straps 19.

20 is a glass tube located within the metal tube 15 and connecting at its lower end with the middle loop 14^c of the vacuum tube and supporting at its upper end my improved valve which is located within the housing. The detailed construction of this valve is shown in the enlarged view Fig. 4. It will be seen that the upper end of the connecting tube 20 is provided with a plug 21. This

may be of carbon or other suitable porous material. The stem of the plug is cemented or otherwise secured in the mouth of the tube so that gases must pass through the pores of the plug and cannot leak around it.

22 is a chamber springing from the tube below its plug-end and having a constricted neck 23 located preferably immediately over and in close proximity with the head of the plug 21. This constricted neck then widens

into the vertical tube 24 forming the upper part of the valve. 25 is another plug of carbon or other suitable porous material located within the upper tube and having its lower end cemented in the opening through the constricted neck. Both plugs may be hollow as shown. The chamber 22 is filled with mercury or other suitable liquid 26 so that when the valve is in its preferred operating position of Fig. 4, the top of the plug

21 will just project above the surface of the liquid. The rest of the valve is a substantial duplication of the valve of my referred to Patent No. 820,364. Thus, is mercury or other suitable liquid in the bottom of the

upper tube 24. 28 is a tube within the upper tube with its lower end surrounding the plug 25 and dipping into the mercury, said inner tube being freely movable up and down and carrying in its upper end the usual laminated armature or movable core 29 consisting of a bundle of iron wires as usual in the art.

30 is a solenoid surrounding the upper tube. The electrical connections shown, although these may vary, are as follows: The primary 6 of the transformer, and the solenoid 30 are in series connected with the source of current supply through the leads 12 from the top of the lamp. The secondary 7 is con-

nected across the electrodes of the vacuum tube.

The operation is as follows: The lamp having been connected with a suitable current source, the vacuum tube will light up, but, after an interval due to the passage of the current, its vacuum will become higher which by lowering the resistance of the tube will cause more current to pass through it and also through the primary of the transformer and the solenoid 30. This will cause the solenoid to lift the armature tube 28 more or less from the mercury 27 and will cause the level of the mercury to fall until it exposes the tip of the carbon plug 25.

In the particular valve shown, the upper end of the vertical tube 24 is shown open to the air. The lamp may be so operated or said tube may be in communication with a generator or reservoir of any other gas or gases, suitable or desired. In any event, when the tip of the carbon plug is exposed, the air or gas will pass through the plug into the chamber 22 and thence through the lower plug 21 down the connecting tube 20 into the vacuum tube. After the vacuum has been slightly lowered in this way, its electrical resistance will rise, cutting down the current in the solenoid, thereby letting the armature tube 28 lower into the mercury, whose level rises and completely submerges the carbon plug 25. This stops further ingress of gas into the tube until the vacuum again rises and the tube calls for more gas. In short, the above is substantially the operation of the valve of my referred to Patent No. 820,364.

The great advantage of my present valve comes in when the lamp is tilted, as for example when being shipped on its side. Thus, in shipping, the mouth of the upper tube 24 will be closed by any suitable form of closure to prevent its body of mercury from running out. Fig. 5 shows the supposed condition of the valve parts when the lamp is on its side. At such time, the upper carbon plug 25 will not be covered by the mercury so that were it not for the present improvement, gas from the tube 24 would pass through the unsubmerged upper plug into the vacuum tube and would so vitiate its vacuum as to require reëxhausting when the tube arrived at its destination. This, however, cannot happen with the improved valve because the mercury in the receptacle 22 as indicated in Fig. 5 will completely submerge the plug 21 when the lamp is on its side and will prevent any gas from passing through it into the vacuum tube in spite of the fact that the upper plug 25 may be fully exposed as shown in Fig. 5.

Preferably the space between the plugs 21 and 23 should be as small as possible since the gas which it confines sooner or later finds its way into the vacuum when the apparatus

is tilted into and out of its operating position. Furthermore, it will be noted that in tilting the valve from the position of Fig. 4 into the position of Fig. 5, the mercury 26 preferably fully covers the plug 21 before the mercury 27 uncovers the plug 25. This is the case with the particular construction shown.

What I claim is:—

1. In combination a vacuum tube having an orifice; means operable from the position of the tube which leaves the orifice open in a given position of the tube and which seals it in other positions; and gas-feeding means delivering gas to the tube through said orifice.

2. In combination a vacuum tube having an orifice, a valve which in the intended position of use of the tube normally seals the orifice, but which is operable to unseal it; and means which seals the orifice in all positions except said intended position of use of the tube.

3. In combination a vacuum tube having a minute orifice impassable to liquid, but passable to gas; and means for controlling the orifice operable from the position of the tube, said means leaving the orifice open for the intended position of use of the tube and otherwise closing it.

4. In combination a vacuum tube having an orifice; means controlling the orifice operable from the position of the tube, said means leaving the orifice open when the vacuum tube is in its intended position of use and keeping it closed in other positions; and a valve operable to admit gas to the orifice, said valve having a normal unoperated position that closes the orifice when the tube is in its intended position of use.

5. The combination of a vacuum tube with gas-feeding means operable to feed gas to the tube in a given position of the tube, and which prevents feed of the gas in other positions of the tube.

6. The combination of a vacuum tube with gas-feeding means operable to feed gas to the tube when it is in its intended position of use, and which prevents feed of gas in other positions of the tube.

7. The combination of a vacuum tube with gas-feeding means which is operable to feed gas to the tube only in the intended position of use of the tube, and which prevents the feed in other positions, and which even in the intended position of the tube is normally non-feeding until operated.

8. The combination of a vacuum tube; means for feeding gas to the tube; and means operated from the position of the tube

which seals the tube from the gas-feeding means except when the tube is in its intended position of use.

9. The combination of a vacuum tube having an orifice, porous material obstructing the orifice, a liquid supported at the porous material which submerges it except when the tube is in its intended position of use and means controlling the intake of gas through said orifice.

10. The combination of a vacuum tube having an orifice, porous material obstructing the orifice, and a liquid supported at the porous material which submerges it except when the tube is in its intended position of use, and a valve controlling the intake of gas through the orifice into the tube comprising a porous material obstructing the orifice, a liquid supported at the material, and means for varying the extent of contact between the liquid and the porous material.

11. The combination of a vacuum tube; a chamber partially filled with liquid having a porous inlet and a porous outlet, the latter leading to the vacuum tube, the porous inlet and outlet being both unsubmerged by the liquid for one position of the chamber and at least one of them being submerged for other positions of the chamber.

12. The combination of a vacuum tube; a chamber partially filled with liquid having an upper and a lower opening, one of which is connected with the vacuum tube; and porous bodies obstructing said openings, that of the lower opening being located above the bottom of the chamber in proximity to the upper porous body and projecting above the level of the liquid, when the chamber is held so that the upper opening is over the lower opening.

13. A portable vacuum tube lighting apparatus comprising a vacuum tube the middle portion of which is bent upon itself to give vertical lengths of tube joined by connecting loops, the intermediate connecting loop being a cross loop at approximately the center of the tube, a vertical gas feed tube joined to said cross loop and around which said vertical lengths of vacuum tube are disposed and a frame supporting said vertical lengths of tube and having a vertical metal tube within which the said gas feed tube is located.

Witness my hand this 16th day of March, 1910, at New York city, N. Y.

DANIEL McFARLAN MOORE.

Witnesses:

ALAN C. McDONNELL,
SARA G. O'ROURKE.