No. 866,859. PATENTED SEPT. 24, 1907.

W. A. HENDRYX.

APPARATUS FOR DEPOSITING METALS.

APPLICATION FILED JUNE 30, 1905.

3 SHEETS—SHEET 1.

Fig. 1.

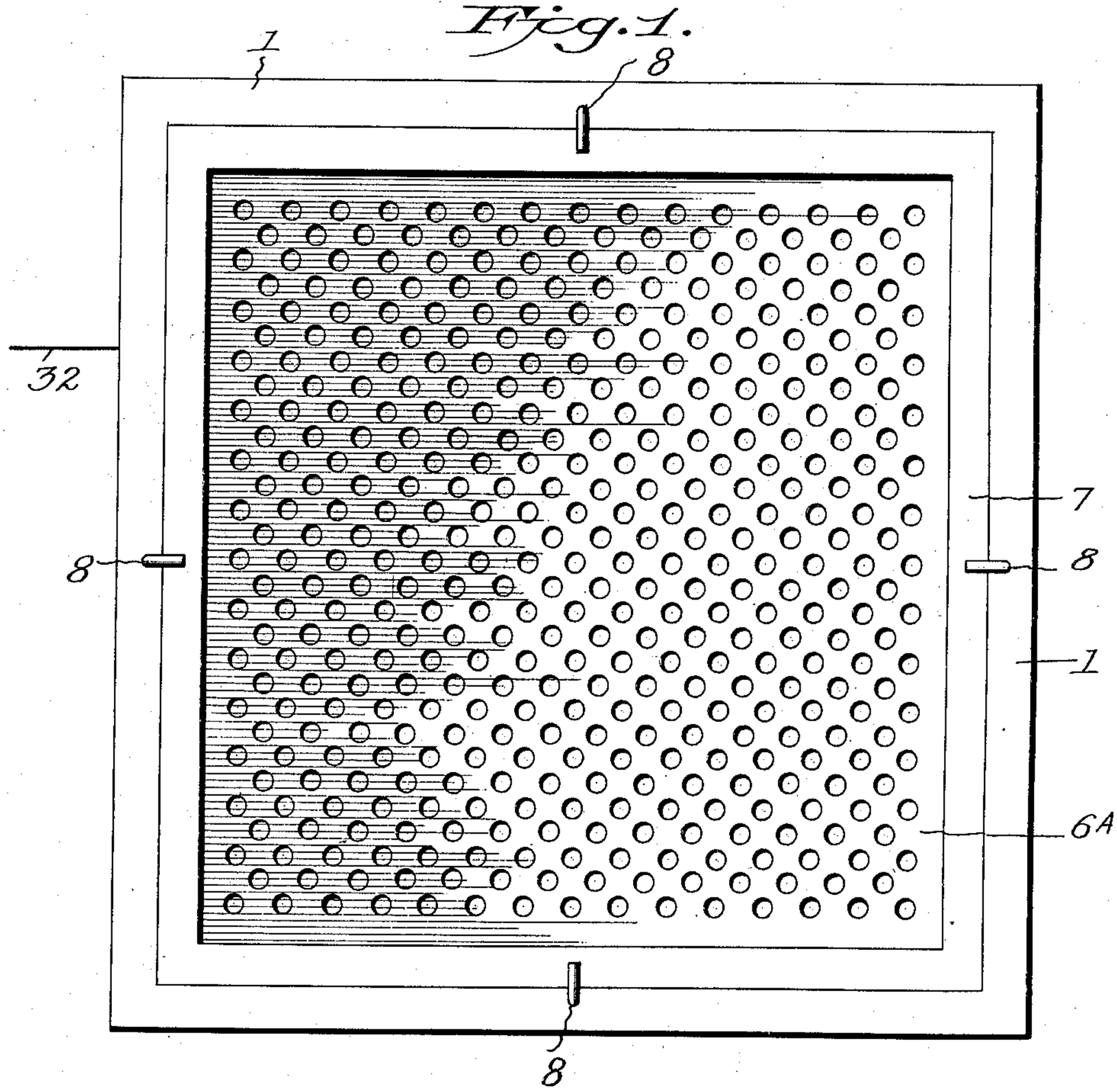
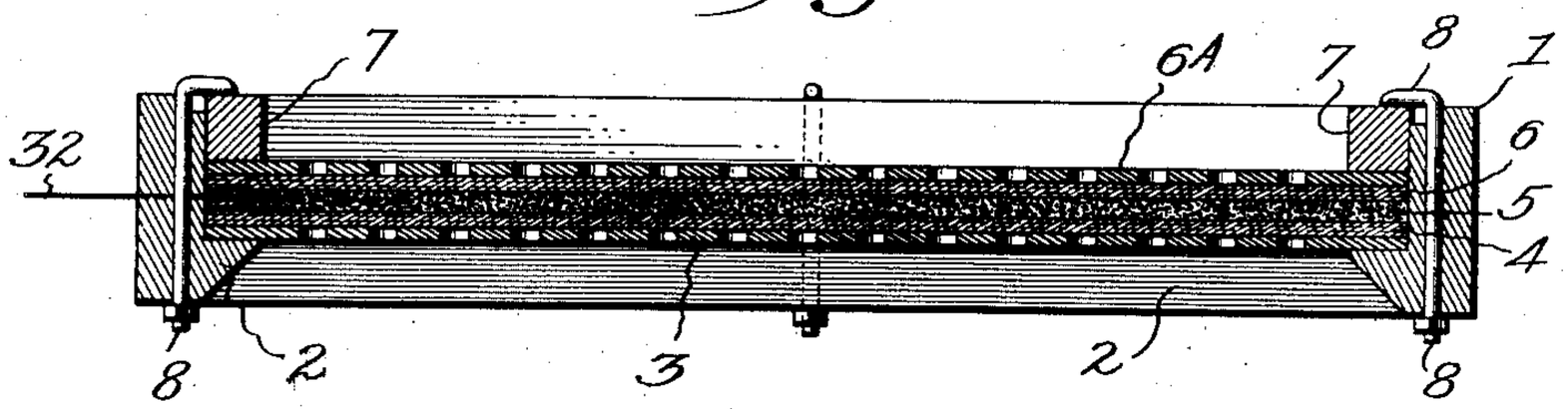


Fig. 2.



Witnesses:
G. Sargent Elliott
J. Harry Stinnson

Inventor:
By Wilbur A. Hendryx.
H. S. Bailey. Attorney.

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3 SHEETS—SHEET 2.

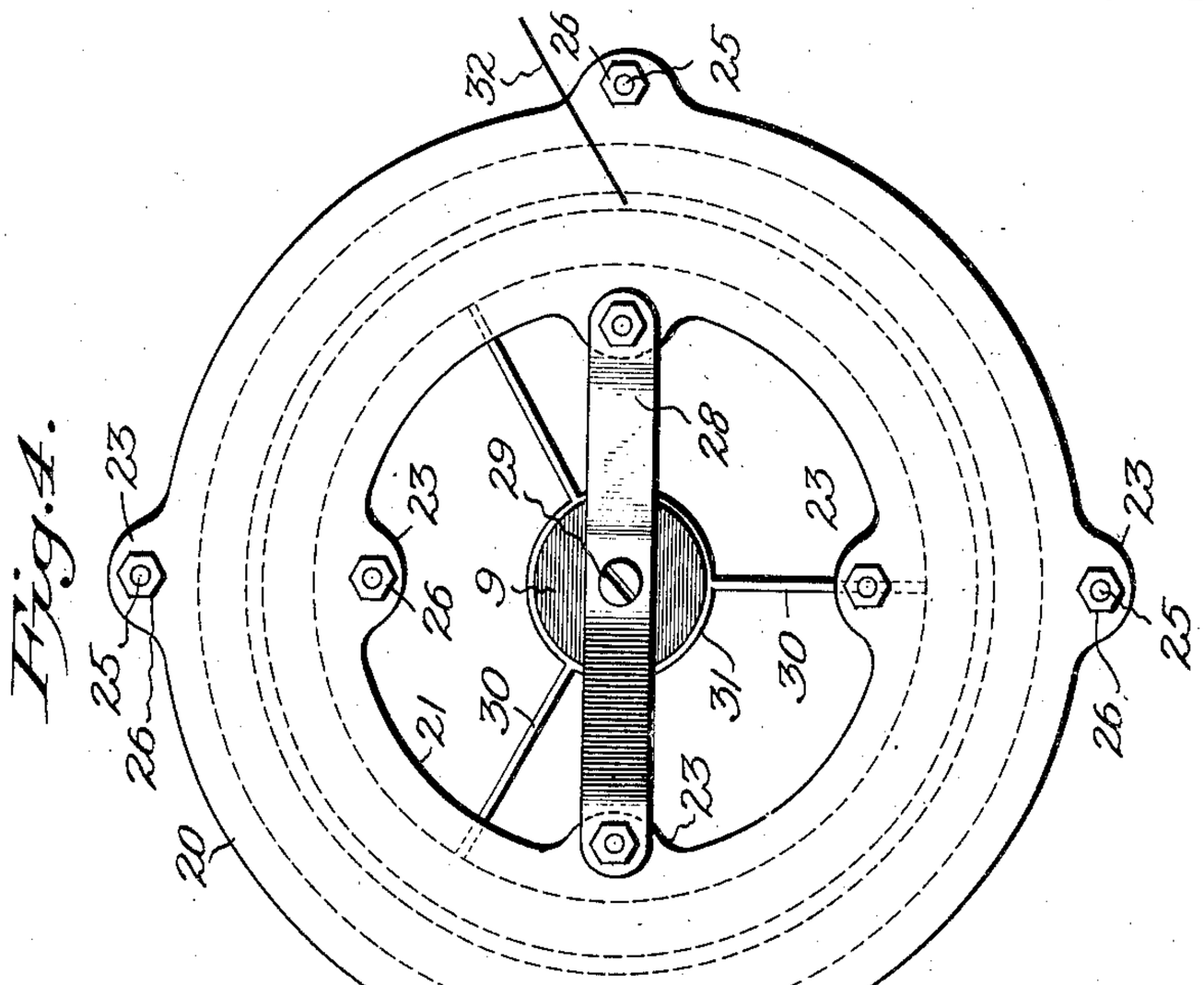

Fig. 4.

Fig. 3.

Witnesses:
G. Bayard Elliott.
J. Harry Stimson

Inventor:
By Wilbur A. Hendryx.
H. S. Bailey. Attorney

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3 SHEETS—SHEET 3.

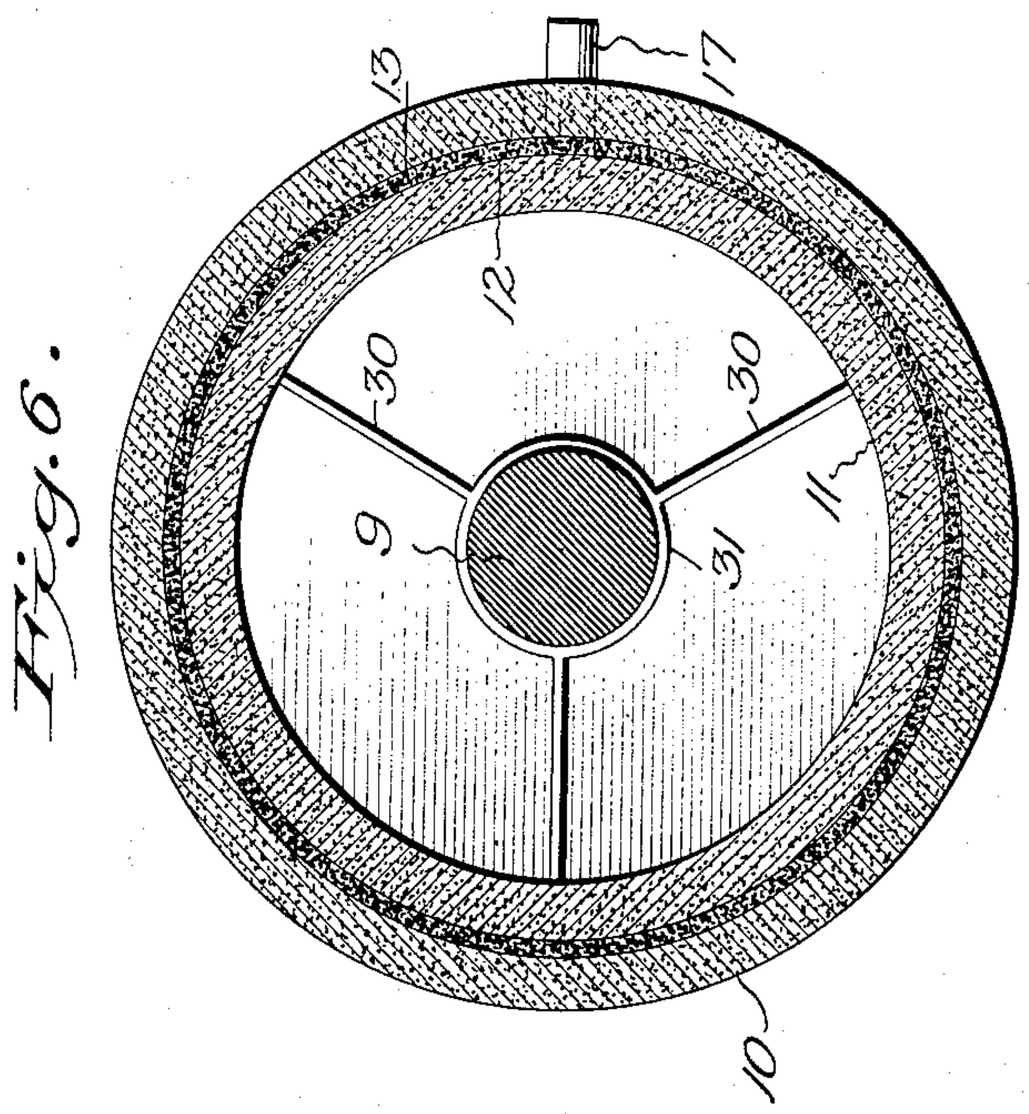

Fig. 6.

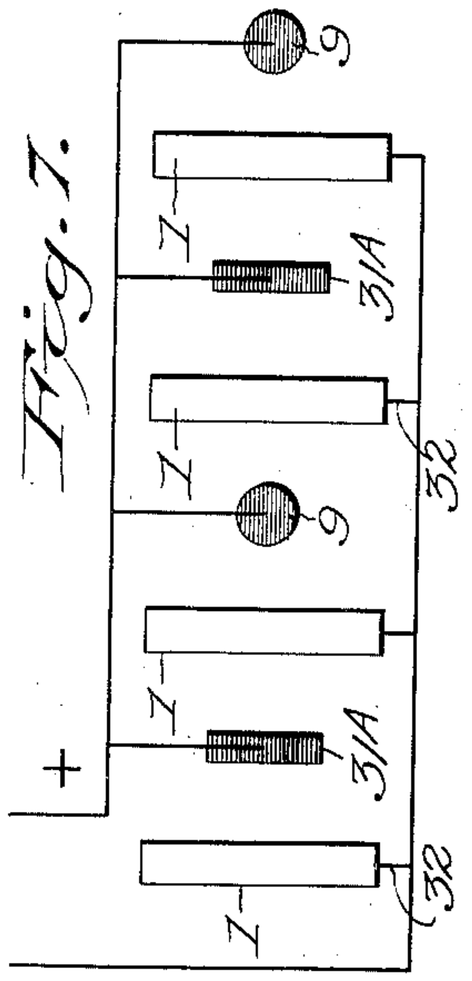

Fig. 7.

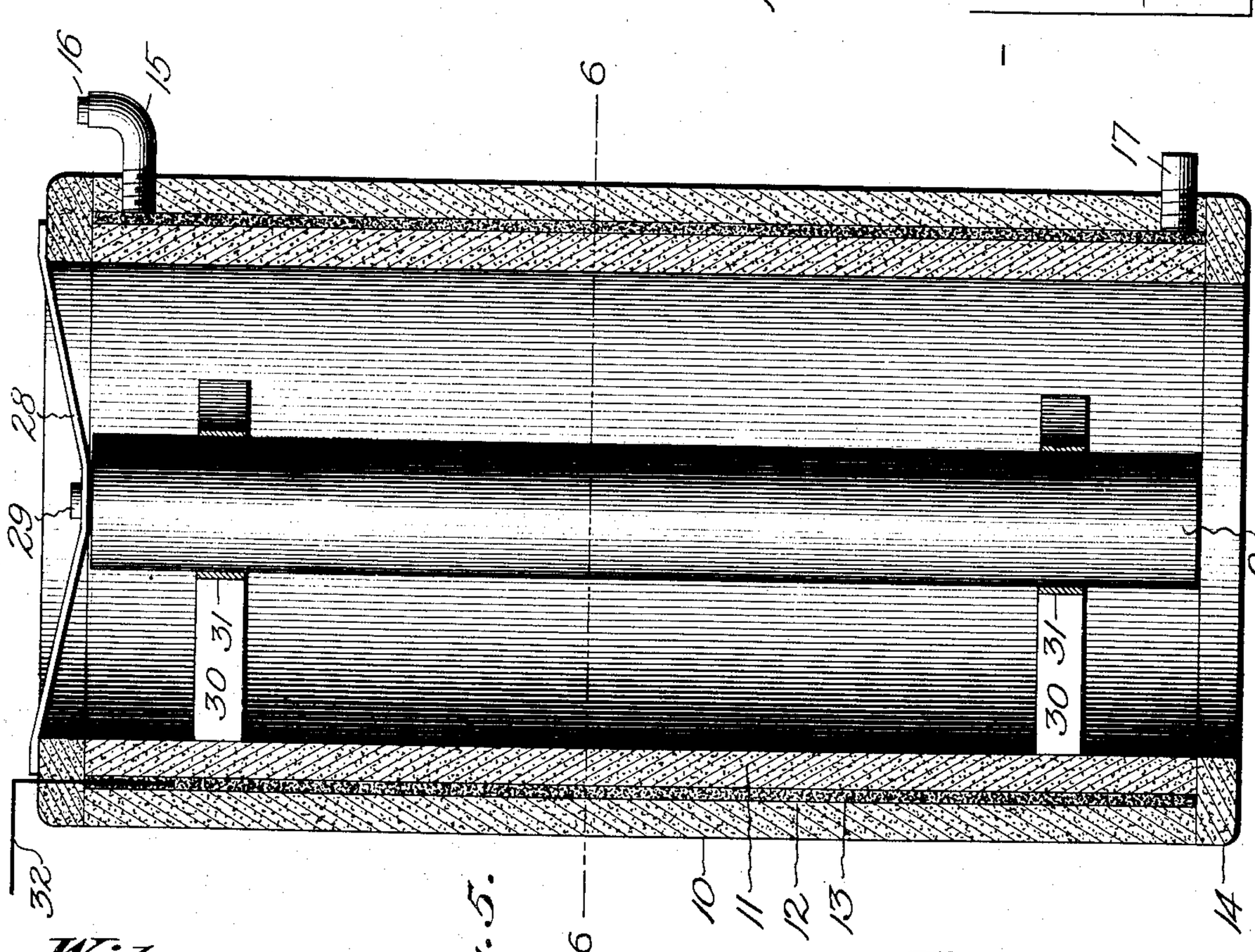

Fig. 5.

Witnesses:
G. Sargent Elliott
J. Harry Stimson

Inventor:
Wilbur A. Hendryx
By H. S. Bailey. Attorney.

UNITED STATES PATENT OFFICE.

WILBUR A. HENDRYX, OF DENVER, COLORADO.

APPARATUS FOR DEPOSITING METALS.

No. 866,859. Specification of Letters Patent. Patented Sept. 24, 1907.

Application filed June 30, 1905. Serial No. 267,786.

To all whom it may concern:

Be it known that I, WILBUR A. HENDRYX, a citizen of the United States of America, residing at the city and county of Denver and State of Colorado, have invented a new and useful Apparatus for Depositing Metals, of which the following is a specification.

This invention relates to apparatus for depositing metals, and more particularly for depositing gold, silver and copper from their cyanid or other solutions. In its preferred form the depositing device comprises an anode, a cathode surrounding the same, and a filtering envelop applied to the interior surface of said cathode. The cathode preferably but not necessarily consists of mercury or an amalgam containing mercury, retained by a pervious envelop, and protected thereby from contamination.

For a full understanding of the invention reference is made to the accompanying drawings, wherein—

Figure 1 is a side elevation of one form of apparatus embodying my invention; Fig. 2 is a transverse section of Fig. 1; Fig. 3 is a central vertical section of a cylindrical form of cathode; Fig. 4 is a plan view of Fig. 3; Fig. 5 is a central vertical section of a modified form of apparatus employing a cylindrical cathode; Fig. 6 is a transverse section on line 6—6 of Fig. 5; and Fig. 7 is a diagrammatic plan view illustrating one mode of connecting the electrodes.

Referring to the specific embodiment of my invention illustrated in Figs. 1, 2, the numeral 1 designates a frame for supporting the cathode. This frame may be made of any material, such as wood, wood-fiber, cement, or metal. I preferably make it, however, of wood. This cathode supporting frame consists of narrow side and end strips and the introverted lip 2, all suitably framed together. This introverted lip portion extends all around the frame, and projects inwardly just far enough to form a lip or step close to the sides and ends, thus leaving a large open space in the frame. In this frame, I place a perforated plate 3, which I construct of any suitable material, but preferably of cement or terra-cotta, potters' clay, wood-fiber, wood, or of any metal suitably coated against the action of the solutions employed. I preferably make these plates of a size that will fit loosely into the frame and rest on the lip. Upon this perforated plate, I place a pervious or filtering medium, 4, which may be in the shape of a cloth or sheet or plate of any suitable pervious or filtering material, such as sheets of asbestos and other suitable pliable material or plates of terra-cotta, cements, natural and artificial filtering stones, potters' clays, and compositions as pervious stuccoes and cements, and asbestos, and other fibers, and mineral wools, and also compositions, or any suitable mineral wool and other materials adaptable to form a suitable pervious filtering medium for cyanid, and other solutions. Upon this pervious or filtering material, I place a cathode 5; this cathode may consist of liquid mercury or quick-silver or of granulated lead, zinc, or of granulated lead and mercury, or granulated zinc and mercury, or of any other metals or suitable metallic compounds mixed together, and adapted to form a cathode to collect the metallic values from cyanid or other solutions. I arrange this cathode in a thin layer on the pervious or filtering material, and upon the cathode I place another sheet or plate 6, of the pervious or filtering material, similar to that placed upon the plate 3, and under the cathode 5, fitting this sheet of filtering material snugly in the frame. Upon this sheet or plate of filtering material, I place another perforated plate 6^A, like the perforated plate 3, which also fits closely and snugly in the frame. I then place on the plate 6^A, and around the inside edges of the frame, clamping strips or a narrow clamping frame 7, which I clamp down tight against the plates and thereby clamp them tight against the lip of the frame by means of clamping bolts 8. These clamping bolts consist of bolts having a threaded end and nut at one end, and a hook at their opposite ends. They extend through perforations formed through the edges of the frame, and their hooks extend over onto the top of the clamping strips or frame, while their nuts bear against the opposite edge of the frame, and are manipulated to clamp the strips or frame, and the plates and cathode tightly against the lip of the cathode's supporting frame.

I preferably use one or more clamping bolts on each of the sides of the cathode supporting frame. I preferably make this frame and the several parts of my enveloped cathode of square shape when the cathode is made in plate form, although it may be made in any polygonal form desired, and can be made in any desired shape. The square shape is the most convenient, and easiest to make, and the enveloped cathode is employed in connection with any number of anodes, 9, as shown in Fig. 7, in any suitable tank or trough, and the metal bearing solutions are turned into the tank or trough for a predetermined period of time, or they are run slowly through them. In Figs. 3 and 4 and 5 and 6, I illustrate a different form or shape, and a slightly different arrangement of my enveloped cathode electrode. In these several views, the numeral 10 designates a casing. This casing may be either cylindrical or square, or octagonal or spherical, or of any other suitable shape. The two forms I would be most apt to use, however, would be square or cylindrical, and of these two I preferably use the cylindrical form as illustrated. This casing 10, I term the outer casing. It may be a pervious or an impervious filtering cylindrical casing of any suitable material. Thus, it could be made of a silicious material, such as potter's clay made into the form of a thin cylindrical ring, close texture terra cotta, natural sand-stones and silicious clays molded and burned into close texture cylindrical rings. This outer casing, may, however, if desired, be made of metal

such as iron, glazed with porcelain, or it may be made of any other suitable material, such as asbestos or wood-fiber, papier-mâché, or paper, or mineral wools, pressed by hydraulic pressure into cylindrical rings, or into the shape it is desired to give the electrodes. It might be desirous for some solutions to make this outer casing out of impervious or non-filtering material, and for other solutions it would be better to have it made out of a pervious or filtering material, as will be explained more fully hereinafter. Consequently, my invention contemplates the use of a pervious or filtering, or an impervious or non-filtering outer casing surface of my enveloped cathode. I preferably make this outer member of the envelop of a filtering material, and have illustrated it as such. This outer member of the envelop may be of any suitable diameter, depending on the size of the vessel containing the solution in which it is to be placed.

The inner surface of my electrolytic cathode is carried by a pervious or filtering cylindrical ring member or envelop, 11, which is preferably made thin and of the same thickness as the outer member of the envelop, and it is made of any suitable filtering or pervious material, and would be made of the same material as the outer cylindrical ring would be if a pervious or filtering outer casing ring were used, as preferred. This inner cylindrical covering for the cathode fits close to but not quite against the inner peripheral surface of the outer casing ring, 10, a narrow space 12, being left between them, which may vary in width with different diameters and lengths of cathodes. This space is, however, quite narrow. I fill this narrow space with a suitable cathode, 13, which may consist of liquid quick-silver, or with powdered or granulated lead or zinc, or charcoal, or coal, or any other suitable carbon, or with an alloy of lead and mercury or zinc and mercury, or iron, or any other suitable metal or metals, or with any other suitable electrolytic cathode material or materials or alloy of materials or a combination of alloyed materials, metals, or chemicals, preferably, however, using either liquid mercury, or an alloy of mercury, such for instance as an alloy of liquid mercury and granulated lead or zinc or carbon or some other suitable metal or material. These two cylindrical rings form a cylindrical casing or shell of my electrolytic cathode. At the bottom, these two cylindrical rings are connected together preferably by an integral base or end portion 14; especially is this the case where liquid quick-silver is used as a cathode; and the top ends of the two rings are also preferably sealed together by joining them with a layer of any suitable clay or cement or plaster material, preferably using the same material the cylinders are made of, and burning them to the ends to form an integral casing. An inlet aperture is formed at the top of the casing. I preferably use for an inlet an elbow 15, and turn the entrance of the elbow upwards to receive a funnel to permit quick-silver to be poured into the cylindrical space in the casing when quick-silver or mercury is to be used as the cathode. A plug, 16, is threaded to the elbow to close its aperture after the cylindrical space is filled with quick-silver. At the bottom of the cylindrical casing, a draining outlet connection is formed, which may consist of a nipple or spigot or plug 17, closing the circumferential space between the rings at the bottom. I may use a plastic cement or plaster of paris, all or portions of which can be easily removed if ever necessary to get into the interior of the circumferential space in the cylindrical casing. An electrolytic cathode, however, constructed in this manner, can only be used with liquid quick-silver or other suitable liquid cathodes. When a powdered or granulated lead, zinc, carbon, is used, or when a quick-silver lead or zinc or other alloy or an alloyed compound is used as a cathode, it is necessary to separate one cylindrical ring from the other. I accomplish this by making cylindrical cap rings 18 and 19, and provide these caps with two projecting circular ring lugs 20 and 21. These two lugs fit over and around the outside of the cylindrical rings of the casing, which are fixed immovably to the end heads. These caps, 18, and 19, are also provided at equi-distances apart with projecting lugs 23 and 24 respectively, which are arranged around the inner and outer periphery of the caps opposite each other, and are each provided with apertures through which long bolts 25, having threaded ends and nuts 26 are placed, and the caps are evenly and tightly bolted by the proper manipulation of the nuts of the bolts. Suitable gaskets 26^A and 27 are preferably placed on the top and bottom of the cylindrical casing, so that when the caps are bolted to the casings, a perfectly tight joint is formed at their opposite ends.

The anode 9 of the arrangement shown in Figs. 3 and 4 and 5 and 6 consists preferably of a cylinder of carbon, which is suspended in the center of the cylindrical casings from a strip of any suitable material or metal 28, the opposite ends of which extend to and rest on top of the cylindrical casing in Fig. 5, but in the form shown in Figs. 3 and 4, the ends of this anode supporting strip are perforated, and are placed over the ends of two of the oppositely arranged bolts, 25, and are bolted to the caps by the nuts of the bolts. The top of the anode is secured to the center of this strip by a bolt 29, which extends through a perforation in the center of the strip and screws into a threaded hole formed in the top of the anode to receive it. The anode is also supported in the center of the cylindrical cathode by one or more spider shaped brackets, 30, that are provided with a ring shaped center portion 31, which surrounds the anode loosely. In place of the cylindrical anodes shown in Figs. 4, 6, and 7, anodes of any other form may be used, and especially in connection with the panel form of enveloped cathode shown in Fig. 1, in connection with which an anode in the form of a plate 31^A, as shown in Fig. 7, is preferably used.

While my enveloped cathode is adapted to be used in tanks and troughs for extracting the gold, silver, copper, and other metallic values of cyanid and other chemical solutions, electrolytically, it is especially adapted for use in my apparatus for extracting metals from their ores, for which Letters Patent of the United States, No. 785,214, were issued to me March 21st, 1905, and in my process application, Serial No. 225,246, now pending, and the panel form of my enveloped cathode, as shown in Figs. 1 and 2, is adapted to be used in groups with group of anodes in a suitable supporting frame as shown in the apparatus of that patent and of that process, although they can be arranged and used in any other suitable manner desired, and when immersed in a metal bearing solution and operatively con-

hected to a low current electric generator, the current flows from the anode to the cathode, and the solutions percolate or filter through the cathode envelop to the cathode, and their metallic values are deposited on the cathode, and if it is mercury or an alloy of mercury with some other metal, the solution saturates it and the gold, silver, and other values are deposited all through it.

In Fig. 1, the cathode envelop illustrated is preferably made of sheets of asbestos, or some other suitable pliable material, and also of thin sheets or plate material, such as sand-stones, cements, plates, terra cotta, and asbestos, and cement composition, and a thick strong perforated supporting plate is used on both sides of the cathode envelop in order to support the envelop rigidly in an upright position, and under pressure against the cathode, which can not be kept in a thin sheet form unless it is held tightly between the sides of the envelop.

In the form illustrated in Figs. 3, 4, 5, and 6, the envelop is made thick enough to hold liquid mercury or any other cathode material, in a thin sheet between its sides, which are thick and strong enough to support it, and are at the same time made of a pervious or filtering material that will permit the solutions to permeate, saturate and filter through to the cathode between its sides. A circuit wire 32 is inserted in the cathode at any convenient point, and extends through the envelop or its supporting frame, and is connected to a suitable source of current supply. The great practical value of my enveloped cathode over the common exposed cathodes in use, is as follows: First, no slimes, however fine they may be, can flow with the solution to the cathode and coat it and thus partially or wholly prevent the deposition of the metals upon or in it. Second, the cathode is always kept clean and free from impurities, and from any matter that may be in the ore pulp that would tend to foul it. Third, the cathode is protected from frictional contact with the cyanid or other chemical or pulp solutions, which in all cases where the common exposed cathode plates are used are apt to be scoured more or less by the agitation or flowing movement of the ore pulp in the tanks or troughs in which the electrical separation takes place. Fourth, the gold, silver, and other metal values are much easier and much quicker retorted and separated from the cathode and the cathode is very much quicker and easier placed in condition for reuse.

My invention is simple, durable, and practical, perfect in its operation, and while I have illustrated several forms of my enveloped cathode, I do not wish to be limited to them, as my invention contemplates the use of any and all characters of material, and any and all arrangements that can be made of covering, incasing, and surrounding any suitable cathode material in such a manner that the slimes and impurities of ore pulp and solution can not come in contact with the cathode, but that at the same time will permit the cathode when operatively arranged in circuit with a suitable anode, and a low current generator, and properly immersed in cyanid or other ore pulp or solutions, to electrolytically deposit the gold, silver, copper, and other metallic values from the same.

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

1. Apparatus for precipitating metals comprising an anode, a cathode support open at both ends surrounding the same, a cathode carried thereby and a filtering medium disposed between said anode and cathode, substantially as described.

2. Apparatus for precipitating metals comprising an anode, a cathode support open at both ends surrounding the same, a cathode carried thereby and a filtering medium applied to the interior surface of said cathode, substantially as described.

3. Apparatus for precipitating metals comprising an anode, a cathode support open at both ends surrounding the same, a mercury cathode carried thereby and a filtering medium disposed between said anode and cathode, substantially as described.

4. Apparatus for precipitating metals comprising an anode, a previous casing open at both ends surrounding the same, and a cathode in said casing, substantially as described.

5. Apparatus for precipitating metals comprising an anode, a previous casing open at both ends surrounding the same, and a cathode of mercury in said casing, substantially as described.

6. Apparatus for precipitating metals comprising a cathode consisting of an amalgam of murcury and zinc, and a permeable covering for said cathode, substantially as described.

7. In apparatus for precipitating metals, a cathode support comprising a permeable casing, inlet and outlet at the upper and lower portions thereof, and a body of mercury in said casing, substantially as described.

8. In apparatus for precipitating metals, a cathode support comprising a permeable casing, inlet and outlet at the upper and lower portions thereof, and a body consisting of an amalgam of mercury and zinc in said casing, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILBUR A. HENDRYX.

Witnesses:
G. SARGENT ELLIOTT,
SARAH L. BOOTH.