

No. 715,626.

Patented Dec. 9, 1902.

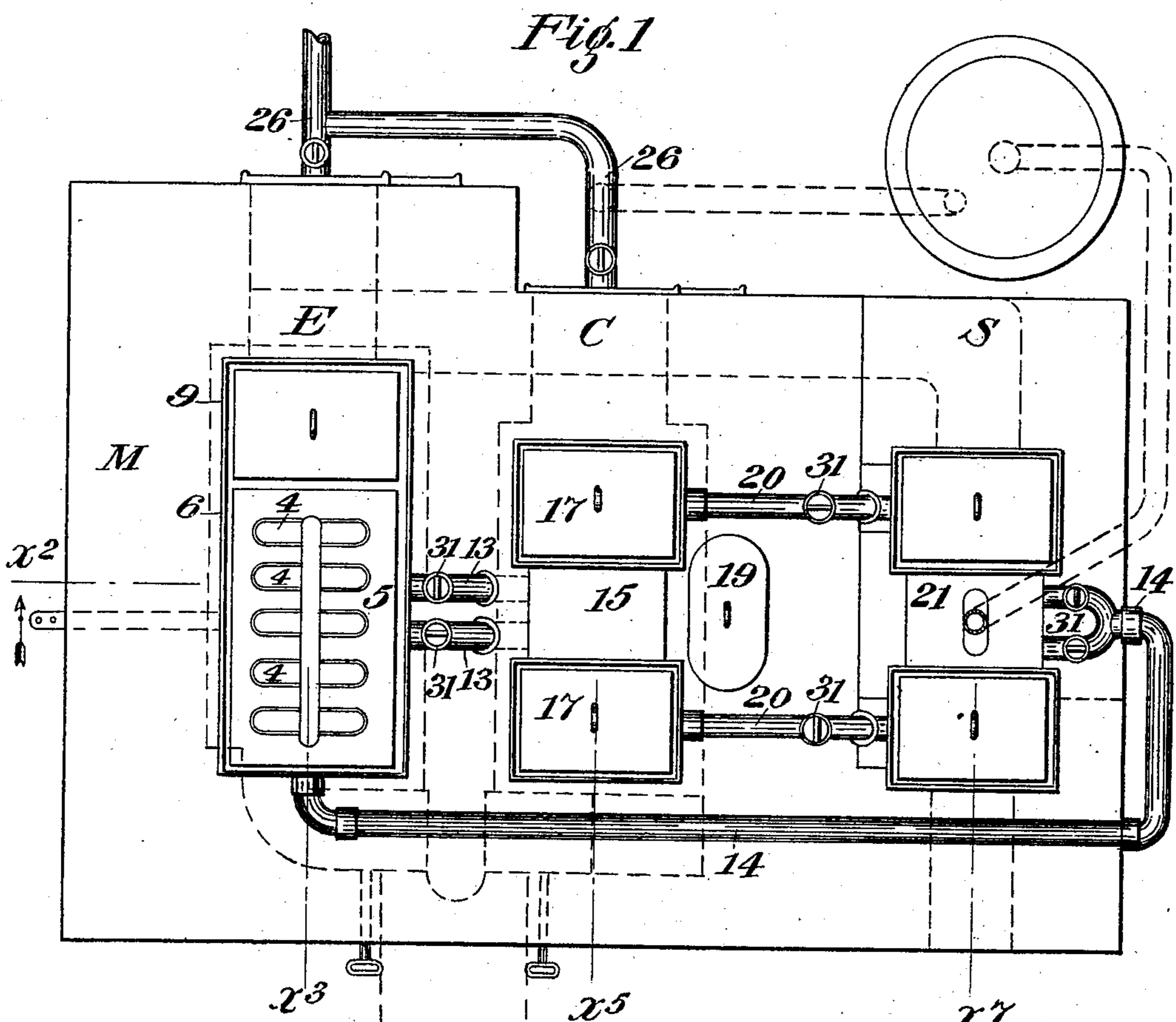
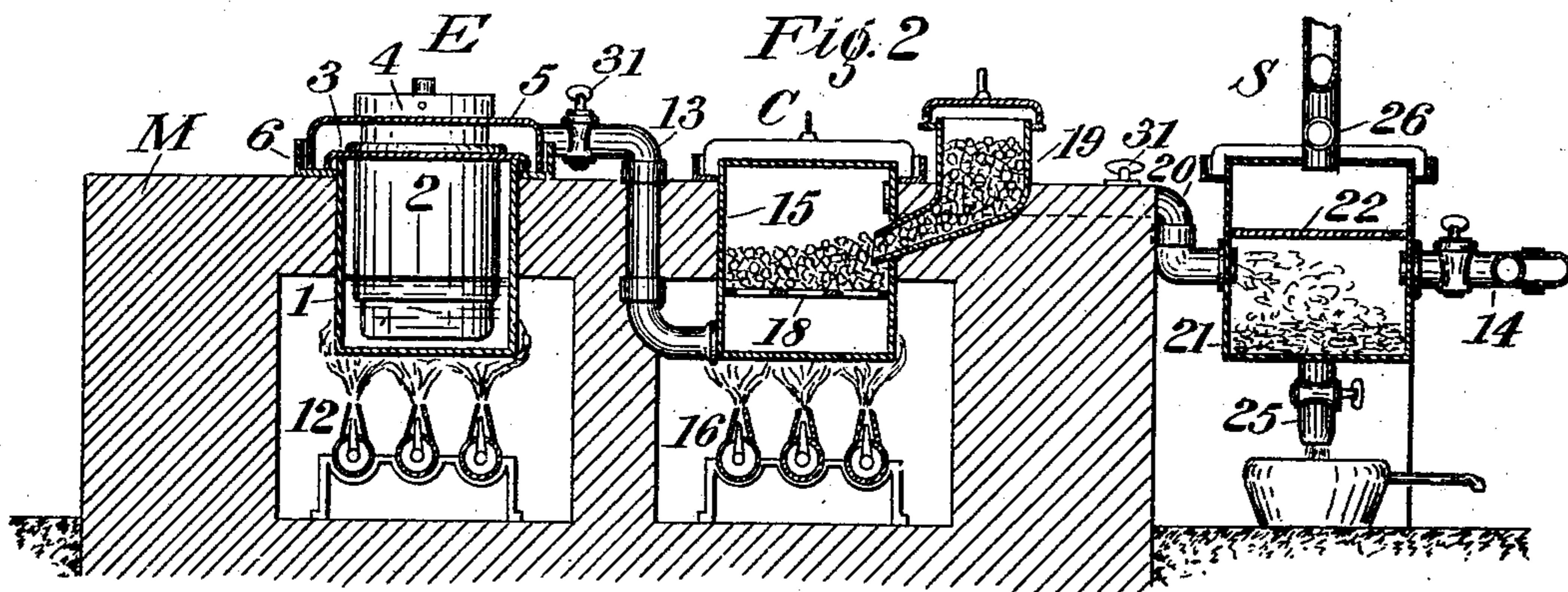
G. TADDEI.

APPARATUS FOR OBTAINING METALS BY ELECTROLYSIS.

(Application filed Dec. 13, 1901.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses
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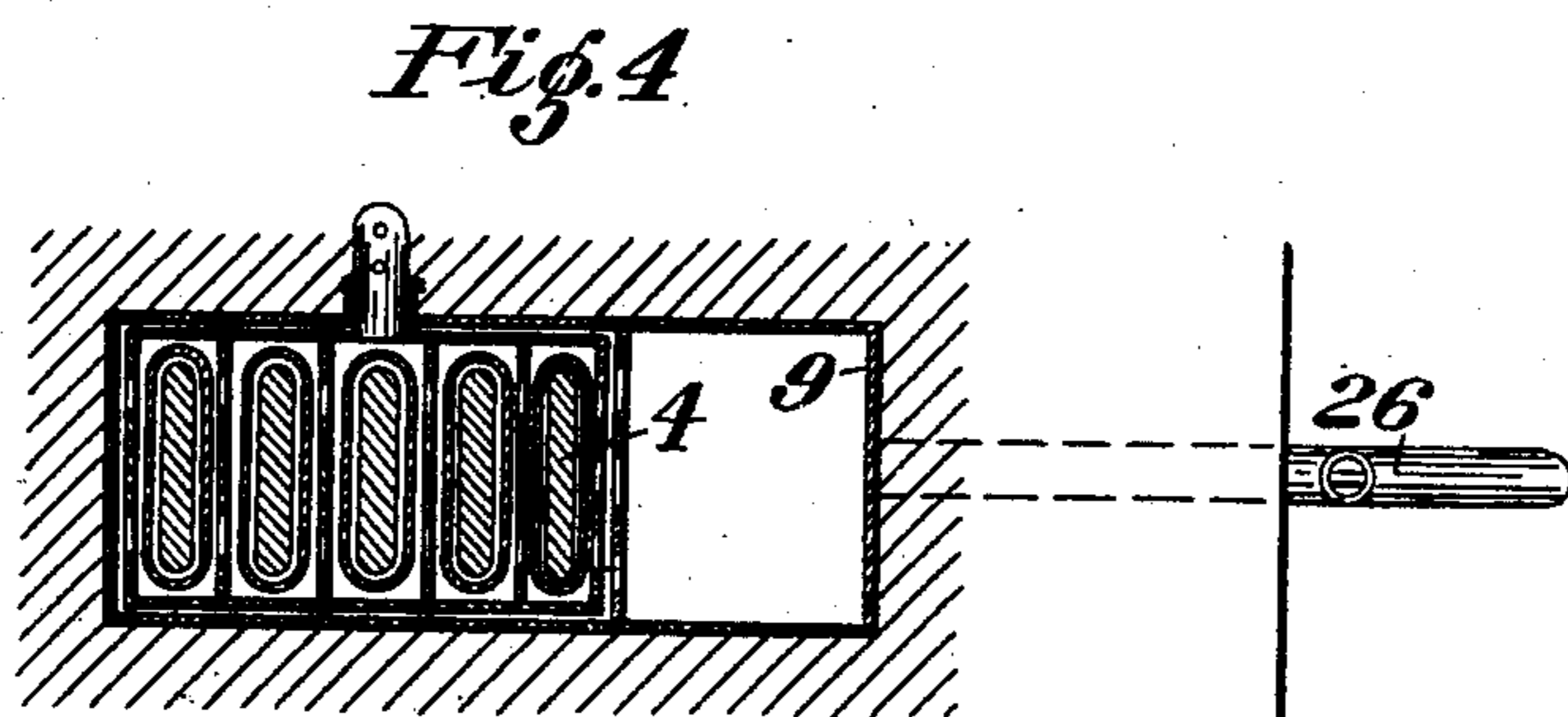
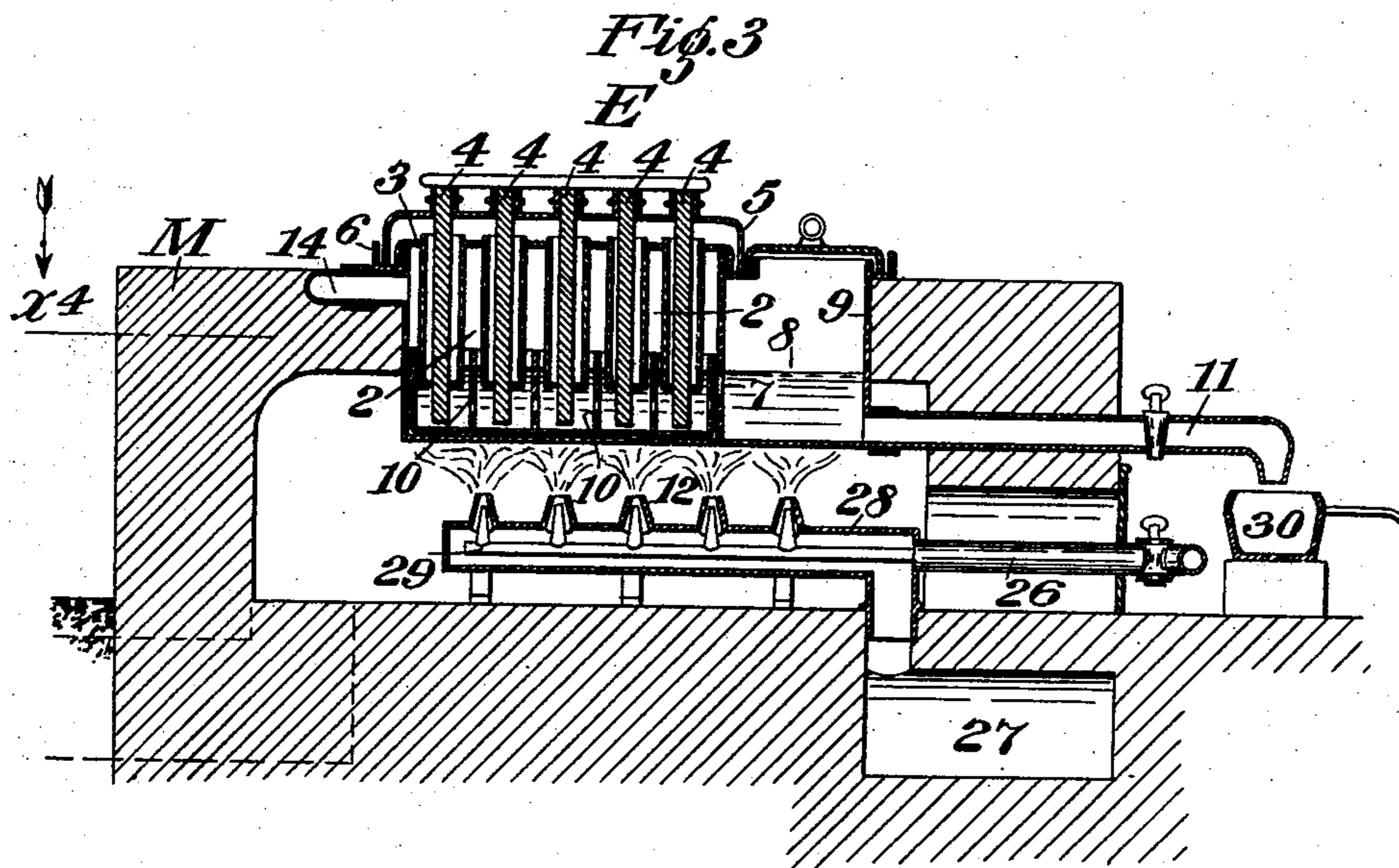
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(No Model.)

3 Sheets—Sheet 2.



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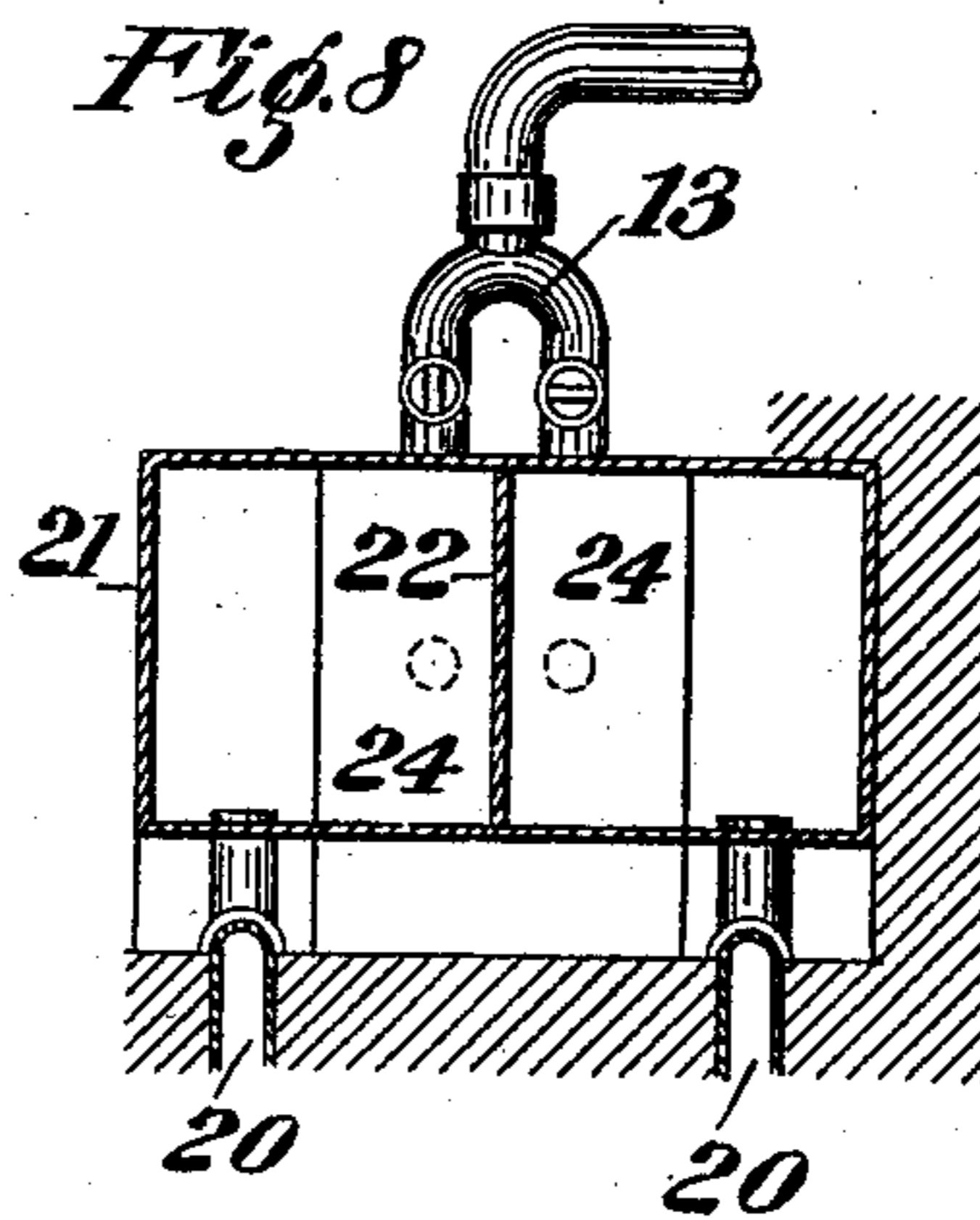
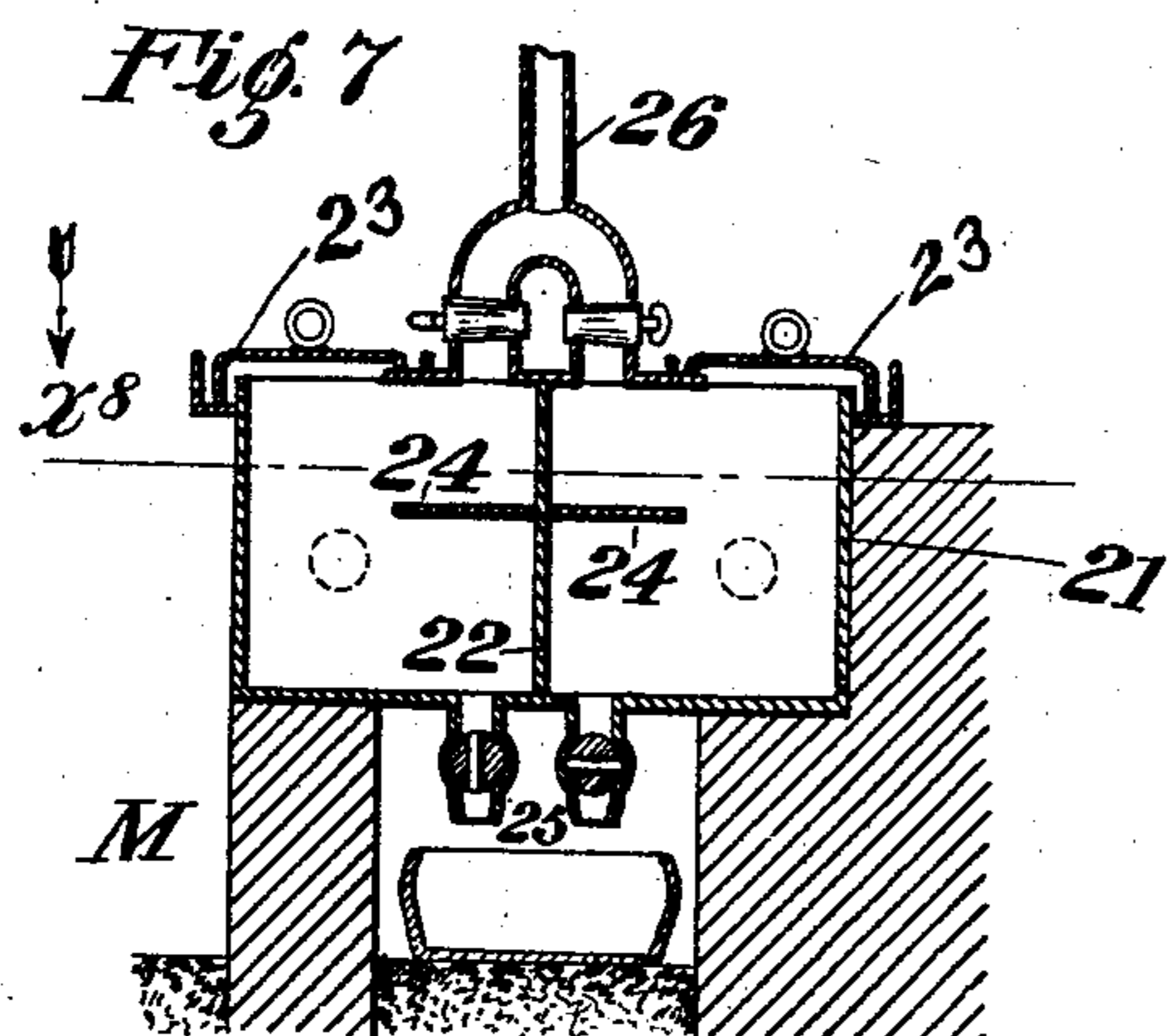
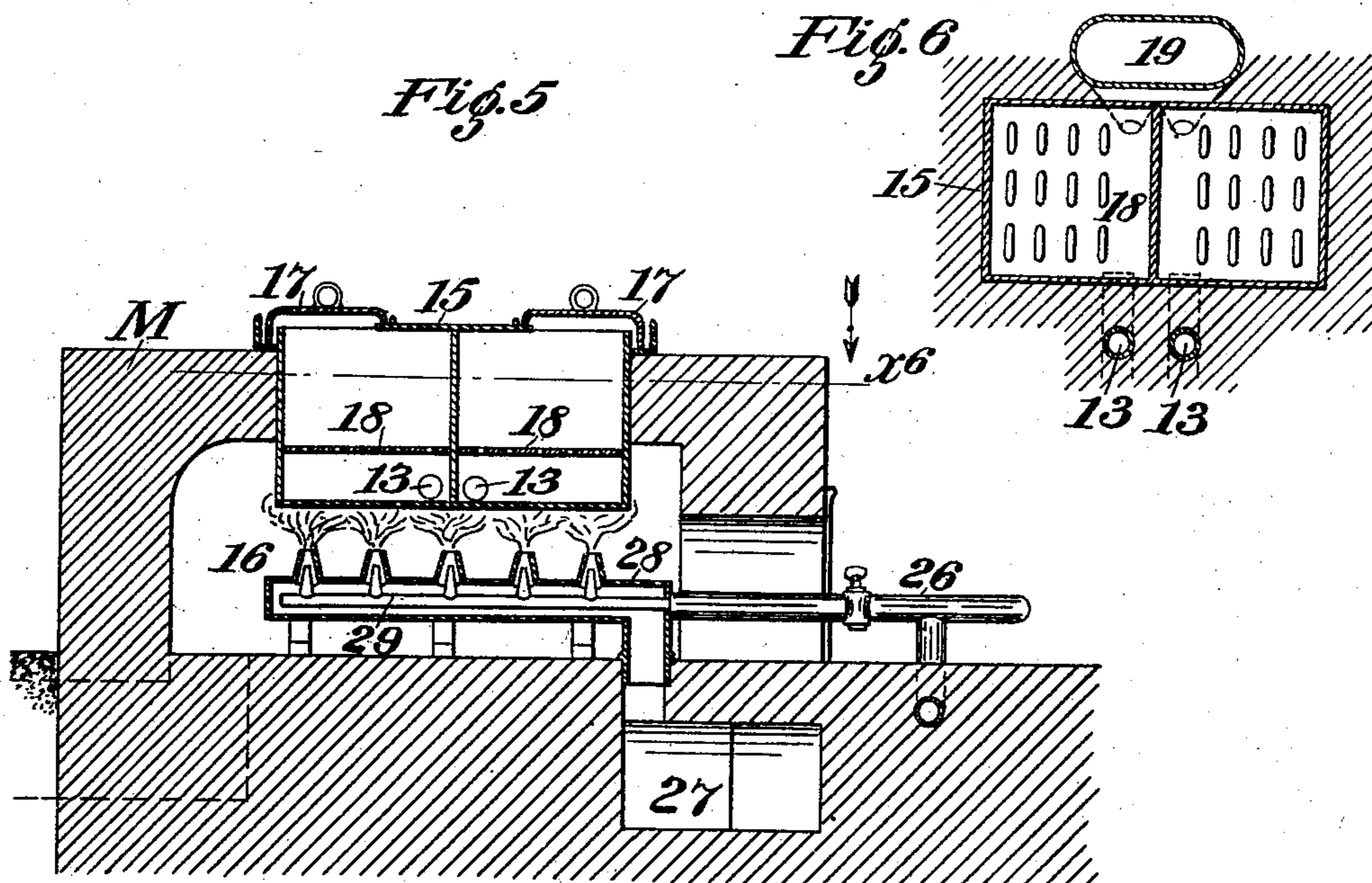
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(No Model.)

3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

GIROLAMO TADDEI, OF TURIN, ITALY, ASSIGNOR TO SOCIETA ITALIANA DI APPLICAZIONI ELETTRICHE, OF TURIN, ITALY.

APPARATUS FOR OBTAINING METALS BY ELECTROLYSIS.

SPECIFICATION forming part of Letters Patent No. 715,626, dated December 9, 1902.

Application filed December 13, 1901. Serial No. 85,772. (No model.)

To all whom it may concern:

Be it known that I, GIROLAMO TADDEI, a subject of the King of Italy, residing in Turin, Italy, have invented certain new and useful
5 Improvements in Apparatus for Obtaining Metals by Electrolysis, of which the following is a specification.

This invention relates to electrolytic apparatus for obtaining metals, and particularly
10 aluminium, by electrolysis at a minimum tension, according to a process embodied in a pending application of mine, Serial No. 68,575, filed July 17, 1901.

In the accompanying drawings, which serve
15 to illustrate an embodiment of the invention, Figure 1 is a general plan of the apparatus, and Fig. 2 is a longitudinal vertical section of the same in the plane indicated by line x^2 in Fig. 1. Fig. 3 is a vertical transverse section at line x^3 in Fig. 1. Fig. 4 is a horizontal section at line x^4 in Fig. 3. Fig. 5 is a vertical transverse section at line x^5 in Fig. 1. Fig. 6 is a horizontal section at line x^6 in Fig. 5. Fig. 7 is a vertical transverse section at
25 line x^7 in Fig. 1, and Fig. 8 is a horizontal section at line x^8 in Fig. 7.

The construction of the apparatus will be readily understood from the drawings and the following description.

30 For convenience of description the apparatus may be considered as divided into three sections—namely, the electrolyzing-section E, the chlorinating-section C, and the substituting-section S.

35 The several sections of the apparatus will be described in the order given above.

The operative features of the apparatus are set in brickwork or masonry M.

The first or electrolyzing section E consists
40 of a vessel 1, into which depend separator-tubes 2, fixed at their upper ends in an inner cover 3. The carbon anodes 4 depend in these tubes 2 from an upper or outer cover 5, elevated above the cover 3. The downwardly-
45 flanged margins of the covers rest in a trough 6 about the vessel 1. At the side of the vessel 1 and connecting therewith by apertures 7, below the level of the electrolyte 8, is a vessel 9 for introducing the electrolyte or
50 adding thereto during the process.

10 represents the iron cathodes, situated between the carbon anodes.

11 is a pipe for drawing off the metallic aluminium, as will be hereinafter explained.

12 is a heater in a chamber beneath the vessel 1 for burning carbonic oxid (CO) mixed
55 with heated air, as will be explained.

From the space between the two covers 3 and 5 two pipes 13 lead to the second or chlorinating section of the apparatus, and a pipe
60 14 leads from the interior of the vessel 1 to the section S.

It may be stated here that the separators may be made from asbestos, graphite, or other
65 suitable refractory material or from a compound of such materials.

The second section of the apparatus (seen in detail in Figs. 5 and 6) consists of a vessel 15, set in the brickwork over the heater 16. This vessel is divided transversely by a partition
70 into two chambers, each provided with a cover 17. Each chamber has a perforated bottom 18, situated some distance above the imperforate bottom, and the pipes 13 enter the space between these bottoms. A hopper
75 19 supplies material to the two chambers in the vessel 15, and pipes 20 lead from the upper parts of the respective chambers in the vessel 15 to the section S.

The third section S of the apparatus (seen
80 in detail in Figs. 7 and 8) comprises a vessel 21, set in the brickwork and divided transversely by a partition 22 into two chambers provided with covers 23. There is also in
85 each chamber a horizontal partition 24, which extends from the partition 22 part way across the chamber. The pipes 20 from the vessel 15 and the pipe 14 from the vessel 1, the latter being forked or branched, enter the vessel 21 below the partitions 24. In the bot-
90 toms of the chambers of the vessel 21 are evacuating or draining outlets 25, and a pipe 26, having forked connections with the chambers in vessel 21, carries off the gases (CO) from the same to the burners or heaters 12
95 and 16.

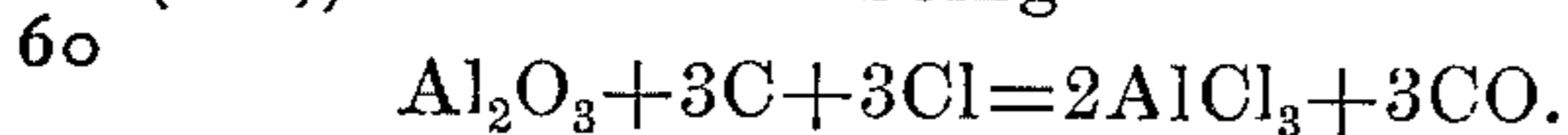
Figs. 3 and 5 show how hot or warm air mixed with carbonic oxid from the vessel 21 is supplied to the burners of sections C and
S. The air from flues 27 in the masonry en- 100

ters a tube-like jacket 28, through which extends a jet-tube 29, connected with the gas-supply pipe 26.

It is proposed with this apparatus to separate metals, and especially the metals of the alkaline earths, from the substances combined chemically with them, and the apparatus may be employed in carrying out other processes—as, for example, the preparation of soda, chlorids, and other similar combinations.

The operation of the apparatus will perhaps be best understood by describing how it is used in the separation of the metal aluminium from alumina (Al_2O_3) dehydrated and mixed according to their equivalents with pitch or resin, so as to form balls of from fifteen to eighteen centimeters in diameter in the proportion $\text{Al}_2\text{O}_3 + 3\text{C}$.

In the vessel 1 of the section E is poured an electrolyte consisting of sodium chlorid, (NaCl), which is kept in a liquid state by the heater below at a temperature of from 900° to 1000° centigrade. To the electrolyte will be added in small proportions the chlorids of potassium, lithium, strontium, or calcium in such a manner as to increase the fluidity and render negligible the portion of the electrolyte evaporated. These chlorids remain always in the bath, their action here being simply catalytic. The electrolysis is produced as follows: Chlorin is developed at the anodes 4, passes up to the space between the covers 3 and 5, and from there passes off by the pipes 13 to the bottom of the vessel 15 of section C. The auxiliary vessel 9, as stated before, is the receiver for the electrolyte, and the apertures 7 will always be below the level of the liquid. The flattened separating-tubes 2 are made to dip into the electrolyte, so as to seal their lower ends, say, ten millimeters; but they do not extend to the bottom of the vessel 1. The disposition of these separators 2 is such that as soon as the chlorin and sodium are liberated from the salt and pass to the respective anodes and cathodes they become separated permanently by the tubes 2. The sodium passes off by the pipe 14 to the vessel 21 of the section S. The vessel 15 of the section C is charged with the balls of alumina and tar, which rest on the perforated bottom 18. The chlorin gas entering by the pipes 13 passes up through the mass on the perforated platform or bottom to the space above the mass. By reason of its affinity for aluminium the chlorin decomposes the alumina, forming aluminium chlorid, while the oxygen set free from the alumina combines with the carbon of the tar or rosin to form carbonic oxid, (CO), the reaction being



The aluminium chlorid mixed with carbonic oxid flows by the pipes 20 to the vessel 21 of the section S. These pipes, as well as those before mentioned, should be well protected against radiation of heat in order to maintain the substances passing through them in a

state of vapor. The vapor of aluminium chlorid mixed with the carbonic-oxid gas on entering the vessel 21 mixes thoroughly with the hot sodium vapor from the vessel 1, and a double reaction takes place. The chlorid is decomposed and the carbonic oxid separated, as expressed in the following formula:



The sodium chlorid thus obtained and the aluminium will be found mixed. To separate the aluminium from the sodium chlorid with the aid of this apparatus, so as to produce the metal in the form of bars or bricks, the mixture of the metal and the chlorid is in the auxiliary vessel 9 of the section E. The sodium chlorid is at once taken up by the electrolyte, and the heavier aluminium in a molten state falls to the bottom and may be drawn off at the pipe 11, as before explained. Fig. 3 shows a ladle 30 to receive the molten metal and convey it to the molds.

The purpose of dividing the vessels 15 and 21 of the respective sections C and S into two parts or chambers, as shown, is to enable one chamber to be emptied and cleaned while the other is in operation, thus avoiding interruption of the process. Suitable stop-cocks 31 are provided in the several pipes to enable this to be effected.

Only one section E, or electrolytic section, is herein shown; but it will be obvious to any one skilled in the art that several of these electrolyzers may be employed in connection with a single large chlorinating apparatus C and a single large substitution apparatus S.

It may be stated that with this apparatus very little sodium chlorid is wasted or removed in any way, the same charge being made continuously.

Having thus described my invention, I claim—

1. An apparatus for the purpose specified, having an electrolyzing vessel or bath, a heater under the same, a chlorinating vessel, a heater under the same, a pipe connecting the upper part of the said bath with the lower part of chlorinating vessel, a substituting vessel, a pipe connecting the said bath with the substituting vessel, a pipe connecting the upper part of the chlorinating vessel with the substituting vessel, and a pipe for carrying the gases from the last-named vessel.

2. In an apparatus for the purpose specified, the combination with the main vessel of the electrolyzer, its heater, its inner cover, the separating-tubes suspended from its inner cover, its outer cover, the anodes suspended therefrom in said tubes, and the auxiliary vessel, of the electrolyzer, of the chlorinating vessel, its heater, the substituting vessel, a pipe leading from the space between the covers of the main electrolyzing vessel to the lower part of the chlorinating vessel, a pipe leading from the main elec-

trolyzing vessel below the covers thereof to the substituting vessel, and a pipe leading from the upper part of the chlorinating vessel to the substituting vessel.

5 3. In an apparatus for the purpose set forth, the combination with the vessel, 1, its inner cover 3, the separating-tubes pendent from said inner cover, the outer cover 5, the anodes 4 pendent from said outer cover in
10 said tubes, and the cathodes 10, of an auxiliary vessel 9 connected interiorly with the main vessel 1 for supplying the electrolyte, pipes for conveying away the separated gases, and a heater under said vessels.

15 4. The combination with electrolyzing means for separating the elements of a salt,

of a chlorinating vessel, 15, having in it a perforated false bottom 18, the hopper for supplying material to said vessel for chlorinating, and a pipe connecting the lower part of
20 the vessel 15 with the electrolyzing vessel for conveying to the former one of the separated elements, of a substituting vessel, and pipes leading thereto from the electrolyzing and chlorinating vessels.

25 In witness whereof I have hereunto signed my name, this 23d day of November, 1901, in the presence of two subscribing witnesses.

GIROLAMO TADDEI.

Witnesses:

EDUARD BRONYUS,
SECONDA TORLA.