No. 777,870. PATENTED DEC. 20, 1904.

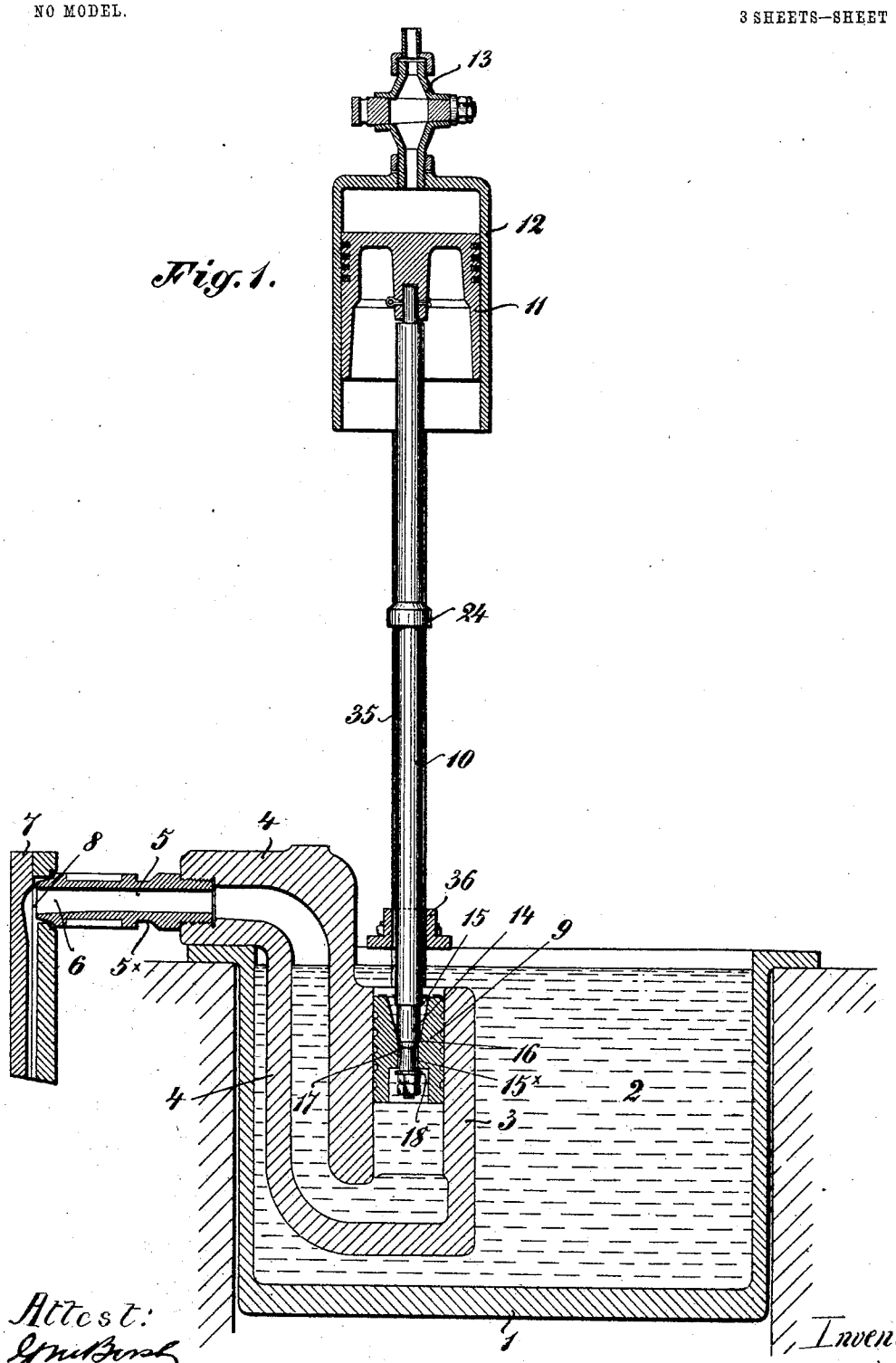
C. VELLINO.

METAL PUMP.

APPLICATION FILED JULY 25, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



Attest:
J. Mitchell
G. Galiani.

Inventor:
Carlo Vellino
By Philipp Sampson Rice & Kennedy
Attys.

PHOTO-LITHOGRAPHED BY JACKETT & WILHELMS' LITHO. & PTG. CO. NEW YORK.

No. 777,870. PATENTED DEC. 20, 1904.

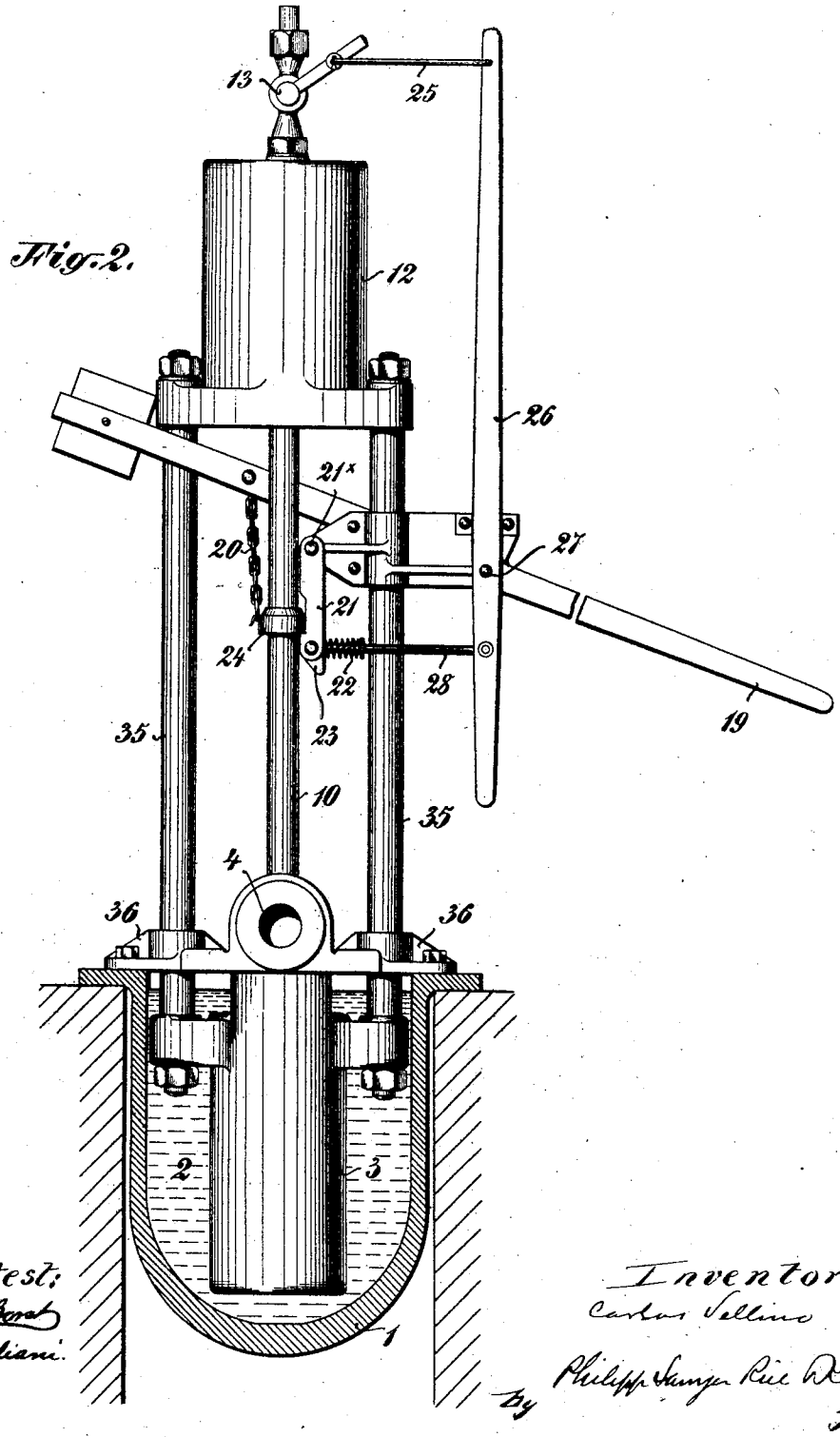
C. VELLINO.

METAL PUMP.

APPLICATION FILED JULY 25, 1902.

NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.



Attest:
[illegible]
[illegible]

Inventor:
Carlos Vellino
By Philipp Sanger Rice & Kenner
Attys.

PHOTO-LITHOGRAPHED BY SACHETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 777,870. PATENTED DEC. 20, 1904.

C. VELLINO.

METAL PUMP.

APPLICATION FILED JULY 25, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

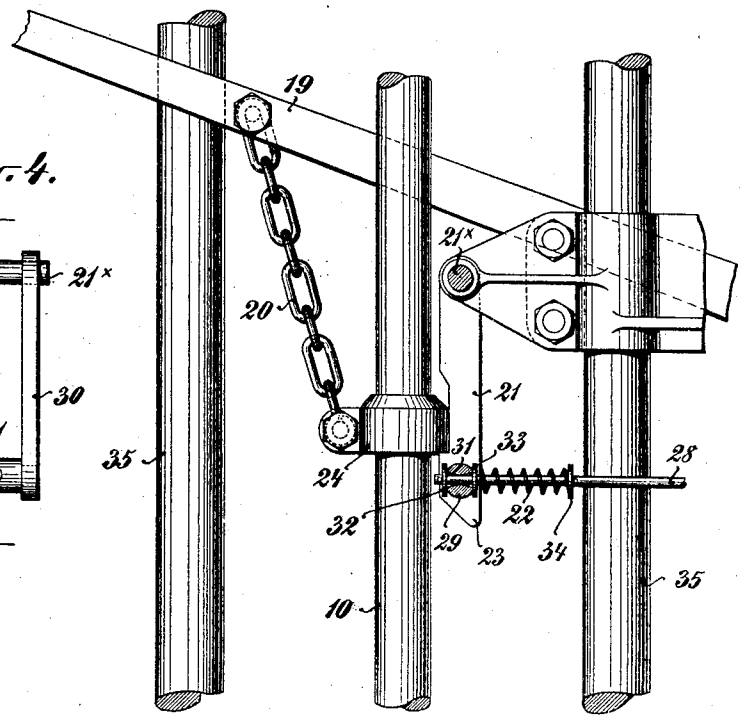
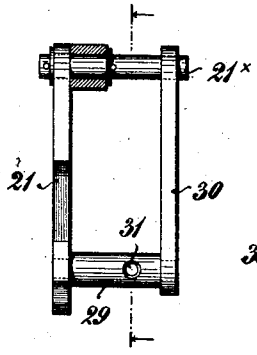


Fig. 4.



Attest:
Geo. Borst
G. Galiani.

Inventor:
Carlo Vellino
By Philipp Stamp Rice & Kenney
Attys.

No. 777,870. Patented December 20, 1904.

UNITED STATES PATENT OFFICE.

CARLOS VELLINO, OF BARCELONA, SPAIN.

METAL-PUMP.

SPECIFICATION forming part of Letters Patent No. 777,870, dated December 20, 1904.

Application filed July 25, 1902. Serial No. 116,955.

To all whom it may concern:

Be it known that I, CARLOS VELLINO, a citizen of Switzerland, and whose post-office address is No. 375 Calle Valencia, Barcelona, Kingdom of Spain, have invented a certain new and useful Improvement in Metal-Pumps, of which the following is a specification.

This invention relates to the manufacture of lead plates for secondary electric batteries by casting, the object being to produce plates of greater durability than has hitherto been the case.

In carrying out the process of casting plates for secondary batteries as hitherto conducted the molten lead is ladled into the mold in the well-known manner. As it is essential to give the plate as large a superficial area as possible, (by the formation of ribs,) &c., it is necessary to work at a very high temperature, owing to the small pressure attainable with ladle casting. At such high temperatures, however, the molten lead absorbs oxygen in large quantities, thereby affecting the structure of the plate in such a manner that when the same is formed (by the Planté method) the plates are only incompletely oxidized, which prejudically affects their durability. On the other hand, the lead in the melting-pot rapidly oxidizes on its surface, and when pouring takes place more or less particles of the oxid scum enter the mold and introduce into the plate causes of disintegration. In addition to this that portion of lead which comes into contact with the walls of the mold solidifies very quickly, producing by its contraction cavities within the ribs of the plates, and this is so much the more the case the higher the temperature at which the lead is cast. These cavities, as it well known, cause distortions of the plates, which result in short-circuiting. In accordance with my invention these defects are obviated by effecting the casting of the plates under high pressure, so that the temperature of the molten lead may be correspondingly lower.

The essential feature of the invention consists in arranging within the vessel in which the lead is melted and below the surface of the molten lead a pump, the cylinder of which becomes filled with lead on the outward stroke of the piston, while upon the return stroke this lead is forced through a pipe ascending from the bottom of the pump-cylinder within the mass of molten lead and communicating through its upper end with a nozzle, against which the mold is tightly applied. This nozzle gradually widens toward the mold and is of smaller diameter than the said delivery-pipe, so that upon the outward stroke of the piston *a* rapid rupture takes place between the fluid portion of the lead filling the nozzle and the portion which has already solidified, which latter portion when the mold is removed forms a casting-head some centimeters in length, which is withdrawn from the nozzle and is then cut off. In order to accelerate the formation of the rupture, the wall of the nozzle is made thinner at the commencement of the flaring portion, so as to effect a more speedy cooling. The capacity of the pump-cylinder should be considerably greater than that of the mold.

By means of the arrangement above described I am enabled to rapidly act upon the molten lead with the pressure of twenty to two hundred kilograms per square centimeter, with the effect that lead at a temperature which only slightly exceeds its melting-point can be forced so quickly into the mold that completely homogeneous plates are produced. Owing to the combination of high pressure and low temperature, a very close and amorphous structure is imparted to the plates, which is exceedingly advantageous for the purpose in view. In addition to this the casting operation is effected practically with the exclusion of air, and transference of oxid from the melting-pot to the mold is prevented. Owing to the close and uniform structure of the plates, their formation takes place slowly and uniformly in all parts, whereby the life of the plates is considerably lengthened. As the formation of cavities is prevented and as, in addition, the lead is forced, owing to the pressure, to come close against the walls of the mold, it is possible to cast plates with much narrower ribs or the like than has hitherto been possible. In other words, a large increase of surface as compared with ladle casting can be produced. The process does not

require so much labor as has hitherto been the case, and its success does not depend upon the skill of the operator, as when once the apparatus has been adjusted any desired number of plates of equal quality may be produced.

The invention is illustrated by way of example in the accompanying drawings, in which—

Figures 1 and 2 are two elevations, partly in section, of the apparatus, taken at right angles one to the other. Figs. 3 and 4 are detail views.

1 is the vessel containing the molten lead 2, this vessel being arranged over a source of heat, which is not shown in the drawings.

3 is the cylinder of the pump arranged in the melting-pot, with the lower part of which cylinder the ascension-pipe 4 communicates. This latter after passing upward leaves the vessel in a horizontal direction, and a horizontally-arranged nozzle 5 is screwed into its outlet. This nozzle is of smaller diameter than the ascension-pipe and widens out from the point $5^{\times}$, so as to form a conical mouth 6. At said point $5^{\times}$ the wall of the nozzle is reduced in thickness. A corresponding opening 8 of the mold 7 is passed upon the mouth 6 of the nozzle, Fig. 1, to which it is tightly fitted. As shown in the drawings, the connection of the nozzle and the mold is effected at the upper part of this latter; but this connection may also be made either at the lower part or in the middle of the mold.

The pump-piston 9 is coupled, by means of a vertical rod 10, with the piston 11 of a pressure-cylinder 12, this pressure-cylinder being open below, while its upper part can be placed in communication, by means of a three-way valve 13, either with a compressed-air reservoir or a steam-generator (not shown) or with the atmosphere. The diameters of the two pistons 9 and 11 should be such that the desired pressure may be obtained with the smallest possible expenditure of pressure medium.

The rod 10, coupling the two pistons, projects, with the reduced portion 14 of its lower end, through a passage 15 in the piston 9. This passage is funnel-shaped at its upper portion. Its middle portion is cylindrical, and its lower portion again widens out. The walls of this cylindrical portion and of the lower widened portion are provided with grooves $15^{\times}$, parallel with the axis of the cylinder. The lower part of the funnel-shaped portion of the passage 15 forms a seat 16 for a correspondingly-formed part 17 of the rod 10. If the piston 11 is raised, the part 17 rises from its seat 16, and lead then flows from the melting-pot, through the funnel-shaped passage and the grooves in its cylindrical prolongation, into the cylinder 3. Upon the lifting of the rod 10 a stop 18, arranged upon its lower extremity, bears against the piston 9 and carries this latter with it. When the piston 11 effects its downward stroke, the rod bears upon the seat 16 and depresses the piston 9.

The upward stroke of the two pistons is produced in the example illustrated in the drawings by hand by means of a weighted lever 19, with which the rod 10 is connected by means of a chain 20.

In order to automatically retain the pistons in their raised position, there is arranged a catch 21, the upper end of which is pivoted on a pin $21^{\times}$, a spring 22 tending to constantly press this catch toward the rod 10. The lower portion of the catch forms an inclined plane 23, against which the beveled upper side of an annular piece 24, attached to the rod 10, strikes when this latter is lifted in such a manner that the catch is pressed back and its spring 22 compressed. When said piece 24 has passed, the spring by its expansion causes the catch to spring back.

In order that the release of the rod 10 and the admission of the pressure medium into the cylinder 12 may be effected by one manipulation, the three-way valve 13 is connected, by means of a link 25, with a lever 26, mounted loosely upon the pivot 27 of the lever 19, and the catch 21 is coupled with this lever 26 by means of a link 28, so that by turning the lower end of the lever toward the right hand the three-way cock is arranged in the admission position and the catch 21 is withdrawn from the piece 24.

As shown in Figs. 3 and 4, the catch 21 is rigidly connected at its lower part, by means of a cross-rod 29, with an arm 30, mounted upon the pivot $21^{\times}$. This cross-rod is provided with an opening 31, through which the link 28 projects. The opening 31 is of the form shown in Fig. 3 in order that the catch 21 may slide on the link 28 when pressed back by the piece 24. Upon the extremity of this rod 28, which passes through the opening 31, a stop 32 is fixed so that the rod 28 upon the displacement toward the right hand of the lever 26 may displace with it the catch 21. In front of the opening 31 is loosely placed upon the rod 28 a stop or washer 33, between which and a rear fixed stop 34 the spring 22 is compressed.

The two cylinders 12 and 3 are rigidly connected one with the other by means of pillars 35, the feet 36 of which are supported upon the edge of the melting-pot.

The manner of manipulating the apparatus and its operation are as follows: Assuming that both pistons occupy their lowermost position, the lever 19 is depressed, the rod 10 rises with the pistons, and by means of its tappet 24 presses back the catch 21, which when the tappet has passed springs back beneath it. During the upward stroke the cylinder 3 becomes filled with lead from the melting-pot in the manner already described. When the upward stroke has been completed, the lever 19

is released, the mold 7 is placed in position, and the lever 26 drawn to the right, thereby drawing back the catch 21 and adjusting the three-way cock in the admission position. The rod 10 immediately falls upon the seat 16, and the piston 9 is driven down in the cylinder 3, out of which the lead passes with corresponding pressure through the delivery-pipe 4 and nozzle 5 into the mold 7. Immediately the mold is filled a shock is produced. When the casting has been effected, the lever 26 is moved back to the left, thereby adjusting the three-way valve in the discharge position and moving the catch 21 into the path of the piece or tappet 24. When the pistons rise, that portion of the lead which has remained fluid in the delivery-pipe and the nozzle is caused to rapidly sink back and to detach from the set portion forming a casting-head, the mold is removed and replaced by an empty one, whereupon the cycle of operations is repeated.

What I claim as my invention is—

1. In apparatus for casting lead plates for secondary electric batteries, the combination, with a vessel for containing molten lead and a mold, of a piston-pump located within the lead-containing vessel, a valve arranged to establish communication between the pump-cylinder and the lead-containing vessel below the surface of the molten lead, a delivery-pipe ascending within said lead-containing vessel from the bottom of the pump-cylinder, a nozzle connected with the outer end of the delivery-pipe, a pressure-cylinder, a piston within the pressure-cylinder, a rod connecting the pistons of the pump and the pressure-cylinder, a weighted lever for raising the rod, a projection fixed to the rod, a pivoted catch, a spring for pressing the catch in the path of said projection, and means for alternately connecting the pressure-cylinder with a pressure-supply and the atmosphere, substantially as and for the purpose stated.

2. In apparatus for casting lead plates for secondary electric batteries, the combination, with a vessel for containing molten lead and a mold, of a piston-pump located within said lead-containing vessel, a valve arranged to establish communication between the pump-cylinder and the lead-containing vessel, a delivery-pipe ascending within said lead-containing vessel from the bottom of the pump-cylinder and connected at the outer end to a nozzle, a pressure-cylinder, a piston in the pressure-cylinder, a rod connecting the pistons of the pump-cylinder and the pressure-cylinder, a weighted lever for raising the rod, a projection fixed to the rod, a pivoted catch, a spring for pressing the catch in the path of said projection, a three-way valve on the pressure-cylinder for alternately connecting the latter with a pressure and the atmosphere, a pivoted lever, and links connecting the three-way valve and the catch with said lever, substantially as and for the purpose stated.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CARLOS VELLINO.

Witnesses:

STANLEY C. HARRIS,

MANUEL SABIO.