

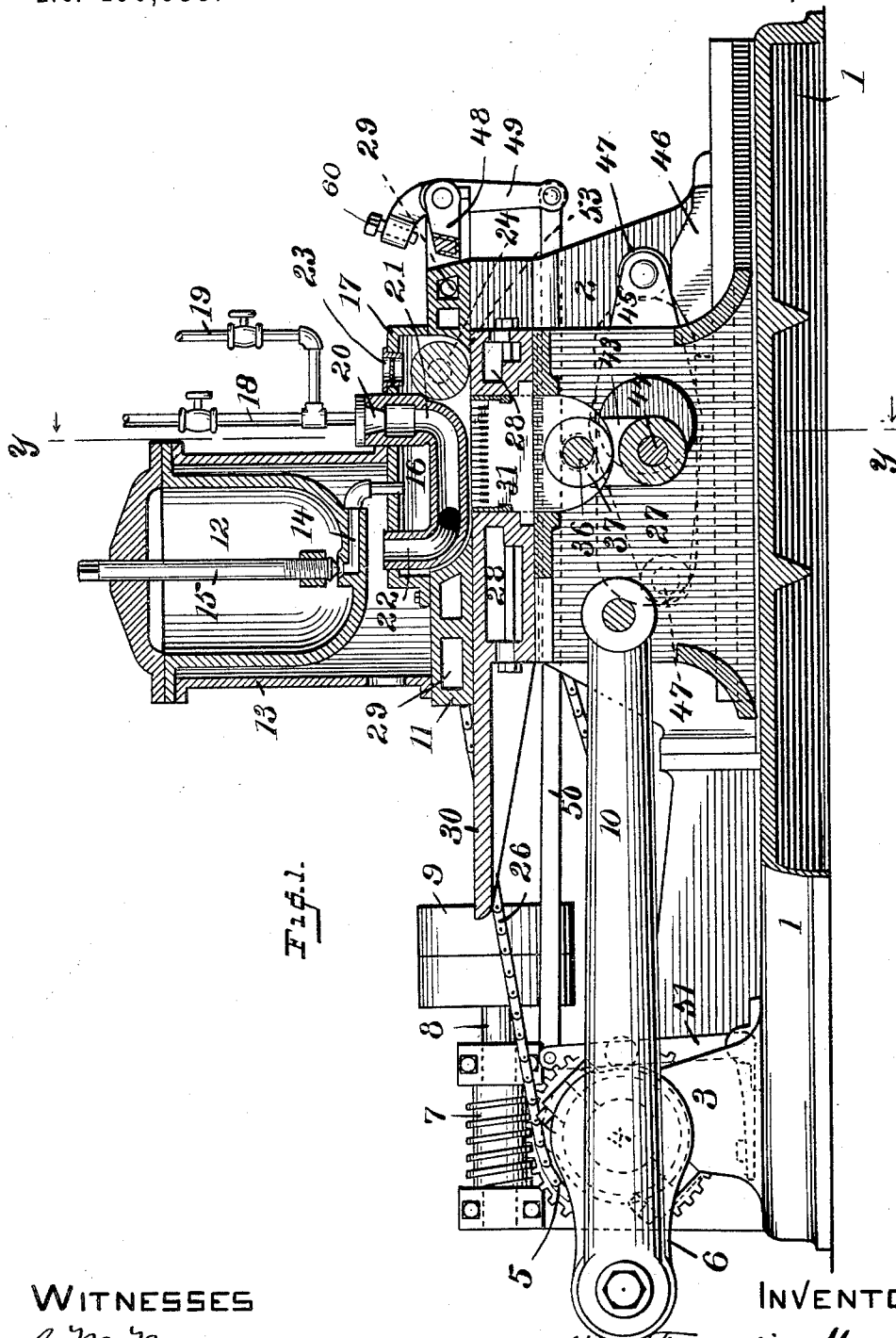
(No Model.)

7 Sheets—Sheet 1.

A. F. MADDEN.
MACHINE FOR CASTING GRIDS.

No. 460,933.

Patented Oct. 6, 1891.



WITNESSES

C. M. Newman,
A. J. Tanner.

INVENTOR

Albert Franklin Madden
by his atty J. H. Hubbard

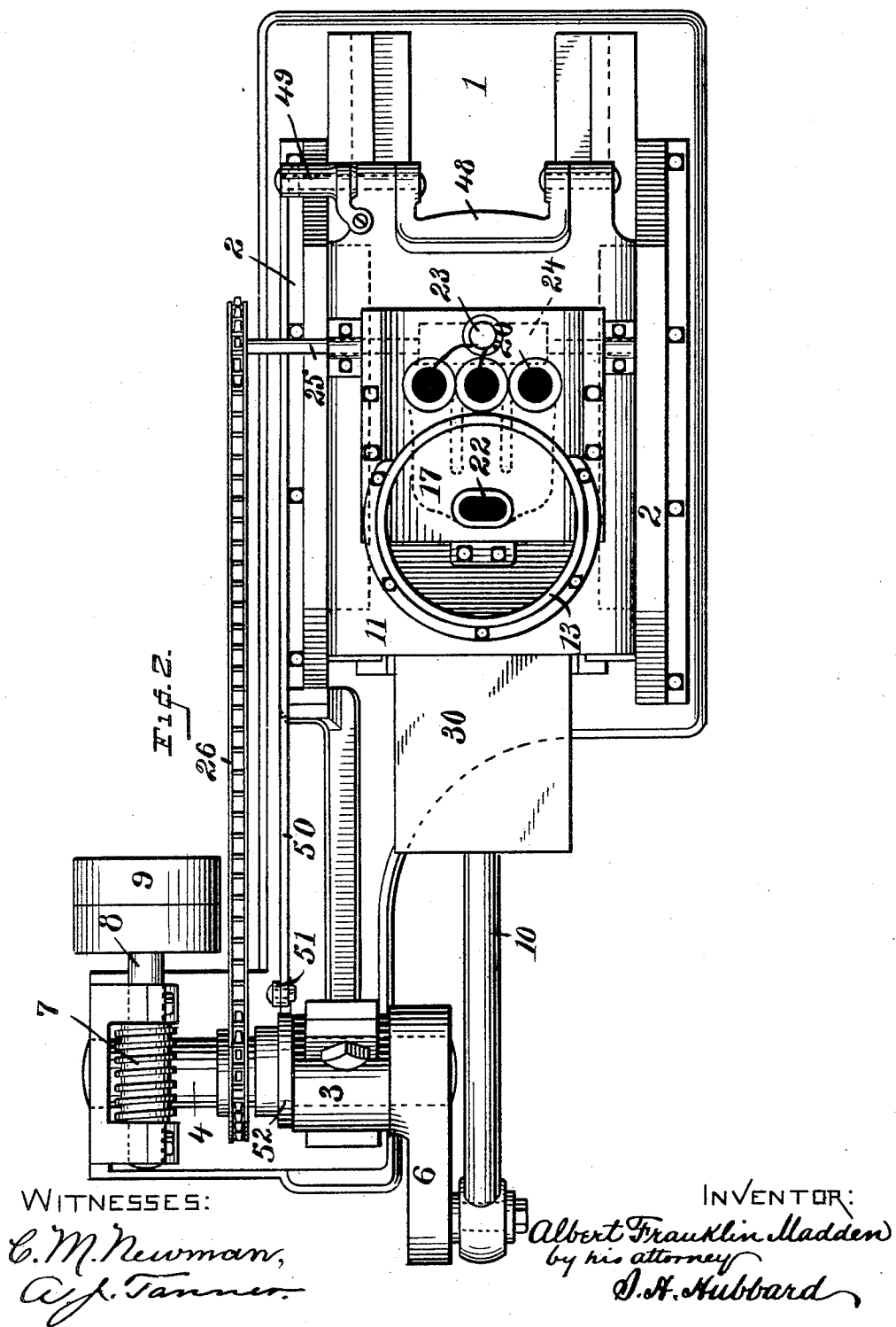
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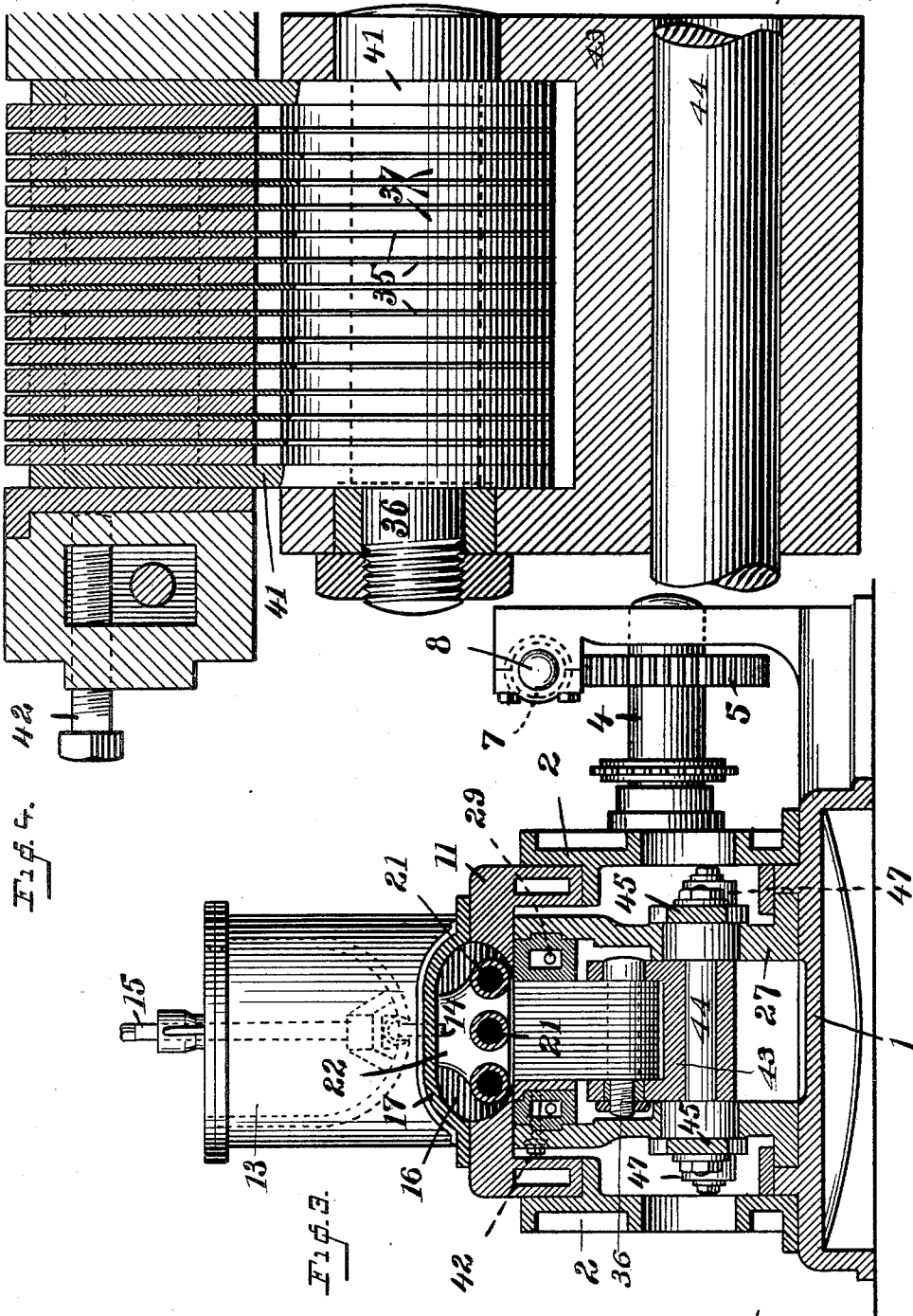
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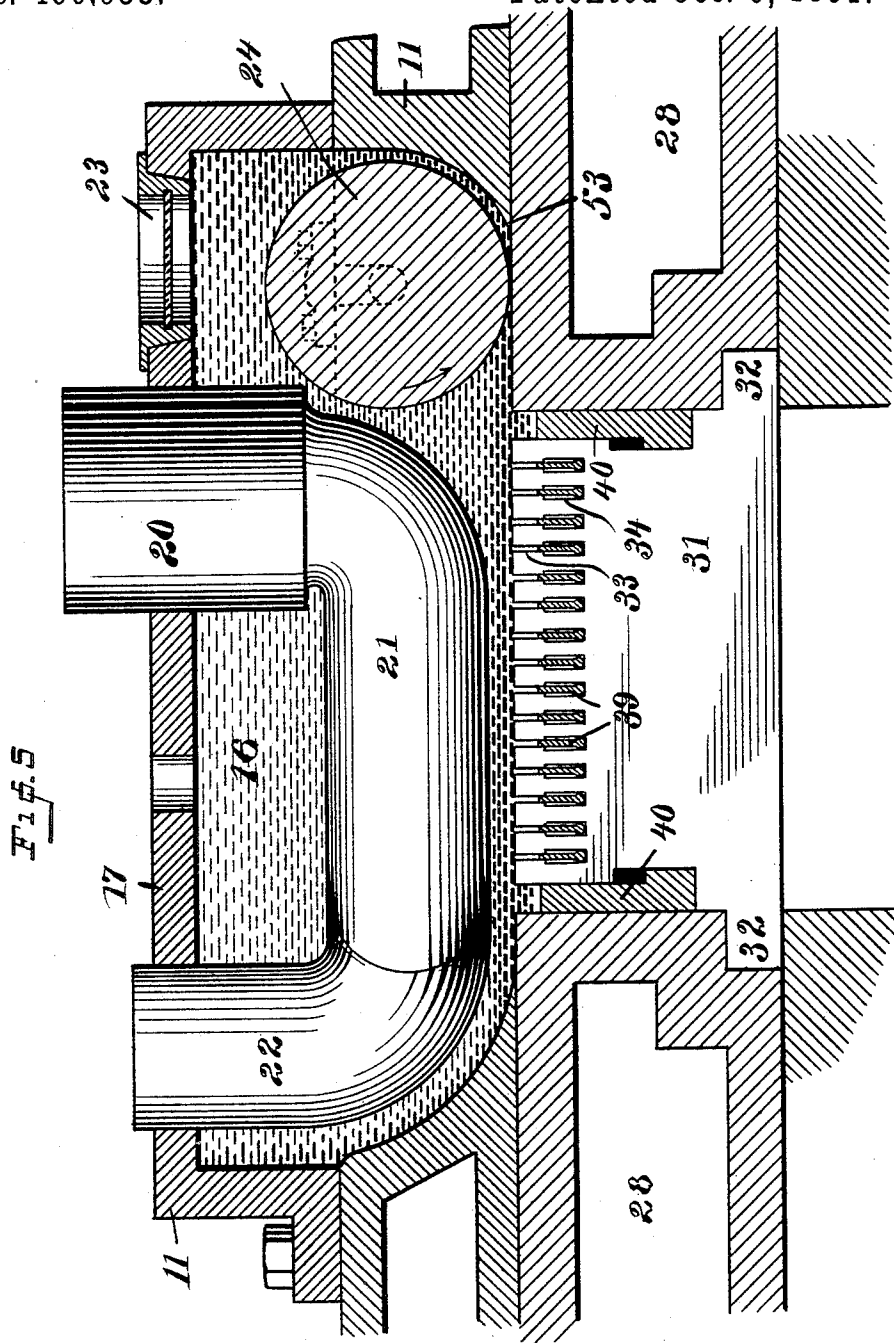
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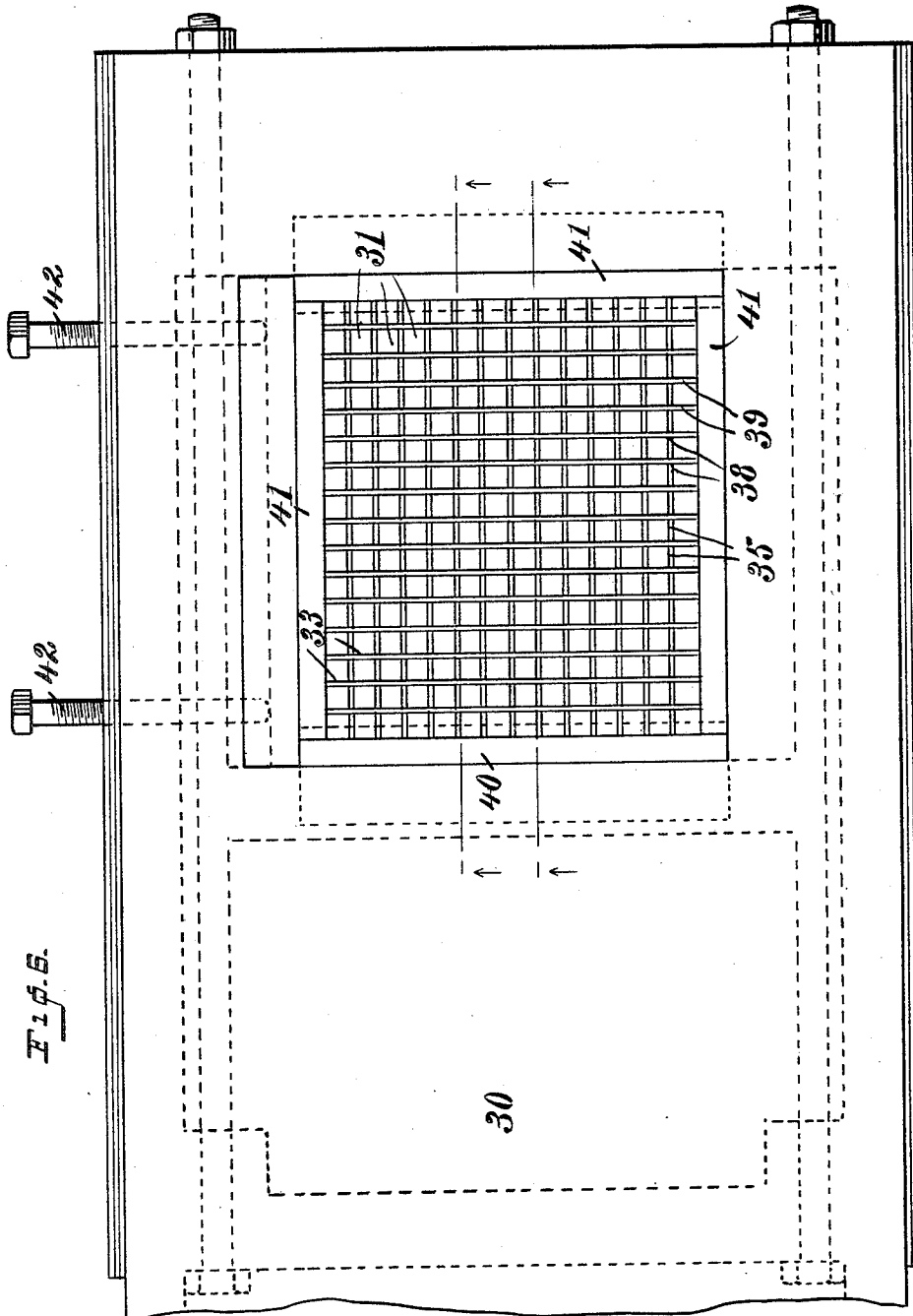
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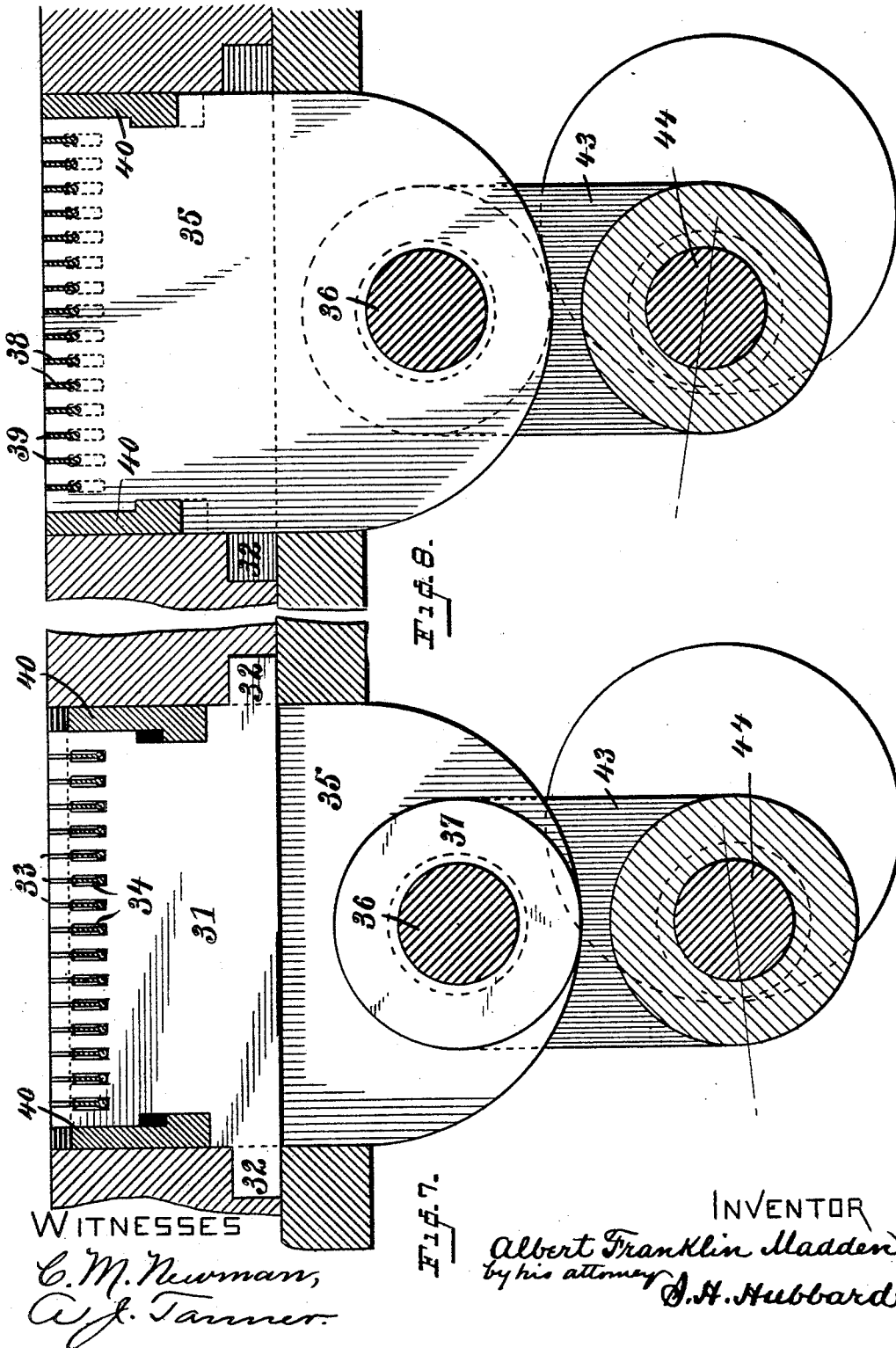
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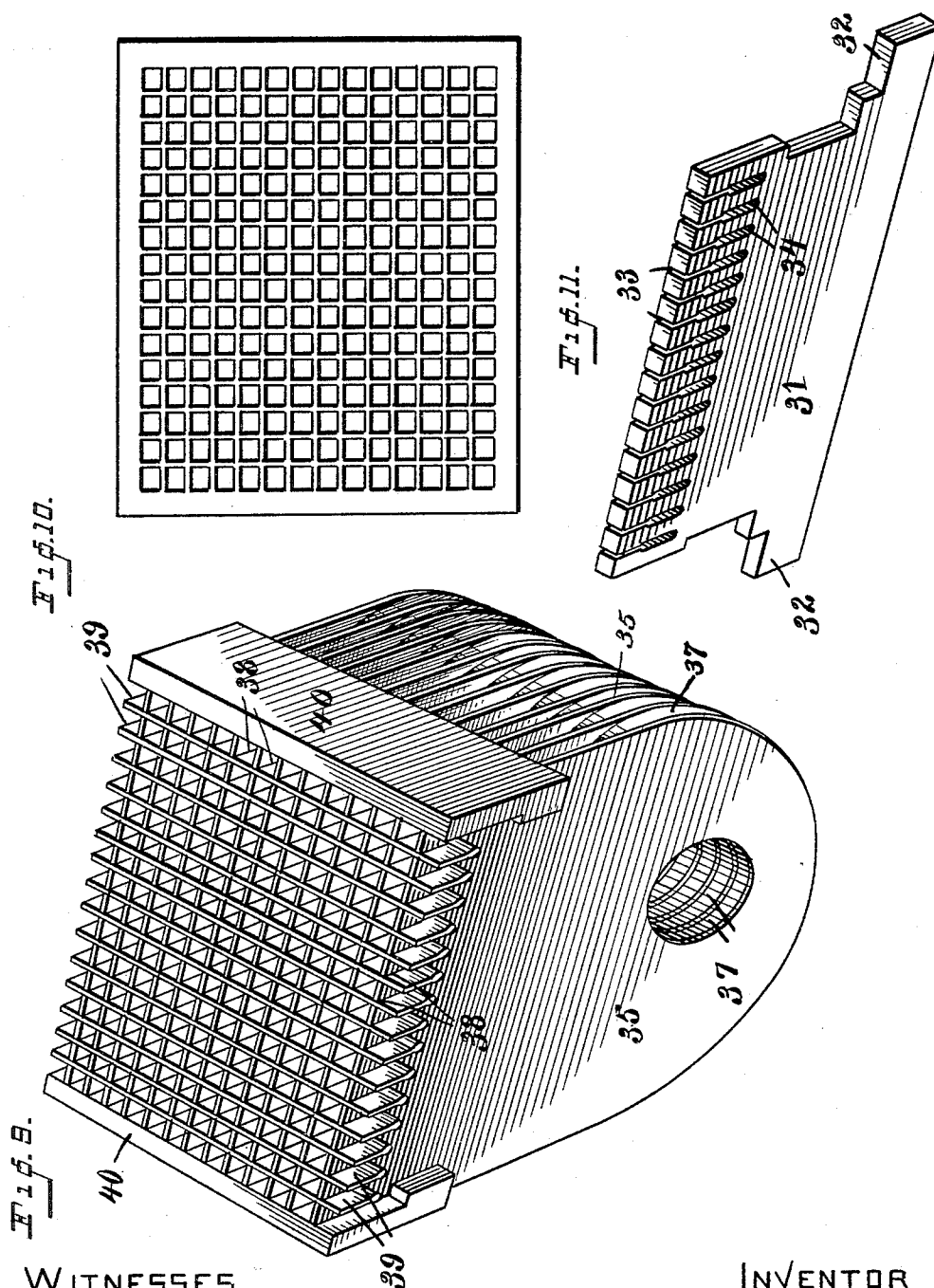
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UNITED STATES PATENT OFFICE

ALBERT FRANKLIN MADDEN, OF NEWARK, NEW JERSEY.

MACHINE FOR CASTING GRIDS.

SPECIFICATION forming part of Letters Patent No. 460,933, dated October 6, 1891.

Application filed May 25, 1891. Serial No. 394,010. (No model.)

To all whom it may concern:

Be it known that I, ALBERT FRANKLIN MADDEN, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Machines for Making Grids for Secondary Batteries; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain new and useful improvements in machines for making grids for secondary batteries, and has for its objects, first, to utilize in the formation of the grid the pasty lead which collects in the melting-pot and is called "putty" lead, and which has been heretofore considered as highly objectionable and a hinderance to the process of casting; second, to force the lead into the mold by a rolling process as contradistinguished from simple casting; third, to provide means novel in construction and method of operation for the heating of the lead and the maintenance thereof at the proper working temperature; fourth, to provide a novel construction of mold in which the grid is shaped, and, fifth and in general, to provide a machine which shall be simple in construction and easy of operation; and with these ends in view my invention consists and resides in the novel features heretofore mentioned and hereinafter to be described in detail, and then recited in the claims, and in the method of forming grids presently to be pointed out, and also incorporated in the claims.

In order that such persons as are skilled in the art to which my invention appertains may be able to fully understand my improved machine and the method which forms a part of my invention, I will now describe these, referring to the accompanying drawings, which form a part of this specification, and to the numerals of reference marked upon said drawings.

Figure 1 is a central longitudinal section through my machine, certain parts being shown in elevation. Fig. 2 is a plan view, the top of the crucible being removed and the blast connections likewise removed. Fig. 3 is a vertical section taken upon the line *y y*

of Fig. 1. Fig. 4 is an enlarged sectional elevation of the parts shown at the center of Fig. 3. Fig. 5 is an enlarged sectional elevation of the parts shown at the center of Fig. 1. Fig. 6 is a detail plan view of the mold and the plate in which said form is set. Figs. 7 and 8 are sections taken, respectively, upon the lines *v v* and *w w* of Fig. 6. Fig. 9 is a detail perspective showing the movable parts of the mold, the stationary bars being omitted for clearness of illustration. Fig. 10 is a plan view of a grid as removed from the mold. Fig. 11 is a perspective of one of the stationary mold-bars. Figs. 4, 5, 6, 7, 8, 9, 10, and 11 are enlarged about four times from the scale of the first three figures.

In the drawings the number of parts of the mold have purposely been reduced below that necessary to make merchantable grids, Fig. 10, for instance, showing the grid-openings about half their proper number and twice their normal size.

Referring now particularly to Figs. 1, 2, and 3, 1 is a base upon which are mounted side plates or standards 2. At one end is a pillar 3, having in its top a bearing in which is mounted a horizontal transverse shaft 4. Near one end this shaft is provided with a gear 5 and at the other end with a crank 6. The gear 5 is engaged and driven by means of a worm 7, mounted on a shaft 8, whose axis is at right angles to that of the shaft 4, and said shaft 8 bears a band-wheel 9, whereby it may be driven. The crank 6 drives a connecting-rod 10, whose forward end is connected to and is adapted to operate a carriage presently to be described in detail. Upon the tops of the side plates 2 is supported a fixed top 11, whose lower face is plane and which is adapted to support certain parts of the machine.

12 is a crucible supported within a jacket 13, which latter is set upon the top 11, heretofore referred to. Its outlet 14 is controlled by means of a plug 15, and by means of a short pipe said outlet is connected with a chamber 16, substantially square in plan view and shown in longitudinal section in Fig. 5. This chamber is formed as to its lower part in the top 11 and is completed by means of a cover 17, suitably secured thereon.

18 and 19 are pipes adapted to convey gas and

air to compound blow-pipe burners 20, three in number, which open into a tubular heater 21, mounted within the chamber 16. This heater, as seen at Figs. 2 and 5, is in triplicate as to the part where the flame enters from the burners; but its three tubes at the other end thereof open into a common outlet 22, which projects upward through the cover 17 and discharges against the bottom of the crucible 12 inside its jacket. The function of this heater is to keep the contents of the chamber 16 at the proper temperature for the making of the grids and at the same time to retain the metal in the crucible in a fluid state, so that it may feed downward freely into the chamber 16 as fast as the metal in the latter is used. In the cover of this chamber is a mica-covered opening 23, by means of which the condition of the interior of the chamber may be observed. Journaled transversely in this chamber immediately beneath the tuyere and at one end of the heater is a roller 24, mounted upon a shaft 25, said shaft being driven at a constant rate of speed by a sprocket-chain 26, driven from the shaft 4. The lower edge of this roller is in substantially the same horizontal plane with the lower surface of the top 11, and its function will be presently explained.

The carriage heretofore referred to is more particularly shown at Figs. 1 and 3. It is denoted by 27 and is gibbed to the base in such manner as to give it an accurately-guided longitudinal movement from the connecting-rod 10. The top plate of this carriage fits closely against the bottom plane surface of the part 11 and closes the bottom of the chamber 16, as will be readily understood from an inspection of Figs. 1, 3, and 5.

28 are openings cored in the top of the carriage for the purpose of lightening the construction, and 29 are similar openings in the part 11. Any or all of these may be provided with connections for the purpose of applying hot air or cold air or water for affecting the temperature and fluidity of the lead. The flat top plate of the carriage I designate by the numeral 30. Near its center said plate 30 is provided with a square opening, whose shape may be readily seen at Figs. 5 and 6. Within this opening is placed the mold in which the grids are made. In the first place this mold consists of a series of mold-bars 31, whose slightly-extended ends 32 are seated in offsets in the opening in the plate. Each of these bars is transversely slotted at regular intervals, so that its top is provided with a number of square projections, which are shown at Fig. 6. The bars are set at a distance apart substantially equal to the width of the slots in their faces.

The transverse slots just referred to are, as to their upper portions, denoted by 33. After extending downward a little below the surface of the mold-bars—say for a quarter or a half an inch—said slots are widened and enlarged, and said enlarged portions are num-

bered 34. Set between these mold-bars are a series of thin ejector-plates 35. They are strung upon a shaft 36 and are separated by washers 37, whose thickness is substantially the thickness of the mold-bars from side to side. Each ejector-plate has in its upper surface a series of notches or seats 38, whose lower ends are slightly enlarged, and in these are held a series of partition-strips or transverse ejectors 39, whose lower edges are enlarged to fit the notches in the ejector-plates. The ejector-plates, their washers, and the partition-strips are shown in their assembled position at Fig. 9, where I have omitted the permanent and fixed bars for clearness of illustration. In placing the parts in this assembled position the mold-bars are first set in place, then the ejector-plates are pushed up between the mold-bars from beneath, with their notches registering with the transverse slots in the mold-bars, the washers are placed in position, the shaft 36 inserted through the washers and ejector-plates, and then the partition-strips 39 are inserted through their seats in the ejector-plates and also through the slots in the mold-bars.

40 represents a pair of end ejectors, which are carried by the ejector-plates and co-operate with two plane mold-bars 41 in the formation of the solid rim or edge around the grid. When these parts are assembled, it will be observed that all parts of the mold except the stationary former-bars are attached to and carried by the ejector-plates. This movement is permitted to the transverse ejectors by reason of the fact that while they are seated fast in the ejector-plates they pass through the enlarged slots in the mold-bars, and may thus have a limited vertical movement relative thereto, as will be seen by a comparison of Figs. 7 and 8. A tightening device consisting of set-screws 42 is shown at Fig. 6. This is immaterial, except that it serves as a convenient means for adjusting the parts transversely to the length of the mold-bars.

As has heretofore been stated, the ejector plates and the washers are strung upon the shaft 36. This shaft, which is properly a large bolt, is connected by a yoked link 43 with a shaft 44, which latter extends between a pair of levers 45, journaled to the carriage. The link just referred to is connected to the levers eccentric to the journal of the latter, as may be seen at Fig. 1, and this eccentricity is sufficient to impart to the ejector-plates a vertical movement in their bearings between the bars when the levers are rocked upon their fulcrum. The movement of the levers I prefer to effect by means of cams 46, secured upon the bed in line with rollers 47, which are borne upon the ends of the levers, so that as the carriage moves the rollers will ride upon the cams and thereby impart the proper vertical movement to the ejector-plates through the link.

Referring particularly to Figs. 1 and 2, 48 is a planer-tool journaled in bearings at the

end of the part 11 and adapted to be depressed by means of the lever 49 and the connecting-rod 50, which latter is connected to the lever 51, engaged by a face-cam 52 on the shaft 4. The upper end of lever 49 is provided with any suitable means whereby the movement imparted by said lever to the planer-tool may be regulated. In Fig. 1 this is shown as consisting of a set-screw 60; but this is an immaterial detail of construction. The operation of this planer or surfacing-tool will be presently explained.

In the operation of my invention the crucible 12 is first filled wholly or in part with lead and the heater started. The flame issuing from the heater beneath the crucible will melt the lead in the latter, whereupon the molten metal will flow downward through the outlet and fill the chamber 16 around the heater and the roller 24. The bottom of the chamber is closed by the top of the carriage, so that either the plane surface of said top or the mold which is set in said top is opposite the bottom of said chamber and in contact with the lead. The carriage has a movement beneath the chamber equal to twice the radius of the crank, and this movement, by bringing different parts of the top in contact with the lead, tends to chill the lowermost stratum of the molten metal and thereby decrease its fluidity. This has heretofore been a great disadvantage in machines dependent upon the ordinary method of casting, since the chilled or putty lead is thick and does not readily flow into and fill the mold. I have shown this stratum of thickened lead by a few heavily-dotted lines at the center of Fig. 5. Suppose the parts to be in the position shown at Fig. 1. At this time the right-hand end of the operating-lever 45 is raised upon the cam, and the several parts constituting the form are in the position in which they are shown at Fig. 7—that is to say, the ejector-plates and the partition-strips are withdrawn to their downward limit of movement. Therefore the spaces between the mold-bars and the transverse notches in said mold-bars are open to and in contact with the lead as far down as the plane of the top of the ejector-plates and the transverse partition-strips. From this position and by means of the rotation of the shaft 4 the carriage is moved upon its ways, thereby carrying the mold out from under the bottom of the chamber. At the same time the roller 24 is revolving at a uniform rate of speed by means of the sprocket-chain 23. The open surface of the mold may partially fill and in its movement will carry with it a considerable amount of the pasty thick lead at the bottom of the chamber, and as said mold passes underneath the roller this lead will be rolled solidly into the interstices of the mold, thereby forming a grid of great solidity and of a most homogeneous character. As the mold clears the bottom of the chamber, the lead within said mold is roughly separated from the mass

within the chamber by means of the oblique edge 53, (shown at Fig. 5;) but as soon as the carriage passes into the field of the planer-tool 48 the latter is caused to operate in proper time by its cam and connecting-rod and to engage and accurately surface the grid as it lies in the mold. When the stroke of the crank has projected the carriage outward until the mold has cleared the planer-tool, the rollers 47, upon the left-hand ends of the levers, will ride upon the cams 46 and through the links lift the ejector-plates and the partition-strips upward relative to the former-bars and thereby eject the finished grid from between said former-bars. From its position upon the top of the carriage said grid may be either removed by hand or by any suitable conveyer mechanism. The crank at this time passes its center and commences to withdraw the carriage toward the position shown at Fig. 1. During its backward stroke the ejector-plates and the partition-strips remain in their raised position until the right-hand rollers upon the levers reach and ride upon the cams 46, at which time the movable parts of the mold will be drawn downward to the position shown at Fig. 1, and particularly in the enlarged view, Fig. 7. By the rotation of the shaft 4 the reciprocatory motion of the carriage is continued, each forward movement rolling the lead into the mold and surfacing the grid and then ejecting the same from the mold, and each backward movement returning the mold beneath the lead-filled chamber and withdrawing the movable parts of the mold to the position required to admit the metal into it.

In a properly-constructed secondary battery the positive and negative plates should vary in thickness, and I propose to manufacture both thicknesses upon the machine herein described by varying the throw of the movable parts of the mold. This may most easily be done by using rollers of different diameters upon those ends of the levers 45 by which the downward withdrawal of the ejector-plates and their attached parts is effected. These are shown at the right hand of Fig. 1. As it is desired in the ejecting movement to raise the finished grid clear of the mold, the rollers which effect this movement and which are shown at the left-hand levers in Fig. 1 may remain the same for both thicknesses of grids.

While the roller in conjunction with the other mechanism herein described is competent to fill the mold completely with the putty lead, at the same time, if the lower stratum be sufficiently fluid to enter the form by its own weight and partially fill the same, the roller will force into it such additional lead as may be required to complete the grid and will solidify the whole, and this whether the metal be of greater or less fluidity.

I claim—

1. The process of making grids for secondary batteries, which consists in placing a suitably-recessed mold in communication with a

superincumbent body of molten metal and simultaneously therewith subjecting successive portions of the metal to the pressure of a roller within the body of metal, whereby metal from the mass is driven into the mold cavities, substantially as and for the purpose specified.

2. The combination, with the carriage having the mold arranged therein and means for effecting its reciprocating movements, of the open-bottomed metal chamber, means for heating it, and a roller journaled in said chamber with its lower surface in the same plane with the top of the mold, substantially as described.

3. The combination, with the carriage having a mold and means for operating said carriage, of the open-bottomed chamber, means for heating the same, the roller revolving in the chamber and adapted to force the metal into the mold, and a surfacing-tool behind the roller in the plane of the upper surface of the issuing grid, substantially as described.

4. The combination, with the mold, of the crucible, the chamber having an open bottom closed by the mold, a connection between said crucible and the chamber, and the tubular heater seated in said chamber and provided with burners, said heater having its open end contiguous to the bottom of the crucible.

5. The combination, with the mold and the open-bottomed chamber, of the tubular heater seated in said chamber and having two or more separate inlets provided with burners, an outlet, and a crucible arranged above said outlet in the path of the issuing heat and connected to the chamber, substantially as described.

6. The combination, with the mold, of the open-bottomed lead-chamber, the tubular heater provided with burners and seated in said chamber, a roller journaled in said chamber in position to act upon the metal therein, means for operating said roller, and mechanism for the reciprocation of the mold.

7. In a machine of the character described,

the open-bottomed lead-containing chamber and a roller journaled in said chamber in position to act upon the metal therein, in combination with the mold consisting of the stationary bars, movable parts arranged between said bars, means for moving the mold bodily relative to the lead-chamber, and additional means for actuating the movable parts of the mold, substantially as described.

8. In a machine of the character described, a mold consisting of a series of fixed bars provided with transverse notches, in combination with a series of ejector-plates seated between the fixed bars, transverse ejector-strips passing through the ejector-plates and the notches in the fixed bars and movable with said ejector-plates, and means for reciprocating said ejector plates and strips, substantially as described.

9. The combination of the bars 31, having transverse notches 33, provided with the enlarged portions 34, the notched ejector-plates 35, lying between the bars, the ejector-strips 39, seated in and carried by the ejector-plates and passing through and movable in the notches of the fixed bars, and means for operating said plates and strips, substantially as described.

10. In a machine of the character described, the combination, with the fixed bars having transverse notches, of a series of ejector-plates between and parallel with said bars, transverse ejector-strips having enlarged lower edges at right angles to the length of said bars and secured to and carried by the ejector-plates, and means for reciprocating said plates and strips, substantially as and for the purpose set forth.

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

ALBERT FRANKLIN MADDEN.

Witnesses:

SHERMAN HARTWELL HUBBARD,
MINNA C. HINCHCLIFFE.