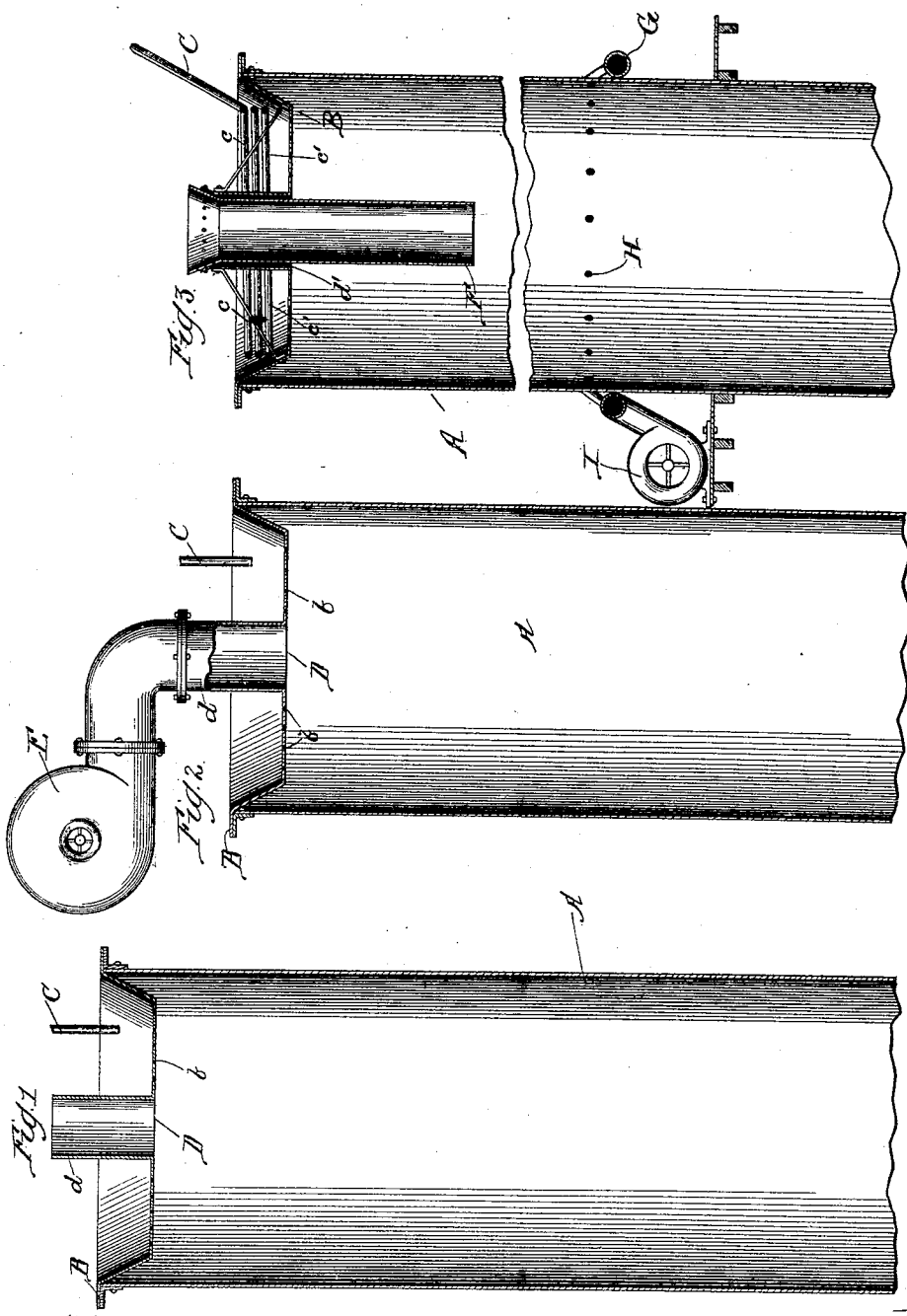
(No Model.)

2 Sheets—Sheet 1.

A. J. DENISTON.

APPARATUS FOR THE MANUFACTURE OF DROP SHOT.

No. 496,044. Patented Apr. 25, 1893.



Witnesses;
Wm. M. Rheem.
F. A. Hopkins

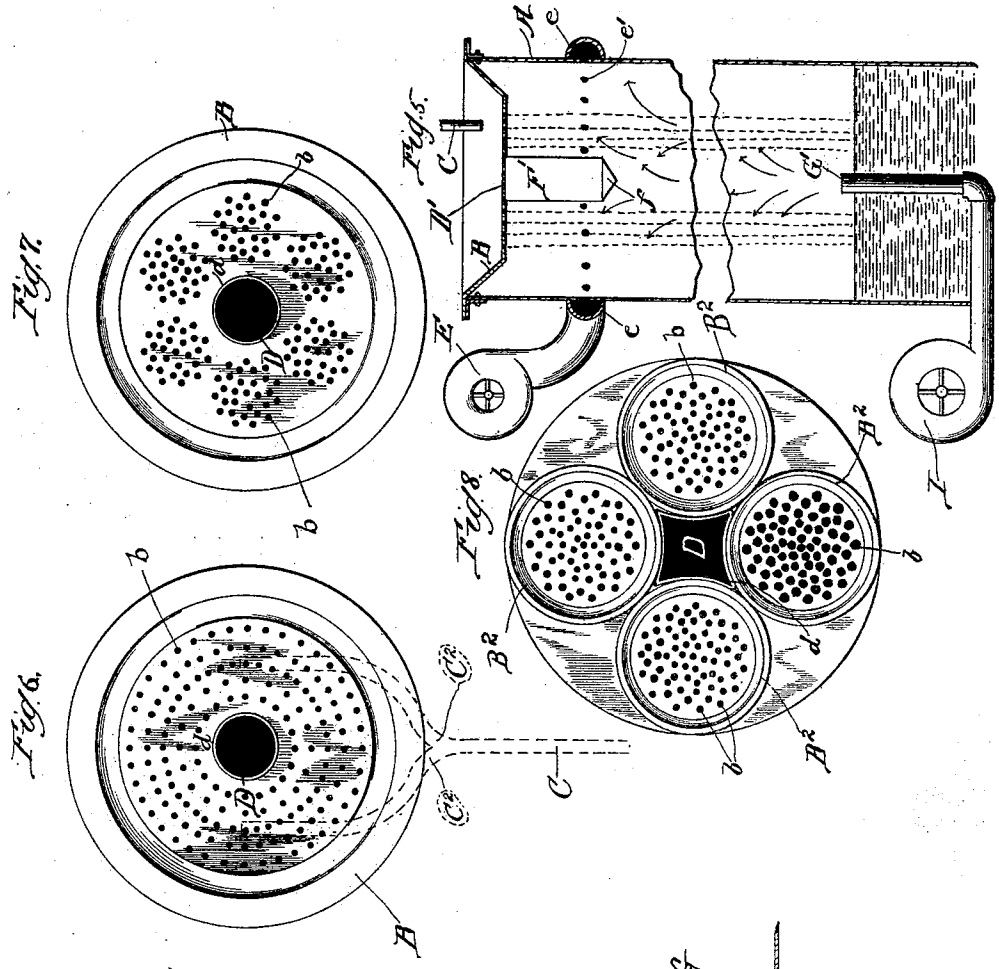
Inventor
Albert J. Deniston
By Elliott & Omohundro
Attys.

(No Model.) 2 Sheets—Sheet 2.

A. J. DENISTON.

APPARATUS FOR THE MANUFACTURE OF DROP SHOT.

No. 496,044. Patented Apr. 25, 1893.



Witnesses;
Wm. M. Sheem
F. A. Hopkins

Inventor:
A. J. Deniston
By
Elliott & Omohundro
Attys.

UNITED STATES PATENT OFFICE.

ALBERT J. DENISTON, OF CHICAGO, ILLINOIS.

APPARATUS FOR THE MANUFACTURE OF DROP-SHOT.

SPECIFICATION forming part of Letters Patent No. 496,044, dated April 25, 1893.

Application filed August 2, 1892. Serial No. 441,905. (No model.)

To all whom it may concern:

Be it known that I, ALBERT J. DENISTON, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Apparatus for the Manufacture of Drop-Shot, &c., of which the following is a full, clear, and exact specification.

My invention relates to apparatus for the production of shot by dropping molten metal from an elevated sieve or perforated dropping pan, through an air shaft or tower into a well or the like, at the bottom thereof, and it is designed more particularly as an improvement on an apparatus of this nature shown and described in my application for United States Letters Patent filed October 5, 1891, Serial No. 407,717.

The common method of manufacturing drop shot is to drop the molten lead from a sieve or dropping pan at the top of a tower of great altitude, through which the drops of molten lead descend and are congealed or solidified by contact with the air in the tower. The tower so employed was necessarily of great altitude, because without it none but the small or medium sizes of shot could be produced. Inasmuch as the proper and thorough chilling or congealing of the molten drops of lead depends solely upon the quantity or extent of air through which the drops pass before reaching the cooling well, many attempts in recent years have been made to do away with the lofty and necessarily expensive towers and employ towers of much less height, and to compensate for the decrease in altitude by supplying forced drafts to the tower by artificial agencies, thus causing the air or other cooling medium used to travel past the shot, and not depending solely upon the movement of the shot through the air, as originally. It is well conceded that immediately provision is made for bringing the falling shot or metal into contact with a sufficient quantity of cold air during a given period, or during its descent from the dropping pan, the height of the tower becomes unimportant and immaterial; but so far as my observation and information go prior attempts to produce the larger sizes by means of the low tower supplemented by the forced draft, have failed. In a word, the reason is that according to prior arrangements, the air must be supplied at an angle to the falling column of shot and from the side of the tower, and it is impossible with the prior methods to force in air in sufficient quantity, and with sufficient velocity to penetrate to the heart of the column of falling metal without blowing the descending drops or shot against one another or the sides of the tower, and in either event, resulting in great wastage, and an imperfect and unmarketable product.

The primary object of my invention, therefore, is to provide for a more intimate commingling of the cooling medium or air with the falling shot or drops.

In a more limited sense, the object of my invention is to break up the compactness of the column of falling shot or drops, and provide for the escape of the medium used as the cooling agent, from the body thereof.

A further object of my invention is to draw the air or cooling medium from the exterior of the column of falling shot or drops inward, toward the center or heart of such column, or else from the center outward.

A still further object of my invention is to prevent the cooling medium or air employed in the tower or other air shaft, from coming in contact with the dropping pan or apparatus.

With these ends in view, my invention consists broadly, or primarily, of an apparatus for the manufacture of shot, &c., so constructed as to permit the air or other cooling or congealing medium used, to escape from the body or interior of the column of falling shot or drops.

My invention also consists in certain other features of novelty hereinafter more fully described in connection with the accompanying drawings, and particularly pointed out in the claims.

In the said drawings, Figure 1 is a vertical section of a portion of a tower or shaft, embodying a simple form of my improvements. Fig. 2 is a similar view, showing the apparatus provided with an exhaust fan for drawing the air from the interior or heart of the column of falling shot. Fig. 3 is a vertical section of a portion of a tower provided with my improvements, the dropping pan being provided with a shield, for guarding against the

influence of the air rising in the tower, and the tower being provided with a blast fan for forcing air thereinto. Fig. 4 is a similar view, embodying the improvements shown in Figs. 2 and 3. Fig. 5 is a still further modification, showing means for admitting the air to the heart of the column in the first instance, and then drawing the same through the sides of the column to the external atmosphere. Fig. 6 is a plan view of my improved dropping pan or sieve. Fig. 7 is a slight modification thereof, involving a different arrangement of perforations; and Fig. 8 is a still further modification of a dropping apparatus or pan, applicable for use when it is desired to employ several melting pots.

In carrying out my invention, I employ a dropping apparatus or pan which is provided with one or more blind spaces. By the term "blind space" I mean broadly any spot or space in the dropping apparatus from which or through which the molten metal can not or does not drop. This blind space in the dropping pan or apparatus will of course form a vacant space or an air space or column surrounded by the falling shot throughout the height of the tower or other shaft through which the shot is dropped. In conjunction with a dropping pan or apparatus of this description I employ means for admitting air or any other cooling or congealing medium to this air space at the interior of the column of falling shot at one point, and also for again drawing off such cooling medium, or permitting it to escape from said inner air space at another point. Such means for drawing off the air or permitting it to escape may consist of simply an exit or escape passage formed through the dropping pan or through the top of the tower or shaft through which the shot drops, or it may consist of a suction device suitably connected with the upper portion of the tower. With such a construction, when the air in the tower and in the annular air space of the column of falling shot, becomes heated by contact with the hot metal a strong upward current will take place, which will induce an ingress of air through the inlet at or near the bottom of the tower, and the place of escape being through the opening at the top, the incoming air will permeate the column of falling shot, in its course to such exit, *via* the said inner air space. The efficiency of an apparatus thus constructed may be greatly increased by the addition of a blast fan or device at the inlet, as well as a suction fan or device at the outlet.

The reverse of the arrangement above described, and which is within the scope of my invention, is to admit the air or cooling medium to the interior of the column of falling shot, that is, to the aforesaid inner air space, at or near the bottom of the tower, and permit it to escape outward from the inner air space, and to be drawn off or allowed to escape through suitable openings arranged around the tower, thus admitting the cooling agent to the interior of the column of falling shot in the first instance, and then drawing it from the inner air space into the space between the column of falling shot and the walls of the tower.

Referring now more particularly to the drawings, in which like signs of reference indicate like parts throughout the several views: A is the upper portion of an ordinary tower or air shaft through which the shot drops, and B is a dropping pan suitably supported at the upper end thereof. The molten metal may be admitted or run into the dropping pan by a pipe C, leading from the melting pot or kettle (not shown), or such pan may be supplied with molten metal in any other well known or suitable manner. The dropping pan B is provided in its bottom with what I have herein termed a "blind space," which in all the forms save that shown at Fig. 5 consists of an opening or aperture D, the molten metal being prevented from running out through such opening by means of a stand pipe *d*, formed on or suitably secured to the bottom of the pan around the opening. The rest of the bottom of the pan may be provided throughout its area, or throughout any desired portions thereof at any suitable or desired distance apart, with a number of perforations, *b*, through which the molten metal drops to form the shot, as will be understood. With an apparatus thus constructed, it will be seen that the falling metal or shot, as it leaves the perforations in the bottom of the dropping apparatus will be in the form of a hollow column, by reason of the perforations *b* being arranged in an annular series, as described.

The tower A at or near its lower end or at any other desired point throughout its height may be provided with an inlet, or perforations, (not shown,) for the admission of atmospheric air or any other congealing agent which it might be desired to employ for solidifying the falling drops of molten metal. The natural consequence of dropping the hot shot or molten metal in the tower is to induce an upward current of air in the tower. As the air is rapidly heated to a high degree by the molten metal and hot shot, and expands, the normal tendency is to escape upward, but as the only means of escape from the top of the column is through the opening D, in the sieve, it follows that the air on the exterior of the column of falling shot will pass through the walls of the column, of falling shot, thoroughly permeating the same in its course to the exit at D, *via* the air space at the interior of the column, and as the air rises within the interior of the column, it will draw in and give place to the external and colder air entering through the inlets at the bottom of the tower. In this manner I am enabled to break up the compactness of the column of falling shot, and cause the air or cooling medium to penetrate to the heart of the column, and more thoroughly permeate the walls thereof, and inti-

mately commingle with the shot, bringing each drop into contact with the requisite amount of air for converting it into a solid sphere, without the employment of strong blasts, or the violent agitation of the shot, and consequent damage thereto.

If desired, the apparatus just described may be provided with a suction fan, E, communicating with the stand pipe *d*, for accelerating the upward draft in the tower, and causing the surrounding air to more thoroughly and positively permeate the body of the column of falling metal. Such a suction fan will also cause the influx of a greater volume of air per given time, than could be induced by the natural ascendency of the air through the hollow column of falling metal. The air of course as it rises through the stand pipe *d* is necessarily heated to a high degree, from its previous contact with the falling metal, and hence ordinarily it could not chill or affect the metal at the bottom of the dropping pan or apparatus, but in the manufacture of the larger sizes of shot, as will be understood, the metal must be very thick; it is run "cold," that is, only a few degrees above the melting point, and hence a slight draft is liable to chill the metal at the bottom and close the dropping perforations. As a safeguard, therefore, against such a contingency, I provide the blind space or portion of the dropping pan or apparatus with a shield, which will prevent the air rising in the tower, from coming in contact with the pan or with its stand pipe *d*. One form of this shield, as shown in Fig. 3 consists of a depending flue or pipe, F, which may be of less diameter than the stand pipe *d*, and is arranged therein in such a manner as to leave an insulating air space *d'* between the two pipes, the upper end of the shield F being if desired riveted to the pipe *d*. This shield pipe F is extended downward a considerable distance in the tower A, and by so doing I arrange the mouth of the exit for the rising air a considerable distance below the bottom of the dropping pan. It will be seen therefore, that the space above the lower end of the pipe F between such pipe and the walls of the tower will contain dead air, which necessarily becomes heated to a very high degree from contact with the bottom of the pan and the falling metal, and the rising column of air which is of course immediately under the pipe F will enter such pipe at its lower end, and pass off therethrough without coming in contact with the dropping pan or any other part, the cooling of which could result in the chilling of the metal. In this form of the device just described, Fig. 3, I have not shown the suction fan at the top of the tower, but instead thereof, I may employ at or near the bottom of the tower or at any suitable intervals throughout its height as shown and described in my aforesaid application, a bustle pipe, G, which supplies air or other cooling medium to the interior of the tower, through any suitable inlets or perforations H, formed through the wall thereof, such bustle pipe being in connection with the blast fan I or equivalent device. In this manner the pressure of the air on the exterior of the column of falling shot is increased beyond that of the air contained in the air space at the heart of such column, and hence the tendency of the outer air to force its way through to the heart of the column, when accelerated by the natural ascendency of the air within the column, will induce a steady and positive current through the blind opening in the dropping pan, and cause the falling shot throughout the height of the column to be subjected to the congealing influence of the air. If desired, however, the suction fan E also may be used in connection with the form shown in Fig. 3, as shown in Fig. 4, thus making an apparatus which is particularly applicable for the manufacture of very large sizes of shot; as by means of it the tower at the bottom may be provided with a copious supply of air, which may be readily drawn off at the top of the tower by the fan E, to give place to fresh air, even before its efficacy as a cooling agent is lost.

As before mentioned, there are various means for transferring the molten metal from the melting pot or kettle to the dropping pan, and any of these may be used, but it is preferable to employ a pipe or conductor which will deposit the metal in the pan at different places, so as to reduce to the minimum the liability of the metal chilling or freezing in running from the discharge end of the spout or pipe around the pan. One means of accomplishing this is to provide the pipe or conductor C with a coil, *c*, which surrounds the stand pipe *d*, and is provided in its lower convolution with a number of discharge openings *c'*, through which the metal runs into the pan at various points.

Another means of accomplishing substantially the same end is to provide the pipe C with a bifurcated discharge end, consisting of two branch pipes, C^2, arranged one on either side of the pan, as shown in dotted lines in Fig. 6.

In the forms shown in Figs. 1 to 4 inclusive, it will be seen that the influx of atmospheric air takes place between the column of falling shot and the walls of the tower, but I wish it to be distinctly understood that my invention is not limited to this arrangement, and that the reverse thereof may be employed with good effect. For instance, as shown in Fig. 5, the cooling medium or air is admitted in the first instance to the heart of the column of falling shot (that is to the vacant space left therein) by means of a pipe or flue G', which may be arranged vertically directly under the blind space in the dropping pan, so as to be out of the way of the falling metal, and extended downward a sufficient distance in the water of the well, and then carried outward to the blast fan I,—the force of the fall of the shot of course being broken by the water before

the shot reaches the horizontal branch of the pipe G′, and hence no damage can result from the presence of this pipe. With this arrangement, however, the blind space in the dropping pan, instead of being an opening, is simply an imperforate portion D′, which prevents the metal from dropping through the pan at this point, and hence forms an air space or column at the heart of the column of falling shot, as before explained. As the air rises from the pipe G′ within the column of falling metal, it is drawn outward through the walls of such column, thoroughly permeating the same, and intimately commingling with the shot, by the suction fan E, which however, in this instance is connected with a bustle pipe *e*, surrounding the tower near its upper end, and communicating therewith through a suitable number of perforations, *e′*. The suction fan, however, is not absolutely essential, for it will be understood that if the air is forced in by the fan I it will naturally escape through the column of falling shot, if an exit be provided for it. In order to prevent the cold air from striking the bottom of the dropping pan in this instance, I arrange a shield, as before described, directly under the blind space in the pan, but this shield, instead of being hollow or tubular like the pipe, F, is provided with a closed end, *f*, supported by a depending body, F′. The closed end *f* is preferably conical, and is arranged slightly below or on a level with the perforations *e′* which constitute the exit for the air, and which are located a suitable distance below the bottom of the dropping pan. Hence it will be seen that as the air cannot escape at a point above these openings, there will be no inducement for it to rise into contact with the pan, but on the contrary the conical ended shield will give it a tendency to turn outward toward the openings, *e′*.

If desired, instead of the dropping pan having perforations arranged as shown in Fig. 6, the same may be provided with an annular series of individual groups of perforations, as shown in Fig. 7, thus more completely breaking up the compactness of the column of falling metal.

In large establishments, where it is desired to use a number of melting pots at a time, and to feed from all of them at once, the dropping pan or apparatus may be composed of a series of individual pans, B^2, each having a group of perforations, which pans if desired, may be independently removable, and into each of which may lead a discharge spout or conductor C, from each of the melting kettles. These individual pans B^2, may be arranged in an annular series, as before explained, around the blind spot or opening D, or in a series of any other desired form. While this construction is substantially the equivalent of the forms shown in Figs. 6 and 7, so far as the effect of the blind space is concerned, it nevertheless possesses the advantage that the interruption of the flow from any one or more of the kettles does not affect the level of the liquid in the other pans, it being understood of course that it is important for the production of perfect shot that the level of the liquid in the pan should not fluctuate.

A still further advantage is, that the several pans B^2 may be provided with different sizes of perforations as shown in Fig. 8, thus adapting them for producing shot of various sizes in the same tower, either by running the molten metal into the various pans by separate pipes leading from the same kettle or from individual kettles, heated to the same or to different degrees of temperature; or by a single pipe having branches as shown in Fig. 6, leading from a single kettle.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. An apparatus for the production of drop shot, &c., having a dropping apparatus adapted to produce a column of falling shot with an open interior, in combination with means for permitting the air, or other cooling or congealing medium used, to escape from said body or interior of said column of falling shot, substantially as set forth.

2. An apparatus for the production of drop shot, &c., having an outlet or exit for the cooling or congealing medium in combination with a dropping apparatus having a blind space adapted to form a vacant space in the column of falling shot, and means for admitting the cooling or congealing medium to said vacant space, substantially as set forth.

3. In an apparatus for the production of drop shot, &c., having an inlet for the cooling or congealing medium, the combination of a dropping apparatus having a blind space adapted to form a vacant space in the column of falling shot, and an exhausting device for drawing the cooling or congealing medium from said vacant space, substantially as set forth.

4. In an apparatus for the production of drop shot &c., having an exit for the cooling or congealing medium at or near its upper end, the combination of a dropping apparatus having a blind space adapted to produce a vacant space in the column of falling shot, and a blower for forcing the cooling or congealing medium into said vacant space, substantially as set forth.

5. In an apparatus for the production of drop shot &c., the combination of a tower having an exit for the cooling or congealing medium at or near its upper end, a dropping apparatus having a blind space adapted to produce a vacant space in the column of falling shot, and a blower connected with said tower and having its point of discharge between the column of shot and the side of the tower for forcing the cooling or congealing medium through the column of falling shot into said vacant space, substantially as set forth.

6. In an apparatus for the production of drop shot, &c., the combination of a dropping

apparatus having a blind space adapted to form a vacant space in the column of falling shot, a blower for forcing the cooling or congealing medium into said vacant space, and an exhausting or suction device for drawing such cooling or congealing medium from said vacant space, substantially as set forth.

7. In an apparatus for the production of drop shot, &c., having an inlet and an outlet for the cooling or congealing medium, the combination of a dropping apparatus having a blind space adapted to form a vacant space in the column of falling shot, and a shield depending from said blind spot, for guarding the dropping apparatus against the influence of the cooling or congealing medium, substantially as set forth.

8. In an apparatus for the production of drop shot, &c., having an inlet for the cooling or congealing medium, the combination of the dropping apparatus having the opening D, and a stand pipe surrounding said opening, substantially as set forth.

9. In an apparatus for the production of drop shot, &c., having an inlet for the cooling or congealing medium, the combination of a dropping apparatus having an opening therein and an exhausting device connected with said opening, substantially as set forth.

10. In an apparatus for the production of drop shot the combination of a tower having openings for the admission of the cooling or congealing medium, a dropping apparatus having an opening therein, a stand pipe surrounding said opening, and a shield pipe depending from said opening into the tower, substantially as set forth:

11. In an apparatus for the production of drop shot, &c., the combination of the dropping apparatus, having an air escape therethrough and means having a number of discharge openings, for conducting the molten metal into said dropping apparatus, substantially as set forth:

12. In an apparatus for the production of drop shot, &c., the combination with a single tower of a dropping apparatus composed of a number of separate dropping pans, and means for supplying said pans with molten metal, substantially as set forth:

13. In an apparatus for the production of drop shot, &c., the combination with a single tower of a dropping apparatus composed of separate dropping pans, and individual pipes, leading to said pans respectively, substantially as set forth:

14. In an apparatus for the production of drop shot, &c., the combination of the dropping apparatus, having a blind space and a conductor for the molten metal having branches leading to different points in the dropping apparatus, substantially as set forth:

15. In an apparatus for the production of drop shot, the combination with a tower, of a dropping apparatus provided with perforations arranged in a number of groups with a space between such groups, substantially as set forth.

16. In an apparatus for the production of drop shot &c., the combination of a dropping apparatus composed of a number of separate dropping pans having a space between them, whereby they will form an open column of falling shot, means for permitting the escape of the air from said column and means for supplying said pans with molten metal, substantially as set forth.

17. In an apparatus for the production of drop shot, the combination with a tower, of the dropping apparatus provided with perforations of different sizes arranged in a number of groups with a space between such groups, substantially as set forth.

18. In an apparatus for producing drop shot, the combination of a tower, a dropping pan arranged therein provided with an opening surrounded by a stand-pipe, and a shield pipe depending in said tower through said stand-pipe, said stand-pipe and shield-pipe having an air space between them, substantially as set forth.

ALBERT J. DENISTON.

Witnesses:
F. A. HOPKINS,
CHAS. MCMILLAN.