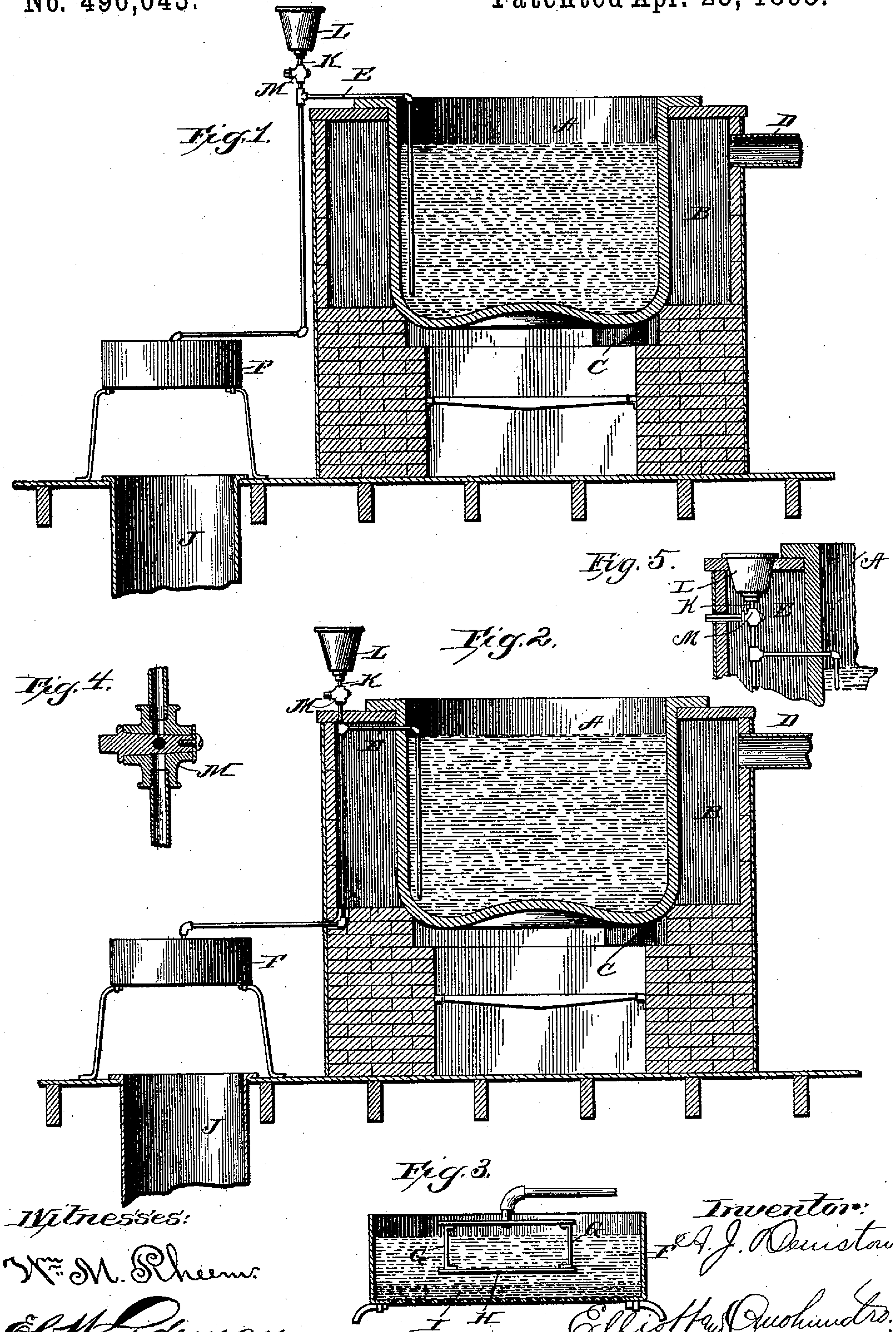
(No Model.)

A. J. DENISTON.

APPARATUS FOR THE MANUFACTURE OF DROP SHOT.

No. 496,043. Patented Apr. 25, 1893.



Witnesses:
Wm. M. Rheem.
E. C. Wurdeman

Inventor:
A. J. Deniston
By Elliott and Hopkins
Atty's.

UNITED STATES PATENT OFFICE.

ALBERT J. DENISTON, OF CHICAGO, ILLINOIS.

APPARATUS FOR THE MANUFACTURE OF DROP-SHOT.

SPECIFICATION forming part of Letters Patent No. 496,043, dated April 25, 1893.

Application filed February 13, 1891. Serial No. 381,267. (No model.)

To all whom it may concern:

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

This invention relates to improvements in apparatus for the manufacture of drop shot, and is adapted and designed for use in connection with either "high" or "low" towers, commonly used in the manufacture of drop shot. In this art, so far as I am aware, but two methods have heretofore been employed for transferring the molten metal from the kettle to the dropping sieve, and these methods have both been in common use for more than a quarter of a century. In the one and principal method, the metal is transferred from the kettle to the sieve, by means of ladles in the hands of men stationed between the kettle and the sieve, and in the other, by a spout at the bottom of the kettle, through which the lead is run into the sieve, a valve being placed in the spout to regulate the flow of the metal. As to the first of these methods, obviously, it is not conducive to the production of perfect shot nor of economical results in the manufacture, giving no assurance of quality or quantity. The other method, although apparently feasible, is practically not much in advance of the ladling process, as will be hereinafter more fully explained. It is very important, in the manufacture of drop shot, that the liquid lead be transferred to the dropping sieve from the melting kettle in a continuous and non-turbulent stream, so that the metal in the sieve will be maintained approximately at a given depth in the sieve, and, consequently, at a substantially uniform temperature and pressure; that is to say, the inflow to the sieve should be so regulated as to compensate for the escaping metal dropping through it, for any sudden change in the depth of the metal in the sieve or any turbulence or commotion therein, occasioned by the transferring of the metal thereto, instantly affects the temperature and pressure thereof and varies the rapidity of the discharge of the metal from the sieve, consequently, deranging the full formation of the drops for which the openings in the sieve are designed. It is well known in this art, that a spout properly proportioned with relation to the sieves ordinarily used and of practicable size for obtaining these results, would have such a small diameter,—ordinarily not more than an eighth of an inch—that it is constantly liable to "freeze;" that is, the lead running through the same is apt to congeal at any time, under a slight change of temperature, either of the metal passing through the spout or of the temperature of the operating room, and to avoid this danger, which renders the use of such a small spout impracticable, it is the common practice to use a larger spout, generally one of about an inch in diameter, with a valve therein for controlling the discharge of the metal, and, obviously, the stream delivered by such a spout into the sieve, would necessarily have an irregular and serpentine form. Manifestly, it is, therefore, impossible to prevent commotion arising throughout the entire contents of the dropping pan with the metal discharged thereto in such commotion and turbulence, the result of which is that all continuity in the dropping is destroyed and streams of stringy lead and sizeless grades of hastily and imperfectly formed shot are sent down into the well, thus producing as much, if not more, waste than marketable shot. But the more serious difficulty encountered in the use of such a spout, is the deposit of red oxide within the spout, which forms instantly the molten lead is subjected to the atmosphere, and, having an affinity for the iron of the spout and valve, it adheres thereto and can only be removed by chiseling. When the spout is of so much greater diameter than the stream of lead running through it, as is necessary in the practical use of a spout, the lead is exposed to the air throughout its passage through the spout, and as a result, the deposit of red oxide is large and rapid and the work must be stopped and the oxide chiseled from around the valve at comparatively short intervals, ranging from one to two weeks, which operation results not only in a loss of time, but in considerable expense.

With my invention, however, which broadly consists in combining with the melting kettle and dropping sieve a siphon for transferring the molten metal from one to the other, I accomplish the most complete transfer of the liquid lead from the kettle into the sieve without any disturbance from any source whatever, or loss of temperature in transit, and I also avoid all danger of freezing of the metal in transit and the consequent expense and loss of time, besides avoiding the possibility of the deposit of red oxide in the transferring medium.

The object of my invention, therefore, is to avoid the difficulties heretofore encountered in the manufacture of drop shot and particularly the loss of temperature and the disturbance or commotion of the lead when transferred into the dropping sieve and also the expense and loss of time involved in the freezing of the lead in transit or a deposit of red oxide in the transferring medium, whereby a uniform and desirable pressure upon the dropping metal is obtained and maintained, the rapid formation of perfect shot is promoted to the maximum degree, and the proportionate production of perfect shot from a given quantity of metal is materially and greatly increased. These and other objects hereinafter referred to, are accomplished by the devices and combination of devices hereinafter more particularly described and pointed out in the claims and illustrated in the accompanying drawings, in which—

Figure 1, represents a central vertical section through the furnace and melting pot of an apparatus for the manufacture of drop shot, embodying my invention. Fig. 2, is a similar view of the same, showing a modification of my invention; Fig. 3, a central vertical section through the dropping sieve, more clearly showing the disposition of the discharge end of the siphon and the diffusing plate therein; Fig. 4, a vertical section through the valve of the siphon starting cup, and Fig. 5, a detail section showing a modification of my invention, in which the starting cup is shown as projecting into the combustion chamber of the furnace.

Referring by letter to the accompanying drawings, A indicates a melting pot of suitable dimensions and contour, set in a furnace of any desirable construction, but preferably of such character as to leave an annular combustion chamber, B, entirely surrounding the pot, in which chamber the products of combustion from the fire box are admitted through the opening C in the back wall thereof, and after passing entirely around and forward of the pot, are discharged from the smoke stack D. It will be understood, however, that I do not desire to limit myself to this particular form of furnaces, but merely illustrate and describe the same herein as being of especial efficiency in gaining the maximum uniform heating of the melting pot at the minimum cost. Dipping into this pot, and preferably resting upon the upper edge thereof, is one leg of the siphon E, extending into and nearly to the bottom of the pot, while the other leg of the siphon, extends vertically down on the outside of the pot to a level with or slightly below the bottom of the melting pot or kettle, and thence continues in a horizontal branch E″ to a point preferably above the center of the dropping sieve F, where it terminates in a short vertical branch, directing the metal properly into the sieve. This sieve, which may be of any ordinary construction, and supported above the upper end of the tower J, in any suitable manner, has suspended therein a diffusing plate above the bottom thereof, preferably by arms G suspending the same from the end of the siphon, although, obviously, the same result might be accomplished by other means, which will readily suggest themselves to a skilled mechanic.

The purpose of the diffusing plate H, is to break the force of the discharging metal on the perforated bottom of the pan and diffuse the same, so as not to disturb the usual layer of dross I, on the bottom of the sieve, which is utilized for preventing a too rapid flow of the molten metal from the sieve, and which, in the absence of the diffusing plate, would soon be worn or washed away immediately under the discharge end of the siphon, thus resulting in unequal dropping of the metal from the sieve.

As a convenient means of starting the siphon into operation, I employ the vertical branch or extension K, preferably coincident with and practically forming a continuation of the vertical portion of the discharge leg of the siphon, upon the upper end of which extension or branch is mounted a starting cup L, of any suitable shape and dimensions, which may be utilized at pleasure in connection with the siphon, by means of a valve M, of any suitable character, located in the branch pipe K, the sole purpose of the starting cup being to form a ready means for bringing the siphon into operation with the least exposure to danger of the operators. Obviously, however, so far as relates to the use of the siphon, this starting cup may be dispensed with and the siphon be started in any other manner.

In practice, to prevent the congealing of the metal by the siphon in starting the operation, the siphon is first raised to about the same temperature as the metal, in any suitable manner, such as by dipping the same into the molten metal, and then, after adjusting the same in position, the starting cup is filled with the molten metal by means of a ladle or similar device, the valve M is opened and the metal permitted to flow from the starting cup through the discharge branch of the siphon into the vertical leg or the discharge end of the siphon, until the starting cup is nearly exhausted, when the valve M will be closed, so as to prevent the entrance of air into the siphon. By this time, the vacuum created in the siphon by the flow of the metal will be sufficient to start the metal flowing therethrough from the kettle, and this operation will continue as long as any molten metal is left in the kettle above the receiving end of the siphon.

In Fig. 2, I have shown a convenient means for maintaining the siphon at all times in a heated condition, so as to avoid the necessity for dipping or otherwise heating the same, preparatory to use, which consists in locating the discharge leg of the siphon in the combustion chamber of the furnace, the heating of the starting cup and the extreme end of the discharge branch beyond where it projects from the combustion chamber, resulting from conduction; or, if desired, the starting cup may also be set down so as to project into the combustion chamber of the furnace, as illustrated in Fig. 5, leaving the top thereof flush with the top plate of the furnace, the valve thereof being provided with a stem projecting through the side wall of the furnace, for convenience of manipulation.

In the manufacture of drop shot, the most important yet difficult results to obtain, are uniformity in the size of the shot, continuity of the operation and a very large percentage of good and marketable shot from a given quantity of metal. The essential features for producing these results are an approximately uniform temperature and pressure of the metal in the sieve and a continuous and uniform delivery of the molten metal to the sieve free from commotion, turbulence, or violent action of any kind, and I have found by practice that with the proper proportion existing between the siphon and the pan, the desired pressure may be obtained and maintained under all conditions, regardless of the diameter of the perforations in the pan, or the different temperatures to which the metal must be heated for running shot of different sizes, for the same siphon may be used in connection with all sizes of sieves and in all temperatures of metal, although it may be found desirable to slightly vary the diameter of the siphon tube between the extremes in the sizes of the shot, such variation, however, not being essential. This result is due to the fact that although the perforations in the dropping pan must be increased in size for the larger sizes of shot, yet the temperature of the metal for the larger sizes of shot must be greatly decreased, and, therefore, the metal will not only discharge with less rapidity from the dropping pan, but the same lessening will occur in the flow of the metal from the melting pot to the dropping pan, and hence, the proportions are, under all conditions, approximately maintained.

I am aware that siphons, as well as spouts, have been used for many years for the transfer of molten metal from one vessel to another, but I am not aware that in the art of shot manufacture a siphon has ever been employed for transferring the molten lead from the melting pot to the dropping pan, and as in this art special conditions arise and exist which are not encountered in any other art in which siphons and spouts have been used, in order that the utility and advantages of my invention may be better understood, I will herein compare my apparatus with the old form of spout apparatus, which is the nearest approach to my invention known to me.

It is well known that with a spout and siphon of the same capacity or diameter, the discharge from the spout is much more rapid than with the siphon, and in fact, that it takes only about one half as long to discharge the same quantity of liquid with the spout as with the siphon, but that by decreasing the diameter of the spout, the discharge may be made about equal.

I have found by practical experience, that the best results in the use of a siphon, in connection with dropping pans of practical dimensions, are obtainable when the siphon has a diameter of not more than one-quarter to three eighths of an inch, which diameter enables the delivery of sufficient metal at any temperature to keep the molten metal at substantially the same depth at all times in a dropping pan of the greatest practical dimensions, the inflow practically compensating for the outflow of the dropping metal from the sieve; and as the supply of metal to the kettle is also practically equal to the discharge therefrom, the molten metal in the dropping pan remains at substantially the same depth at all times during the operation, and, consequently, the pressure upon the falling column of lead from the dropping pan or sieve, is uniform and substantially the same at all times during the operation. By reason of the more rapid discharge from the spout, it is necessary, to obtain these desirable results, to either materially lessen the capacity or diameter of the spout, or else use a spout of larger diameter and throttle down with a valve, which in practice is necessarily located within the kettle, although both these expedients are open to serious objections in themselves and also result in other objections equally serious. In the first place, if a smaller spout be employed, the diameter thereof will necessarily be so small that the spout would be entirely impracticable, because the lead would freeze or congeal therein upon very slight changes in temperature, either of the lead flowing through the spout, or of the air in the work-room, especially in running comparatively cool metal for the larger sizes of shot, which is heated only just sufficiently to make it flow. If it is sought to overcome this objection by raising the temperature of the metal sufficiently to cause it to flow through a spout of the smaller diameter necessary, then the larger sizes of shot could not be produced thereby, beside which the temperature of the metal would have to be raised to such a degree that the arsenic contained in the lead, and which is an essential, would be volatilized by such heat and escape from the lead, in which case the shot would not form to but small extent, nor be marketable if formed. If, on the other hand, the diameter of the spout is increased, the flow would be so copious that the pan would overflow, or else it would become necessary to increase the dimensions of the pan and tower to such an extent that the column of falling shot would be so mammoth that the interior of the column could not be cooled, and, consequently, the most of the product would be waste.

The impracticability of the smaller spout has, in practice, compelled those manufacturers using a spout, to employ one of much larger size than my siphon, in fact, about an inch in diameter, or three or four times the diameter of the siphon, employing in connection with the spout a valve located within the kettle, with a stem extending up through the molten metal, to throttle the same, so as to control the discharge from the spout. The objections to this expedient are almost as serious as the other, for the comparatively thin streams of lead rushing through the spout in a wavering and serpentine form, expose so much of the molten metal to the action of the atmosphere, that the formation and deposit of red oxide in the spout, and particularly around the valve and its seat, is extremely large and rapid, the oxide having a particular affinity for the iron of the spout, and so much so, that the oxide soon chokes the valve beyond usefulness and has to be chiseled therefrom at short intervals, of from one to three weeks.

Another important objection to the use of a valve is that, if the metal is allowed to cool in the melting pot at any time, the unequal shrinkage of the valve and its seat and the congealed metal will cause the valve to withdraw from its seat and be thus held fast by the congealed metal until the whole contents of the pot are remelted and the valve and valve stem are released. On every such occasion, there is an uncontrollable and expensive leakage, because, in firing up, the metal, of course, melts first at the bottom of the kettle, and as the valve is locked off of its seat by the unmelted metal above the bottom of the pot, the molten metal runs out past the unseated valve and the leakage cannot be checked until the whole contents of the pot are melted, by which time a bad leakage has occurred and the metal has again congealed in the spout beyond the valve.

The best results in the use of either a spout or siphon, are obtained by maintaining a substantially uniform depth of metal in both the melting pot and the dropping pan, but for the reasons just explained, it is, obviously, not practical to have this continuous supply and discharge in the case of the spout, because of the great loss of time resulting when any metal is allowed to congeal in the melting pot, especially over night, but aside from that, is always encountered in the use of a spout the large and rapid formation of red oxide. In some cases, it has been sought to avoid these objections in the use of a spout, by melting a kettleful of lead and then running all of it out without stopping, but such a method is objectionable for the reason that the pressure on the falling column of lead, and consequently, the rapidity of the flow of the lead into the dropping pan, is constantly changing, and hence, the depth of the metal in the pan is continually changing and the result can only be imperfect shot of many different sizes and grades, besides the loss of time and expense incident to the constant filling and emptying of the kettle and the expense and loss of time in manipulating the furnace so as to raise the molten metal to the desired temperature for the desirable size of shot, which is also of considerable importance. At best, the proportion of perfect shot formed by the use of a spout, is very small, being little more than fifty per cent., of total amount of the lead dropped, while the grades or sizes of shot produced, vary considerably from the desired sizes, and, furthermore, the amount of lead which can be successfully dropped by means of a spout, even when producing such a small proportion of perfect shot, is little more than can be dropped by the old hand ladling process, ranging from ten to fifteen tons of metal per day. On the other hand, by the use of my siphon, at least ninety per cent., of perfect shot are obtained, of almost uniform size, and I am enabled to drop from forty to sixty tons of metal in an ordinary day's work of ten hours, for, with my apparatus, the dropping of the metal is continuous, although it may be interrupted at any time, without detriment or loss, and without material loss of time in starting again, and, if desired, the kettle may be left full of metal over night, as the siphon may be conveniently removed therefrom at any time. It will, of course, be understood, that no deposit of red oxide takes place in my siphon, because the siphon is full of metal at all times throughout its length, and the molten metal does not come into contact with the atmosphere until after it leaves the siphon. It will thus be seen, that there is a vast difference between the employment of a siphon and a spout in the manufacture of drop shot, which difference results in the advantages of the production of a vastly increased quantity of perfect shot from a given quantity of metal, the maximum proportion of the desired size of shot as compared to the whole product, the quality of the shot so produced and the vastly increased quantity of shot which may be produced in a given time. All these features are of the utmost importance, utility, and commercial advantage in the manufacture of drop shot, and none of these advantages can be offset or equaled by any modification, variation or change in the size, proportion or manner of use of the old form of spout.

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

1. In an apparatus for the manufacture of drop shot, the combination with the melting pot and a dropping pan or sieve, of a siphon for transferring the molten metal from the pot to the sieve, substantially as set forth.

2. In an apparatus for the manufacture of drop shot, the combination with the melting pot and a dropping pan or sieve, of a siphon for transferring the molten metal from the pot to the sieve, and means for starting said siphon into operation, substantially as set forth.

3. In an apparatus for the manufacture of drop shot, the combination with a melting pot and a dropping pan, of a siphon arranged to convey the shot from said pot to said pan, and a valved cup arranged directly over and communicating with the discharge branch of the siphon, whereby the metal will pass from said cup directly down said discharge branch of the siphon without running back into the pot, substantially as set forth.

4. In an apparatus for the manufacture of drop shot, the combination with the melting pot and a dropping pan or sieve, of a siphon dipping into said pot at its receiving end, and a diffusing plate arranged under the discharge end of said siphon, substantially set forth.

5. In an apparatus for the manufacture of drop shot, the combination with the melting pot and a dropping pan or sieve, of a siphon dipping into said pot at its receiving end, a diffusing plate arranged under the discharge end of said siphon, and a valved cup on said siphon for starting the same, substantially as set forth.

6. In an apparatus for the manufacture of drop shot, the combination with the melting pot, of a siphon dipping into said pot at its receiving end, a dropping sieve arranged under the discharge end of said siphon, and a diffusing plate arranged in said sieve below the top of the sides thereof, and under the discharge end of the siphon, whereby such plate may be maintained beneath the surface of the metal in the sieve, substantially as set forth.

7. In an apparatus for the manufacture of drop shot, the combination with the melting pot and the furnace, of a siphon dipping into such pot, a heating chamber inclosing part of said siphon a valved cup for starting said siphon arranged to discharge into the discharge end of the siphon, a diffusing plate arranged under the discharge end of said siphon, and a dropping sieve arranged under said plate, substantially as set forth.

8. In an apparatus for the manufacture of drop shot, the combination of the melting pot and the furnace. A siphon dipping into said pot, a heating chamber inclosing part of said siphon, a valved cup on said siphon for starting the same, also inclosed by said chamber, a diffusing plate secured to and arranged under the discharge end of said siphon, and a dropping sieve arranged under said plate, substantially as set forth.

ALBERT J. DENISTON.

Witnesses:
R. C. OMOHUNDRO,
JAMES R. SCOTT.