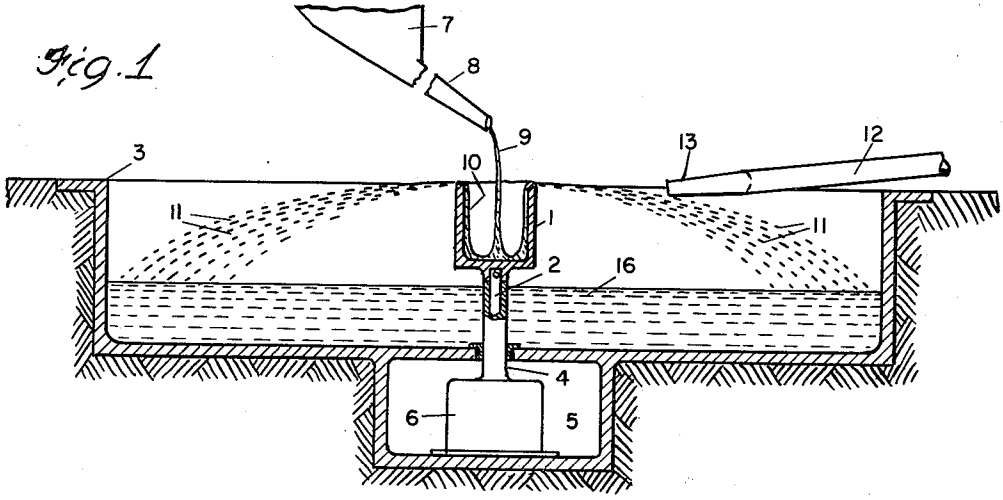
Feb. 9, 1943. H. MARETTE 2,310,590

METHOD OF FORMING METAL SHOT

Filed July 23, 1941

Fig. 1



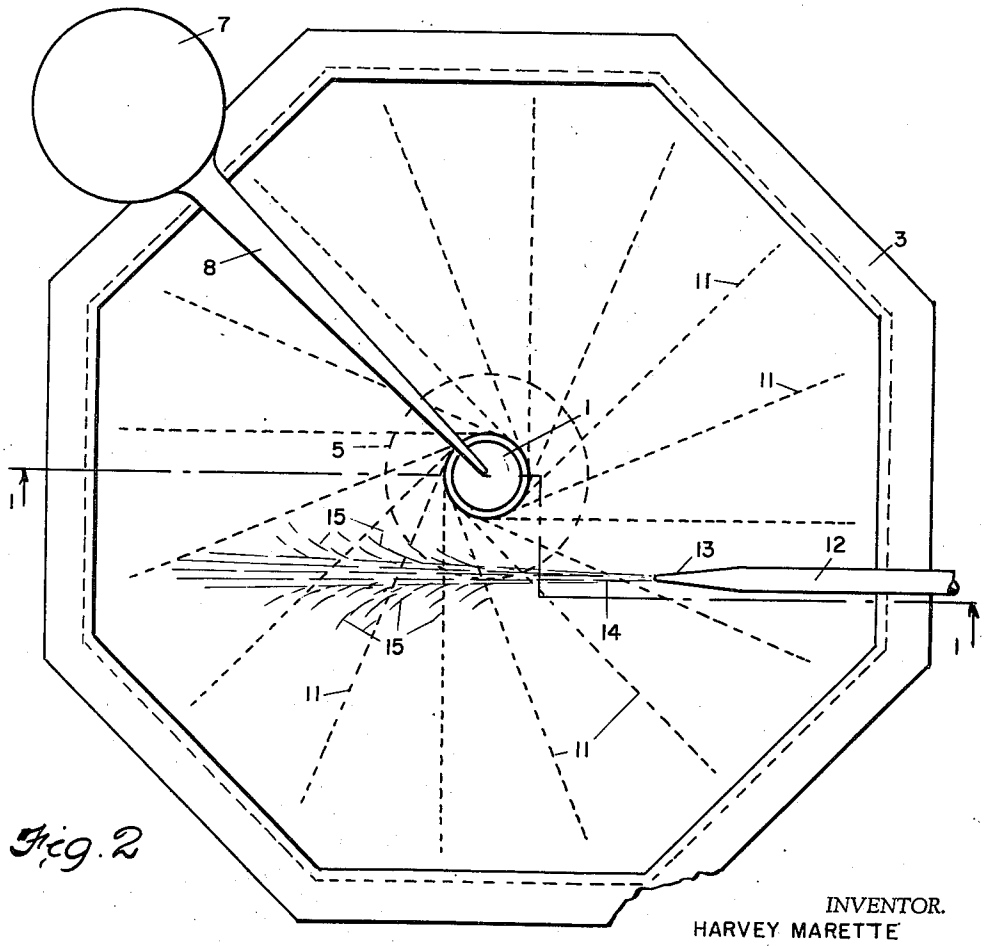




Fig. 2

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# UNITED STATES PATENT OFFICE

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## METHOD OF FORMING METAL SHOT

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4 Claims. (Cl. 83—91)

My invention relates to improvements in methods and apparatus used in the forming of metal shot, and particularly to methods and apparatus by which molten iron or steel may be converted into shot, a large percentage of which will be small enough to pass through a screen having openings .068 inch across.

In methods of making shot from molten iron or steel, it has been known to break up a stream of molten metal by intercepting the stream with a jet of steam under high pressure as disclosed in U. S. Patent No. 446,988 to Benj. C. and Richard A. Tilghman. Also it has been known to substitute a jet of high pressure water for the steam jet as taught in U. S. Patent No. 1,886,285 to David Martin and thereby avoid the formation of substantial percentages of undesired small sizes. Also, it has been known to form such shot by throwing molten metal centrifugally from a revolving vessel as taught by U. S. Patent No. 809,671 to Percy F. Cowing. In the forming of shot by said centrifugal method, the size of the shot formed decreases with increases of the speed with which the vessel is revolved, and decreases with increases in the fluidity of the molten metal, which fluidity increases with the temperature.

The formation of fine shot by the use of a jet of high pressure steam is uneconomical because a substantial percentage of the molten metal is not converted into usable shot but into irregular masses of metal. When the centrifugal method is used in the formation of fine shot, the throw of the molten metal is such that a quenching pool must be provided of a size which from the point of economy is prohibitive.

The problem to be solved is the provision of methods and apparatus whereby substantially all the molten metal may be converted into usable sizes of shot with a major portion thereof of sizes such as will go through a screen having a mesh of .068 inch or smaller.

An object of my invention is the provision of methods and apparatus for producing shot, of steel or iron, under controls effective to secure a substantially complete conversion of molten metal into shot, a large percentage of which is of a size which will pass through a screen having a mesh of .068 inch. Objects of my invention and the invention itself will be understood by reference to the drawing and to the following description of a preferred practice of my improved method and of apparatus used therein.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawing and the following description setting forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various means in which the principle of my invention may be used.

In said annexed drawing:

Fig. 1 shows a cross-sectional view of apparatus used in the practice of my improved method; and

Fig. 2 shows a top view of the apparatus of Fig. 1.

By my improved method of converting molten metal into shot, substantially all the metal is converted into usable shot, and a large percentage of very fine size may be secured. In the practice of this method, a stream of metal is broken up into small discrete portions, forming molten globules, which are thrown through the air toward a quenching pool. The molten globules so formed are struck in their flight by a stream of water projected under pressure in a direction opposed to the direction of flight of the molten globules. The kinetic force of the water when it strikes these globules disintegrates the molten metal into many fine particles, which at once assume the globular form of shot and are quenched when they drop into the quenching pool.

Referring to said drawing, an open top vessel 1 is mounted on a vertical shaft 2, centrally of a pool 3 having walls and bottom of concrete or other suitable material. The said shaft 2 is rotatably mounted through a pipe 4 sealed in the bottom of the pool 3 and communicating with a chamber 5 therebelow. In said chamber 5 is a motor 6, operative to rotate the shaft 2 which is mounted thereupon. Suitable means (not shown) supply electric current to motor 6 and other suitable means (not shown) control the speed of rotation. Adjacent the pool 3 is a cupola 7 operative to melt iron and steel supplied thereto. A trough 8 conducts molten metal from cupola 7 and discharges same in a continuous stream 9 into the open vessel 1. In the rotating vessel 1 the molten metal rises on the sides as indicated at 10 and overflows the top of the vessel 1. The escaping molten metal will be thrown tangentially from the top or lip of vessel 1 in molten globules as indicated by the lines 11 which show the direction of flight of certain of such globules.

Above the pool 3 is a water pipe 12, in com-

munication with a source, supplying water under pressure, as for instance the public service system of a municipality. The pipe 12 terminates in a nozzle 13 preferably of the fish tail type, and is positioned substantially horizontally with the longer dimension of the fish tail nozzle in a vertical relation. The nozzle 13 is so placed that a stream of water 14 ejected therefrom under pressure will intercept the tangential lines 11 followed by the globules thrown from a substantial arc of the top or lip of the vessel 1.

In operation the vessel 1 was rotated at a speed of 500 to 700 R. P. M., and molten iron heated to a temperature of approximately 2600° F. was fed in a stream to the vessel 1 from the cupola 7. The globules thrown from the top of the vessel 1 followed tangential lines such as shown at 11. A stream of water 14 under a pressure of approximately 25 pounds per square inch was so thrown from the nozzle 13 as to intercept the globules thrown from a substantial arc of the lip of vessel 1. The globules so intercepted were disintegrated into fine particles which formed small globules and followed paths, such as indicated by the lines 15, into the quench water 16 in pool 3. It will be understood that by using a plurality of water nozzles 13, spaced about the vessel 1, a very substantial part of the molten metal will be disintegrated into particles which form fine shot.

Under the operating conditions stated, but without ejecting water from the nozzle 13, the molten metal thrown from the rotating vessel 1 formed shot, only approximately 10% of which would pass through a screen having a mesh of .068 inch. When the globules thrown from the vessel 1 under said operating conditions were intercepted in mid-air by a stream of water as explained, the globules so intercepted were converted into shot of such size that more than 80% were passed through a screen of said mesh. Moreover, substantial percentages of said small shot so formed were of very small sizes such as would pass screens respectively of meshes of .0238, .0183 and .0165 inch.

By my novel improvement in methods of forming shot of molten iron, I am able to secure at will quantities of the very small sizes much in demand under present shop practices. It will be recognized that a marked advantage arises from the ability to form a desired quantity of these small sizes without the former handicap of producing at the same time larger and undesired sizes.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:

1. The method of forming metal shot of small size comprising supplying molten iron and the like in a stream into a rapidly revolved vessel, whereby such molten metal is thrown centrifugally from the vessel as molten globules; intercepting such molten globules in the air with a stream of water ejected under pressure in excess of 20 pounds per square inch in a direction opposed to the direction of flight of such globules, whereby such globules, while still in the molten state, are disintegrated into smaller globules; and catching the smaller globules so formed in a quenching bath.

2. In the conversion of molten iron and the like into shot by throwing small portions thereof through the air whereby they assume the form of molten globules, the improved method including the step of intercepting such molten globules so formed in mid-air with a stream of water ejected under pressure substantially of the order of 25 pounds per square inch in a direction opposed to the direction of flight of such globules, thereby disintegrating such globules, while still in the molten state, into finer particles and dropping the smaller particles so formed into a quench bath.

3. The method of producing metal shot of substantially uniform size from molten metal, which consists in intercepting molten globules, thrown from a disintegrator of molten metal, with a stream of water ejected under pressure exceeding 25 pounds per square inch in a direction substantially opposing the direction of flight of the molten globules, whereby the larger globules, while still in the molten state, are further disintegrated resulting in a product of relatively uniform size.

4. The method of forming metal shot of small size comprising supplying molten iron and the like, which has been heated to a temperature of approximately 2600° F., in a stream into an open vessel revolved at a speed of 500 to 700 R. P. M., whereby such molten metal is thrown centrifugally from the vessel as molten globules; intercepting such globules in the air with a stream of water ejected under a pressure of 25 pounds per square inch in a direction substantially opposed to the direction of flight of such globules, whereby such globules, while still in the molten state, are disintegrated into smaller globules; and catching such smaller globules in a quenching bath.

HARVEY MARETTE.