This invention relates generally to the class of metallurgy and pertains particularly to improvements in apparatus for refining metals.

A principal object of the present invention is to provide a method and apparatus for refining metal by centrifugal action whereby the metal is effectively separated from the slag.

A further object of the invention is to provide apparatus for separating metal from slag by centrifugal action, which comprises a revolving hopper or crucible into which the molten ore is introduced from the bottom, the molten material being forced to climb the sides of the crucible as the latter is rotated and the metal passing out through apertures in the wall of the said structure while the lighter slag rises higher through the center of the molten material to pass out through upper apertures.

The invention will be best understood from a consideration of the following detailed description taken in association with the accompanying drawings forming a part of the specification, it being understood, however, that the invention is not intended to be limited to the strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

Figure 1 is a view in top plan of a separator constructed in accordance with the present invention.

Figure 2 is a vertical section taken substantially upon the line 2—2 of Figure 1.

Referring now more particularly to the drawings the numeral 10 generally designates a frame structure or support for the separator, such support comprising vertical legs 11, a top frame 12, and a platform or floor 13 resting upon the top frame 12 and having a central circular opening 14 therethrough.

Mounted upon the top of the platform or floor 13 is the circular track 15 which is concentric with the opening 14.

The numeral 16 generally designates the revolving separator cone or crucible which is disposed vertically and upright, that is, with the apex down, within and upon the vertical center of the frame 10 as shown in Figure 2. This separator cone comprises the conical metal shell 17 which is open at its bottom as indicated at 18 and which has its inner surface lined with fire-brick or other suitable refractory material as indicated at 19.

At about half-way up the height of the cone the shell 17 is provided with the metal discharge ports 20 and the lining 19 has corresponding ports 21 formed therethrough from the inside of the cone, the lining in the circular area in which the ports 21 are formed, being shaped or molded to form the annular vertical wall portion 22.

At its bottom end the cone is open to form the inlet port 23 through which molten metal is introduced from the blast furnace, not shown, by way of the pipe 24 which is lined with fire-brick or other suitable refractory material as indicated at 25. The outlet end of this pipe and the refractory lining are shaped to provide a close joint with the edge of the inlet port 23, as indicated at 26 and the lowest part of the pipe 24 which is immediately adjacent the upwardly curving portion 27 where it connects with the intake port 23 of the cone, is provided with the clean-out door 28 through which may be removed material remaining in the cone after the rotation of the same has been stopped.

The top of the cone shell has been formed integrally therewith the enclosing turned relatively wide guard lip 29 which functions to prevent any of the molten material escaping from the top of the revolving cone.

Connected with the top portion of the cone shell, are the upwardly and outwardly extending hanger frames 30, each of which includes a short axle 31 which extends radially with respect to the open top of the cone and upon each of these axles is mounted a flanged wheel 32 which rests upon the circular track 15.

Encircling the lower end of the cone structure is a collar 33 with which are connected the radially outwardly extending trunnions 34 upon each of which is mounted a flanged wheel 35. These wheels 35 rest upon a circular track 36 which is supported upon a suitable frame support 37 which is constructed around the cone as shown in Figure 2. By means of these upper and lower wheel assemblies, running upon the circular tracks 15 and 36, the cone is supported for free rotation.

In the upper part of the cone structure there is formed the circular series of slag discharge ports 37 which pass through the refractory lining and the shell of the cone, radially outwardly as shown. These slag discharge ports 37 open into the continuous mouth 38 of an encircling receiving chamber 39 which closely encircles the upper part of the cone as shown and this chamber has leading therefrom the downwardly and laterally extending discharge spout 40 through which the slag passes.
Encircling the revolving cone in the plane of the ports 20—21 is a second circular chamber 41 which has a continuous mouth opening 42 into which the ports 20—21 open. Leading from this chamber 41 into which the molten metal passes, is the downwardly and laterally extending molten metal discharging spout 43. Each of the circular chambers 39 and 41 has its bottom or floor inclined toward the discharging spout to encourage the flow of molten metal thereto.

Secured about the cone, preferably below the annular molten metal receiving chamber 41, is a ring gear 44 with which is connected a spur gear 45 carried by a driving shaft 46 which is connected with a suitable source of driving power, not shown. By this means rotation is imparted to the cone.

In the operation of the present structure for refining metals, the molten ore is passed through the pipe 24 into the bottom part of the cone which is revolving at a predetermined rate of speed sufficient to cause the material to move upwardly over the inner surface of the cone. The heavier metal will be forced outwardly by centrifugal action more rapidly than the lighter molten slag and thus, as the material is caused to rise along the wall of the cone, the molten metal will flow out through the ports 20—21 into the annular molten metal receiving chamber 41 and the lighter slag will not be caused to pass through these ports but will rise to the top of the cone where it will pass out through the ports 37 into the annular receiving chamber 39. In this manner the metal will be effectively refined or removed from the undesired slag.

The taper of the cone will be determined by the character of the material being handled and the speed of rotation at which the cone will be operated and therefore, it is to be understood that the invention is not limited to the proportions of the cone structure or crucible here illustrated.

I claim:

A molten metal refining apparatus comprising a vertically arranged conical receptacle having its apex directed downwardly, a material admis-