March 10, 1959 F. W. RIDDINGTON ET AL 2,876,736

CENTRIFUGAL SPRAYING APPARATUS FOR APPLYING COATINGS TO CAVITIES IN OBJECTS

Filed July 15, 1954 2 Sheets-Sheet 1

Fig. 1.

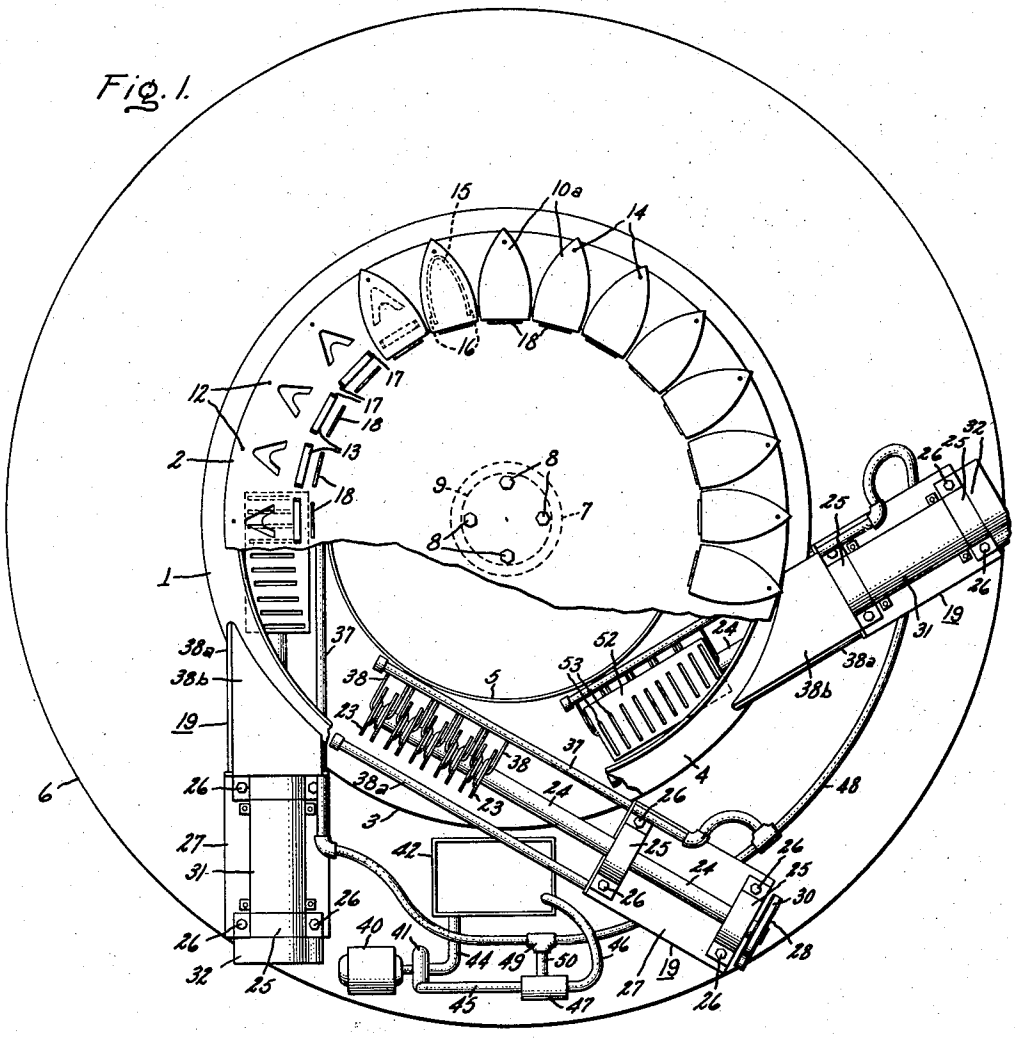
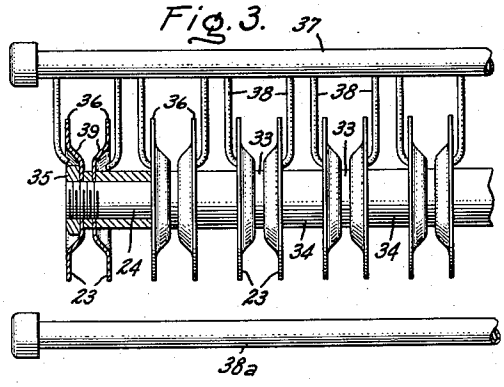


Fig. 3.



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Fig. 2.

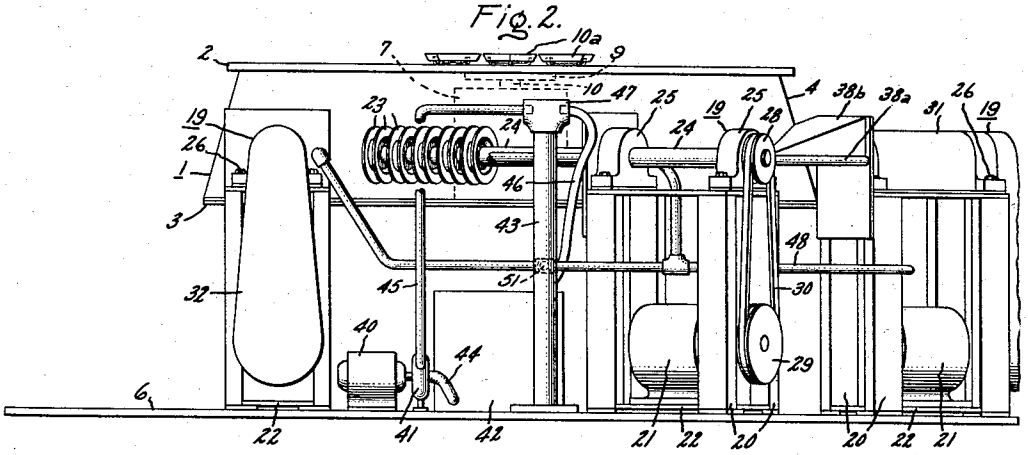


Fig. 4.

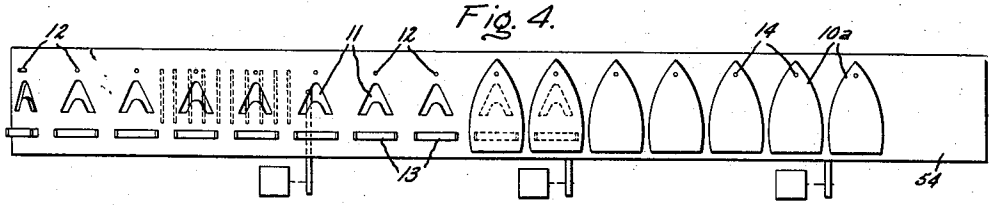


Fig. 5.

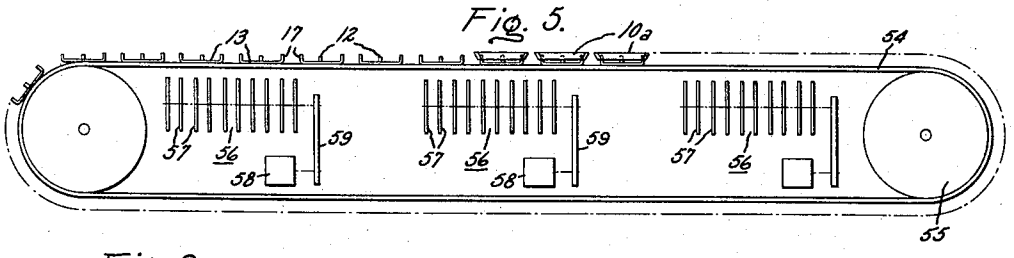
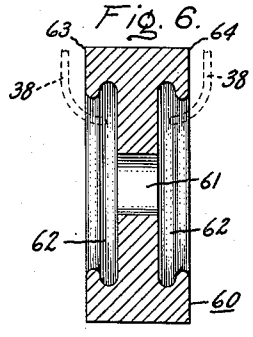


Fig. 6.



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United States Patent Office 2,876,736
Patented Mar. 10, 1959

2,876,736

CENTRIFUGAL SPRAYING APPARATUS FOR APPLYING COATINGS TO CAVITIES IN OBJECTS

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Application July 15, 1954, Serial No. 443,608

6 Claims. (Cl. 118—301)

Our invention relates to apparatus for automatically applying coatings to objects and more particularly to apparatus for automatically coating the flash boiler cavity of a steam iron.

In the copending application of Gilbert J. Extale and Frederick W. Riddington Serial No. 443,644, filed July 15, 1954, there is described and claimed an improved coating for the boiler cavity of steam irons and an improved method for applying the coating to the boiler cavity. The present invention relates to apparatus for carrying out in a rapid and convenient manner the process of the aforementioned copending application.

It is an object of this invention to provide an improved machine for applying a plurality of coats of material to a surface to be coated.

It is another object of this invention to provide an improved machine for applying a plurality of coats of a coating material to the flash boiler cavity of a steam iron soleplate.

It is a further object of our invention to provide an improved machine for applying a plurality of successive coats of coating material to the boiler cavity of a steam iron soleplate and for automatically providing for the drying or partial setting of each coat before the next successive coat is applied.

Further objects and advantages of our invention will become apparent as the following description proceeds and the features of novelty which characterize our invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of our invention a plurality of laterally spaced spray elements are employed. A supporting member for the soleplates is positioned above the spray elements, the soleplates and the spray elements being made relatively movable. The soleplate supporting member is provided with a plurality of openings having fixtures adjacent thereto for positioning the soleplates so that the boiler cavity of each soleplate is in line with a corresponding opening. In one form of our invention, this member is continuously moved so that each soleplate is brought successively past the laterally spaced spray elements. The speed of movement is selected so that each coat has sufficient time to dry or at least to partially set before the boiler cavity is brought into alignment with the next successive spray element for application of the next coat thereto. The spray elements are preferably in the form of rapidly rotating disks or wheels to which fluid is supplied and thrown outwardly by centrifugal force onto the boiler cavities. We employ the disks or wheels because ordinary spray nozzles have a tendency to clog after a short period of operation.

For a better understanding of our invention, reference may be made to the accompanying drawings in which Fig. 1 is a plan view, partially broken away, of an apparatus incorporating an embodiment of our invention.

Fig. 2 is an elevation view of this apparatus with portions removed for clarity in illustrating internal parts.

Fig. 3 is an enlarged view showing details of the spray elements.

Fig. 4 is a plan view, largely in diagrammatic form, of a modified form of our invention.

Fig. 5 is an elevation view, also largely in diagrammatic form, of the form of the invention shown in Fig. 4.

Fig. 6 is an enlarged view of a modified form of spray element.

Referring to Figs. 1 and 2, the apparatus includes a lower stationary portion or member **1**, and an upper movable portion or member **2**. The lower portion **1** includes a flat base member **3**, and two generally concentric walls or shields **4** and **5**. The base member **3** and the spaced walls **4** and **5** form an annular spray chamber, the top of which is covered by the movable member **2**. The base member **3** and the structure supported thereon is supported from a lower member or plate **6** by conventional legs which, for clarity in illustrating the remainder of the elements, have been omitted in the drawing.

In the form illustrated, the member **2** is in the form of a generally circular rotatable member. This member is slowly rotated by means of a motor, illustrated merely in outline at **7**, mounted on the base member **3**. The member **2** is fastened in any suitable manner, as by bolts **8** to a plate or disk **9**, which is driven from the motor **7** through a shaft **10**.

The soleplates **10***a* to be coated in accordance with our invention are arranged to be received on the rotatable member **2**. Since it is desired to coat only the boiler cavity of the soleplate onto which water is to be fed for flash conversion into steam, the member **2** is formed to provide a plurality of spaced openings **11**, each of the same shape as that of the boiler cavity of each soleplate. As shown in Fig. 1, these openings are equally spaced about the circumference of the member **2**, the member **2** being otherwise solid so as to block passage of fluid from the spray elements onto other portions of the soleplates.

In order to insure disposition of each of the soleplates with the boiler cavity thereof in proper relationship to the corresponding opening **11**, a locating pin **12**, and a strap **13** are provided on the member **2** in the region of each of the openings **11**. Each of the soleplates includes near the toe thereof a locating hole **14** which is utilized as a locating point in various manufacturing operations, and the corresponding pin **12** is adapted to be received within the locating recess **14** to properly position the forward portion of the soleplate. Each soleplate contains a U-shaped conventional sheathed heating element cast on or embedded within the soleplate so that a boss of U-shape is formed extending upwardly from the soleplate. The generally U-shaped boss has been illustrated in dotted lines on one of the soleplates at **15**. The rear portions of this boss, indicated at **16** on one of the soleplates, are adapted to be engaged on the outer surface by the upwardly extending ears **17** of the strap **13** to position the rear end of the soleplate. By this three point supporting engagement with the fixture formed on the member **2**, the boiler cavity of each soleplate is fixed in proper aligned relationship with the corresponding opening **11**. If desired, an upwardly extending flange **18** may also be provided against which the rear edge of the soleplate rests for further support.

In order to provide means for spraying the coating fluid onto the boiler cavities a plurality of spray assemblies **19** are spaced about a proportion of the periphery of the apparatus and extend into the spray chamber. In the form illustrated, three such assemblies are employed but it will be apparent that a greater or lesser number of assemblies can be utilized depending on the number of coats to be applied and the number of spray elements

included in each assembly. In the form illustrated, the three spray assemblies 19 are spaced through about one-half of the circumference of the apparatus. The remaining half is thereby made available for the operator to apply uncoated soleplates to the fixture and to remove the coated soleplates therefrom.

Each of the spray assemblies includes a plurality of supports or legs 20 by which the spray assemblies are supported from the lower plate 6. They may be fastened to the plate 6 in any suitable manner, for example, by bolting. A motor 21 for driving the spray elements of each of the assemblies is mounted on a supporting plate 22 which is secured to the legs 20.

In order to direct the coating fluid upwardly onto the boiler cavities a plurality of spaced spray elements 23 are mounted on a shaft 24. One end of the shaft 24 on which the spray elements 23 are mounted extends through the outer wall 4 into the spray chamber. The other or outer end of the shaft is mounted in two spaced bearings 25. The bearings 25 are secured in any suitable manner, as by bolts 26 to a supporting plate 27 which is mounted on the legs 20. To provide a driving connection between the motor 21 and the shaft 24, a pulley 28 is mounted on the outer end of the shaft 24, and a companion pulley 29 is mounted on the motor shaft. The two pulleys are connected by a belt 30. It will be noted that the driving motor and the bearing supports for the shaft 24 are all mounted outside the spray chamber, the spray elements 23 being mounted on an overhanging portion of the shaft 24 which extends into the spray chamber. This is an advantage since the coating material used may be somewhat abrasive and it is desirable to avoid entry of this material into the motor or shaft bearings. As set forth in the aforementioned Riddington application, Serial Number 443,644 filed July 15, 1954, the coating material found to be particularly suitable for flatirons is a colloidal dispersion of hydrated silica. Silica, as is well known, is highly insoluble. Hence, if the usual compressed air operated spray equipment is employed, insoluble silica deposits quickly build up and plug the equipment. The spray apparatus in accordance with this invention, however, obviates such difficulties, since even if silica is deposited on the rotating wheels, operation is not materially impaired. The drive shaft between the bearings 25 is enclosed by a cover 31 which is bolted or welded to the supporting plate 27. The belt 30 and its pulleys 28 and 29 are enclosed by a guard 32.

Each of the spray assemblies includes a plurality of disk-like spray elements mounted in longitudinally or laterally spaced relationship along the shaft 24. In the form illustrated each assembly includes ten spray elements, but it will be apparent that a greater or lesser number can be employed if desired. As shown in detail in Fig. 3, the plurality of spray elements 23 are approximately equally spaced along the shaft by a series of spacers 33 and 34. A nut 35 on the screw-threaded end of the shaft holds the spacers and spray elements in assembled relationship.

Each of the spray elements in the form shown in Figs. 1, 2 and 3 is made in a dish-shape. In the form illustrated, the successive spray elements are reversed, although it will be apparent, as this description proceeds, that they all could be faced in the same direction, the generally equally spacing then being obtained by using spacers of approximately the same length instead of the unequal length spacers 33 and 34. The dish-shape of the spray elements allows the coating fluid to be supplied to the receptacle provided by the concave or dished central portion of the spray element and then to be thrown outwardly beyond the circumferential edge 36 by the centrifugal force as the shaft 24 is rotated. This allows the coating material to be discharged in a thin stream of finely divided or atomized fluid.

In order to supply coating fluid to the spray elements 23 a long pipe or conduit 37 is provided with each spray assembly extending generally parallel to the shaft 24. This pipe 37 acts as a manifold to which are connected a plurality of spaced distributing tubes 38. The ends of the tubes 38 are positioned in the region of the concave or dished central portion 39 of the spray elements 23, so that the fluid supplied through the manifold 37 is discharged through the tubes 38 into the receptacles provided by these concave central portions. A rod 38*a* is arranged parallel to the conduit 37 at the opposite side of the shaft 24. Together with the conduit 37 the rod 38*a* provides support for a cover 38*b* which abuts the wall 4 and covers the shaft 24.

In order to supply the fluid at a relatively constant pressure and at a relatively constant rate to the spray elements 23, there is provided a fluid circulating system including a motor 40, a pump 41, a tank 42, and a stand pipe 43 mounted on the lower supporting plate 6. The pump 41, which is driven by the motor 40, re-circulates the coating fluid from the tank 42 through the pipes 44, 45 and 46. From the pipe 45 the fluid is pumped into the top of the stand pipe 43 at the connection 47. This keeps the stand pipe 43 constantly full; any excess of fluid overflowing the stand pipe passes through the pipe 46 back to the tank 42. The pipe 45 has been broken in the drawing to show the spray elements more clearly, but it will be apparent that in the actual machine, the pipe 45 is continuous from the pump 41 to the connection 47. Each of the conduits or manifolds 37 of the spray assemblies is connected to a common supply pipe 48. The pipe 48 is connected through a connection 49 and a nipple 50 to the stand pipe 43 at 51. Thus, a constant head is provided on the manifolds 37 corresponding to the difference in height between the top of the stand pipe 43 and the manifolds 37. This assures a relatively constant flow of fluid to the spray elements 23 and hence a relatively constant stream of fluid from the circumference of each of the spray elements onto the boiler cavities.

Since improved results appear to be achieved by a plurality of relatively thin coats rather than by a single heavier coat formed by continuous stream, the speed of the member 2 is chosen so that the coating deposited on the boiler cavity from one spray element 23 is allowed to dry, or at least to set partially, before the stream from the next successive spray element 23 reaches the corresponding portion of the boiler cavity. In order to further confine the spray stream so as to project a plurality of sharply defined spaced streams upwardly, a cover 52 is positioned over the spray elements of each of the spray assemblies. This cover includes a plurality of spaced slots 53 which are arranged in line with the peripheral edges of the spray elements. Although not illustrated in the drawing, it will be apparent that any excess of coating fluid collecting in the spray chamber may be caused to collect in a sump disposed at the bottom of the spray chamber beneath the sets of spray elements and to be drained therefrom through conduits back to the tank 42.

Improved coating of the boiler cavities, and particularly the generally vertical side walls thereof, may be secured by reversing the direction of rotation of successive spray assemblies. For example, the spray elements of the first and third assemblies in the form illustrated may be driven in one direction, and the spray elements at the second assembly driven in the opposite direction.

In the form illustrated, the upper platform or member on which the soleplates are diposed, is made movable and the lower portion of the apparatus including the spray assemblies is stationary. This is advantageous since there is a smaller mass and much less cumbersome apparatus mounted on the upper member and also the rotation of this table allows the soleplates to be placed on the table and removed therefrom by an operator stationed at one point. However, it will be apparent that the same coating operation can be accomplished, if desired, by placing the soleplates on a stationary apparatus

and causing the spray assemblies to move relative to the soleplates.

Although the presently preferred form of apparatus includes the generally circular supporting structure and the generally circular rotating member **2**, it will be apparent that the coating could be accomplished by mounting the soleplates on a conveyor belt and causing them to pass transversely across the path to each of the spray elements. A modified form of our invention utilizing this type of apparatus is illustrated in Figs. 4 and 5. As shown, the structure includes a belt type conveyor **54** mounted on pulleys **55**. Power is supplied in a suitable conventional manner to one of the pulleys **55** for driving the belt **54**. The belt **54** is formed to include a plurality of spaced openings **11**, locating pins **12** and locating straps **13**, corresponding to the similarly numbered parts in Fig. 1. The pins **12** and the straps **13** form fixtures for properly positioning the soleplates in the same manner as the structure previously disclosed in Fig. 1. Below the top section of the belt **54** there are mounted a plurality of spray assemblies **56** which correspond to the spray assemblies **19** of the form previously described. The spray elements of these assemblies, indicated at **57**, are driven from a motor **58** and belt **59** in the same manner as the spray elements **23** are driven from the motor **21** and the belt **30** in the form previously described.

The spray elements and the conveyor belt are shown merely in diagrammatic form in Figs. 4 and 5 to illustrate the general operation involved since the details of the structure will be apparent from those illustrated in Figs. 1, 2 and 3. In the modified form shown in Figs. 4 and 5 fluid is supplied as in the form previously described and is sprayed in successive coats onto the boiler cavities of the soleplates which pass successively across the path of the spray elements as the conveyor belt **54** is driven at relatively constant speed. A plurality of successive thin coats of the coating material are thus applied to the boiler cavities of the soleplates.

In lieu of the dish-shaped spray elements shown in Fig. 3, a modified form of spray element or wheel **60**, illustrated in Fig. 6, may be employed. The spray wheel **60** includes an axial passage **61** for receiving a shaft corresponding to the shaft **24**. Each face of the wheel **60** is recessed, as indicated at **62**, to provide a centrally dished portion for receiving fluid from tubes **38**. It will be apparent, of course, that a plurality of wheels **60** are longitudinally or laterally spaced along a shaft or corresponding to the shaft **24**.

The operation of the wheel **60** corresponds to that of the spray elements **23**. Fluid is supplied into the concave or dished portion provided by the recesses **62**. As these recesses become filled with fluid, the fluid spills over onto the side walls or faces of the wheel **60** and is thrown outwardly by centrifugal force being discharged in two parallel streams from the edges **63** and **64** of the wheel **60**. Since in this form two spray streams are projected from each wheel, half as many wheels can be employed compared to the number of disks in the previous form to achieve the same number of coats.

While we have shown and described specific embodiments of our invention, we do not desire our invention to be limited to the particular apparatus shown and described, and we intend by the appended claims to cover all modifications within the spirit and scope of our invention.

What we claim as new and desired to secure by Letters Patent of the United States is:

1. A machine for applying coating material to the boiler cavity of a steam iron soleplate comprising a rotatable member for removably supporting a plurality of soleplates, said member including a plurality of openings each permitting passage of coating material therethrough to the corresponding boiler cavity, walls defining a spray chamber below said member, a rotatable shaft extending through one of said walls into said spray chamber, a plurality of axially spaced discs mounted on said shaft in proximity to the path of movement of the openings in said member and within said chamber, bearing means outside said chamber for supporting said shaft, conduit means including a constant pressure supply source and a discharge tube associated with each of said discs for supplying a substantially constant flow of fluid coating material centrally onto said discs, means connected to said shaft outside said chamber for rotating said shaft and said discs whereby coating material supplied to said discs is projected tangentially outward in a thin spray stream from each of said discs and through the openings in said member, and means for moving said soleplate supporting member to carry the soleplates transversely of said discs whereby said soleplates are caused to pass successively through each of said spray streams so that a plurality of successive coats of coating material are applied to the boiler cavity of each of the soleplates.

2. A combination of claim 1 wherein each of said disks is dish-shaped to provide a recess in the central portion thereof for receiving said coating material, said coating material being caused to flow from the recess to the peripheral edge of each of said disks and to be discharged tangentially therefrom during rotation of said disks.

3. A combination of claim 1 wherein each of said disks is in the form of a wheel having an annular groove in each side face thereof and wherein each groove is formed to provide an inwardly facing annular pocket for receiving said coating material whereby, as said coating material overflows said pocket, it is projected rapidly outwardly along the sides of said wheels during rotation of said wheels and is discharged along the peripheral edges thereof.

4. A machine for applying coating material to the boiler cavity of a steam iron soleplate comprising a rotatable member for removably supporting a plurality of soleplates, said member including a plurality of openings each permitting passage of coating material therethrough to the corresponding boiler cavity, walls defining a spray chamber below said member, a rotatable shaft extending through one of said walls into said spray chamber, a plurality of axially spaced discs mounted on said shaft in proximity to the path of movement of the openings in said member and within said chamber, a shield positioned between said discs and said openings, said shield having a plurality of slots, each slot being aligned with a corresponding one of said discs, conduit means including a constant pressure supply source for supplying a fluid coating material centrally to said discs at a uniform and limited rate, means connected to said shaft outside said chamber for rotating said shaft and said discs whereby coating material supplied to said discs is projected tangentially outward in a thin spray stream from each of said discs and through the openings in said member, and means for moving said soleplate supporting member to carry the soleplates transversely of said discs whereby said soleplates are caused to pass successively through each of said spray streams so that a plurality of successive coats of coating material are applied to the boiler cavity of each of the soleplates.

5. A machine for applying coating material to the boiler cavity of steam iron soleplates comprising an upper rotatable member for removably supporting a plurality of soleplates, said member including a plurality of openings each permitting passage of coating material therethrough to the corresponding boiler cavity, a base member and two concentric upwardly extending walls below said rotatable member forming with said rotatable member an annular enclosed spray chamber, a plurality of spray assemblies arranged in angularly spaced relationship about at least a portion of said annular spray chambers, each of said spray assemblies including a rotatable shaft extending through one of said upwardly extending walls

into said annular spray chamber, a plurality of axially spaced disks mounted on said shaft within said chamber in proximity to the openings in said rotatable member, bearing means outside said chamber for supporting each of said shafts, conduit means including a constant pressure source for supplying a fluid coating material to said disks centrally thereof, means connected to each of said shafts outside said spray chamber for rotating said shafts and said disks whereby coating material supplied to said disks is projected tangentially outward in a thin spray stream from each of said disks, and means for rotating said soleplate supporting member to carry the sole plates transversely of said disks whereby said soleplates are caused to pass successively through each of said spray streams so that a plurality of successive coats of coating material are applied to the boiler cavity of each of the soleplates.

6. The combination of claim 5 wherein the shaft of at least one of said spray assemblies is rotated in a direction opposite to the direction of rotation of the shafts of the remaining spray assemblies for facilitating deposition of coating material on the generally vertical side walls of the boiler cavities.

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