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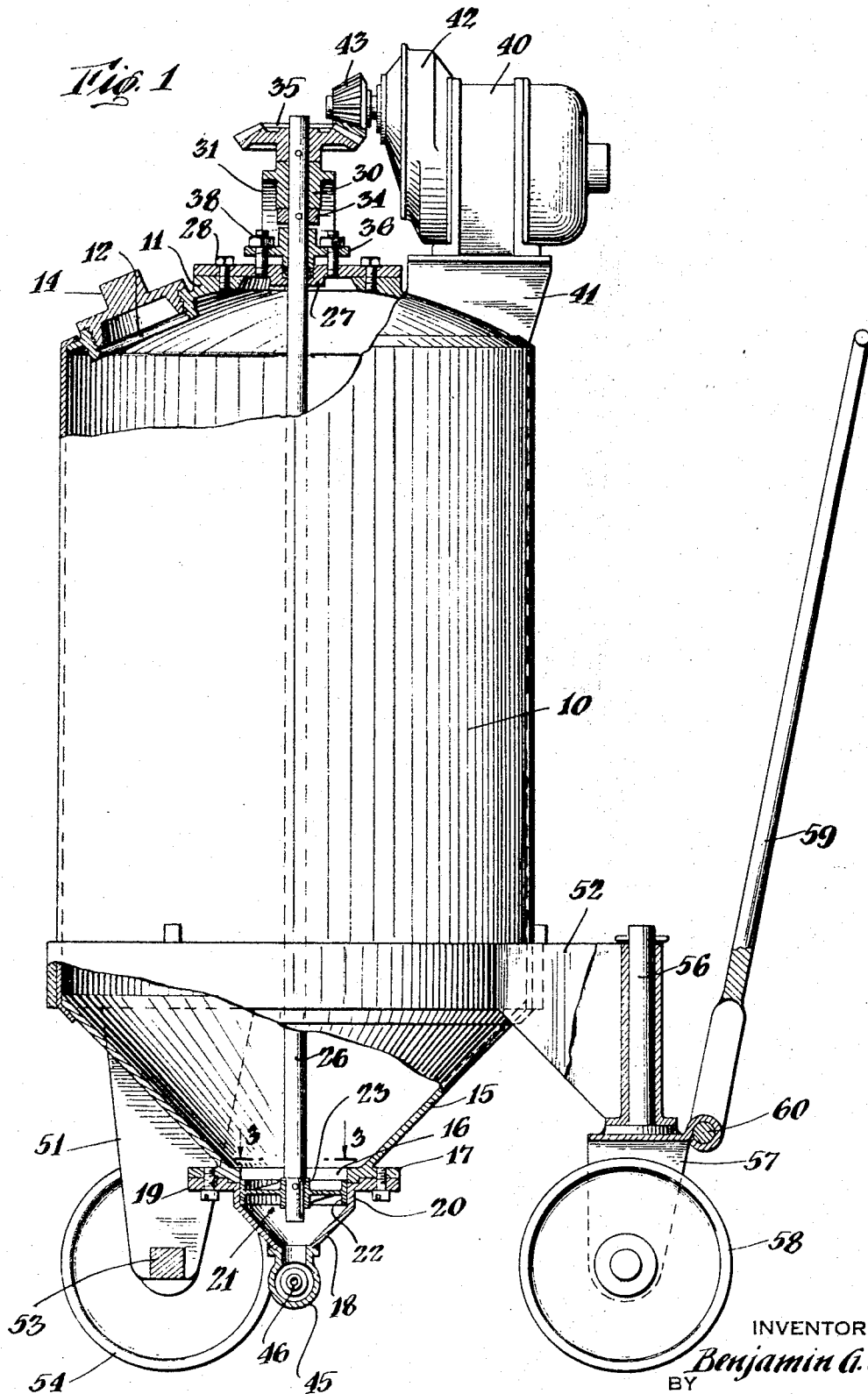
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FEEDING SOLID REAGENTS IN PULVERULENT CONDITION

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2 Sheets-Sheet 1



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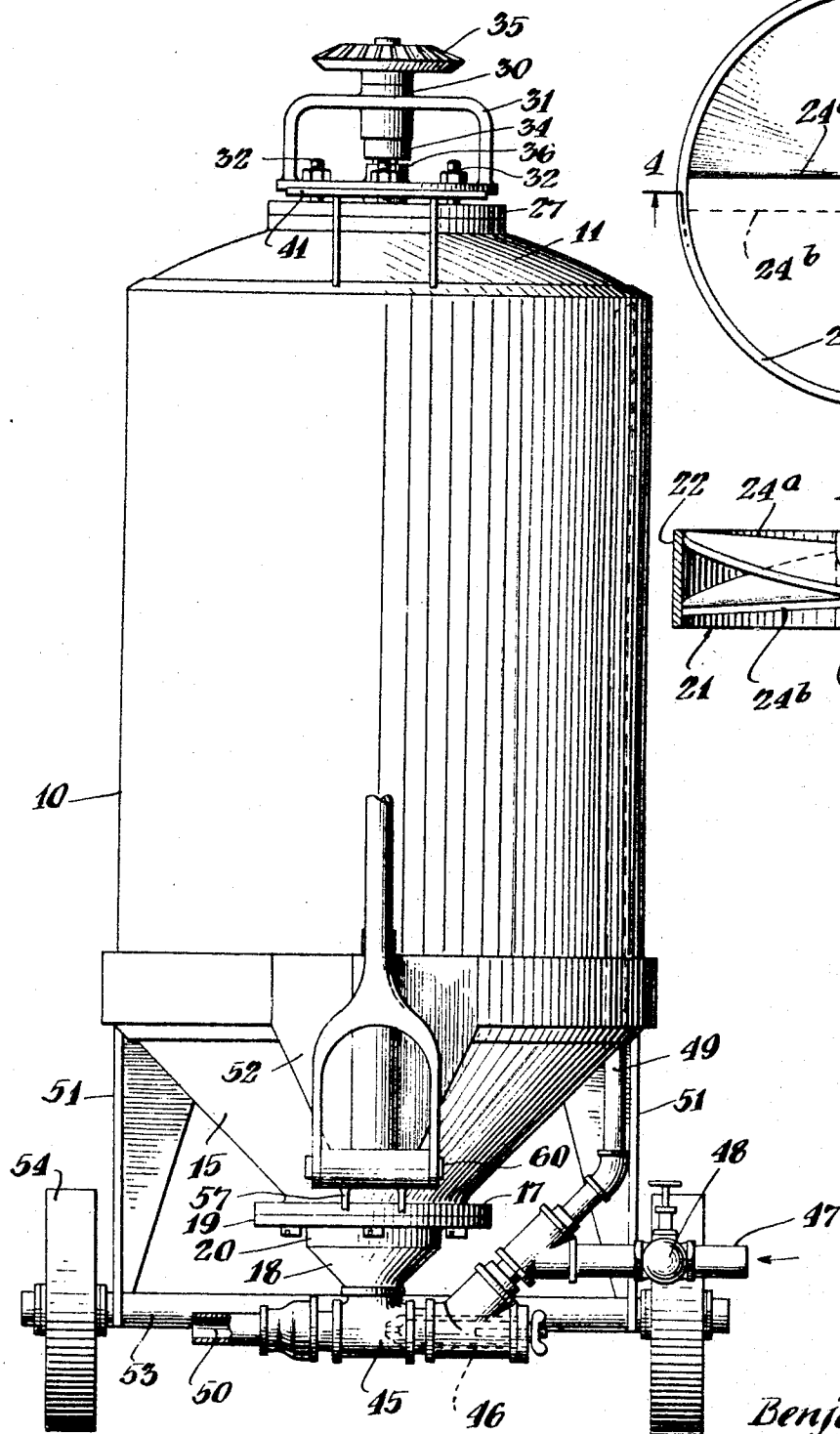
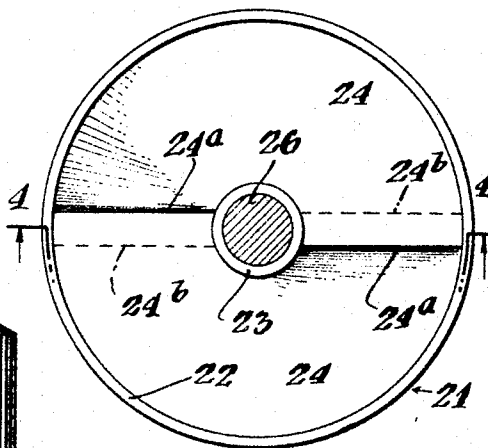
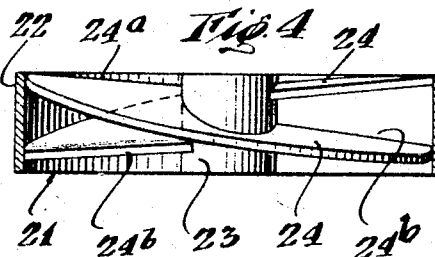
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2 Sheets-Sheet 2

Fig. 2

Fig. 3



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FEEDING SOLID REAGENTS IN
PULVERULENT CONDITION

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4 Claims. (Cl. 302—52)

This invention relates to the feeding of solid materials in pulverulent condition and more particularly to apparatus for introducing a solid reagent in desired physical state into a molten bath or the like.

In various metallurgical processes it is necessary to introduce a solid reagent into a molten bath. As a specific example, in treating copper in an anode furnace it is frequently desirable to introduce soda ash into the bath so as to facilitate the removal therefrom of such impurities as arsenic, antimony, etc. The soda ash available for this treatment is often received in a damp condition and is practically always lumpy. Various difficulties are accordingly involved in introducing the same into the bath in a uniform and controlled manner.

It is accordingly an object of the present invention to provide means for introducing the soda ash in the bath in a uniform manner regardless of the condition in which the soda ash is received.

Another object is to provide an apparatus for the above purpose having means for agitating or breaking up the lumpy material and feeding the same into an injector in a condition suitable for being picked up by the current of air or other gas and being delivered thereby to the desired point.

A further object is to provide an apparatus of the above type which is simple and dependable in operation and which is capable of various commercial uses.

Various other objects and advantages will be apparent as the present description and the nature of the invention is more fully disclosed.

In the accompanying drawings

Fig. 1 is a side view, with parts broken away, of a feeding device embodying the principles of the invention;

Fig. 2 is a view of the same device taken at right angles to that shown in Fig. 1;

Fig. 3 is a view taken along the line 3—3 of Fig. 1 looking in the direction of the arrows; and

Fig. 4 is a view taken along the line 4—4 of Fig. 3 looking in the direction of the arrows.

Referring to the drawings, more in detail, the invention is shown as embodied in a device comprising a vertical cylindrical tank or receptacle 10 having a conical top 11 having an opening 12 therein through which the solid material is charged, said opening being closed by a suitable cap 14.

The receptacle 10 is also shown as provided with a tapered conical bottom 15 terminating in a discharge opening 16 surrounded by a bottom flange 17. A feeding chamber 18 is provided with a flange 19 which is secured to the flange 16 and forms a continuation of the conical bottom 15. This feeding chamber may be provided with

a cylindrical wall 20 in which a propeller 21, to be described, is seated.

The propeller 21, as shown more in detail in Figs. 3 and 4, comprises a hub 23 and an outer rim 22 which is adapted to form a comparatively close fit within the wall 20 of the feeding chamber 18. A plurality of blades 24 extend between the hub 23 and the rim 22. In the embodiment shown, these blades are of helical formation, with the leading edge 24a of each blade spaced from and overlapping the trailing edge 24b of the preceding blade for the purpose to be set forth.

The hub 23 of the propeller 21 is secured to a vertical shaft 26 which extends upwardly through the receptacle 10 and through a suitable opening in a top plate 27 which is secured to the conical top 11 of the receptacle by suitable means, such as by bolts 28. Suitable bearing means for the shaft 26 are provided, such, for example, as a bearing 30 carried by a bracket 31 which is secured to the top plate 27 by bolts 32 (Fig. 2). Thrust bearings may be formed by a bearing ring 34 secured to the shaft 26 beneath the bearing 30 and by a bevelled gear 35 which is secured to the top of the shaft 26 above said bearing 30. A packing gland 36 may be adjustably secured to the top plate 27 as by bolts 38 (Fig. 1) for forming a tight seal around the shaft 26.

For driving the bevelled gear 35, a motor 40 is provided which is suitably mounted on a bracket 41 secured to the top 11 of the receptacle. The motor 40 drives through a set of reduction gears, not shown, mounted within a housing 42 and driving a bevelled pinion 43 meshing with the bevelled gear 35.

The feeding chamber 18 communicates at its bottom with an injector 45 comprising an air nozzle 46 communicating with an air inlet pipe 47 which is adapted to supply air under pressure thereto and containing a control valve 48. A pipe 49 communicates from the air pipe 47 to the interior of the receptacle 10 so as to equalize the air pressure and thus facilitate the proper feeding of the reagent. The injector 45, the parts of which are secured with a wing nut as shown in Fig. 2 to facilitate removal of the parts for cleaning, is adapted to pick up the powdered material received from feeding chamber 18 and to feed the same along with the current of air (or other gas) through a duct 50 which communicates with a hose or the like (not shown) for feeding the pulverized material to the bath for treatment. The hose is, of course, suitably provided with a metal tip or pipe extending below the surface of the bath for introducing the reagent at the desired point therein. The entire device is supported on brackets 51 and 52, brackets 51 carrying an axle 53 on which wheels 54 are journaled. The bracket 52 carries a spindle

56 attached to a yoke 57 carrying a wheel 58. A suitable handle 59 is pivotally connected, as at 60, to the yoke 57, thus serving to guide and steer the apparatus when same is moved from place to place.

In the operation of the above described apparatus, the material to be fed, such, for example, as powdered soda ash which may be in a damp or lumpy condition, is charged into the receptacle 10 through the opening 12, after which the cap 14 is secured in place thus sealing the apparatus against egress of air or gas and the entrance of further moisture.

With the propeller 21 stationary, the overlapping blades 24 form a substantially tight closure for the bottom of the receptacle and prevent the material from falling therethrough. When it is desired to feed the material for use as a reagent, air under pressure is supplied through the pipe 47 to the injector 45 and to the interior of the receptacle via pipe 49. The motor 40 is caused to drive the propeller 21 in a direction such that the leading edges 24a of the blades 24 bite against and pulverize the material within the receptacle and feed the same downwardly to the feeding chamber 18. The blades 24, in addition to breaking up the lumps and suitably pulverizing the material, also serve to agitate the material and to maintain the same in proper feeding condition. The material thus fed by the propeller 21 is picked up by the air current in the injector 45 and is fed along with the current of air through the duct 50 to the bath in the manner above outlined.

It may be noted that the rate of feed can be accurately controlled by controlling the speed of operation of the propeller 21. The propeller provides a positive feed and prevents the flow of material into the feeding chamber except in response to the feeding action of the propeller itself. The maximum size of the particles which can be fed to the chamber 18 is automatically determined by the spacing and speed of rotation of the blades. The propeller accordingly serves to break up and feed the material regardless of its previous physical condition. The device is thus adapted to receive the material in whatever condition in which it may be supplied thereto and to feed the same in a uniform, pulverulent state without any pretreatment such as drying or breaking up of the lumps, etc.

While the device has been shown as portable, it can, of course, be constructed as a stationary, permanent unit of the furnace equipment. Furthermore, it is to be understood that the device is capable of various uses, as will be readily apparent to a person skilled in the art, the particular use set forth being a typical one and illustrative of its various adaptations.

Certain specific terms and disclosures have been used herein for convenience in referring to various details of the invention and for describing same. Naturally, various changes and modifications may be made within the scope of the invention as defined by the appended claims.

What is claimed is:

1. Apparatus for feeding a solid, pulverized material comprising a receptacle for said material having a discharge opening, a rotatably mounted propeller comprising a rim seated in said discharge opening, the blades of the propeller forming, when stationary, a substantially complete closure therefor, a vertical shaft driv-

ing said propeller, a driving motor carried by said receptacle, mechanical driving means inter-connecting said motor and said shaft whereby said propeller is driven at a speed determined by the speed of operation of said motor, a feeding chamber mounted to receive material fed through said discharge opening by said propeller, and a gas injector means associated with said feeding chamber for picking up said material and feeding the same.

2. Apparatus for feeding a solid reagent in pulverulent form comprising a receptacle for said material having a discharge opening, a rotatably mounted propeller comprising a rim seated in said discharge opening, said propeller having a plurality of helical blades with their ends overlapping so as to form a closure for said discharge opening when said propeller is stationary, a vertical shaft driving said propeller in a direction to cause same to agitate, pulverize and feed the material through said discharge opening, a driving motor carried by said receptacle, mechanical driving means inter-connecting said motor and said shaft whereby said propeller is driven at a speed determined by the speed of operation of said motor, a feeding chamber carried by said receptacle below said propeller, and air injector means connected to receive the material thus fed by said propeller and to feed the same.

3. Apparatus for feeding a solid reagent comprising a receptacle for said material having a discharge opening, a rotatably mounted propeller comprising a rim seated in said discharge opening, said propeller having a plurality of helical blades with their ends overlapping so as to form a closure for said discharge opening when said propeller is stationary, a vertical shaft driving said propeller in a direction to cause the same to agitate, pulverize and feed the material through said discharge opening, a driving motor carried by said receptacle, mechanical driving means inter-connecting said motor and said shaft whereby said propeller is driven at a speed determined by the speed of operation of said motor, a feeding chamber carried by said receptacle below said propeller, air injector means adapted to pick up and feed material supplied to said feeding chamber by the operation of said propeller, and means equalizing the air pressure in said air injector means and within said receptacle to facilitate the feeding of reagent therefrom.

4. Apparatus for feeding a solid, pulverized material comprising a receptacle having a tapered bottom terminating in a discharge opening, a propeller comprising a rim seated in said discharge opening and blades forming, when stationary, a substantially complete closure for said opening, a vertical shaft driving said propeller, said shaft extending upwardly through the top of said receptacle, bearing means for said shaft comprising a bracket mounted on said top, a packing gland forming a seal with said shaft, a driving motor carried by said receptacle, mechanical driving means inter-connecting said motor and said shaft whereby said propeller is driven at a speed determined by the speed of operation of said motor, a feeding chamber carried by said receptacle below said propeller, and air injector means adapted to pick up and feed the pulverized material supplied to said feeding chamber by the operation of said propeller.

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