May 2, 1944. W. H. EMERSON 2,347,940

CHINA WARE SANDING MACHINE

Filed Jan. 11, 1943 3 Sheets-Sheet 1

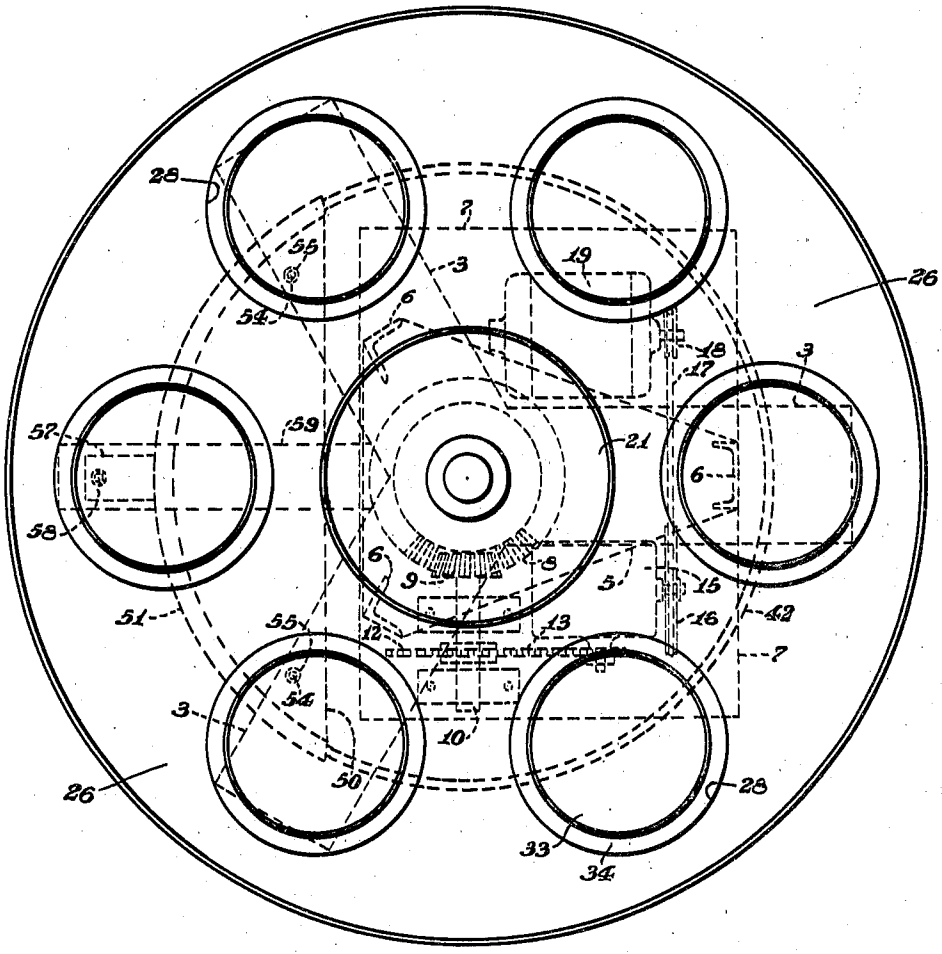


FIG. 1

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CHINA WARE SANDING MACHINE

Filed Jan. 11, 1943 3 Sheets-Sheet 2

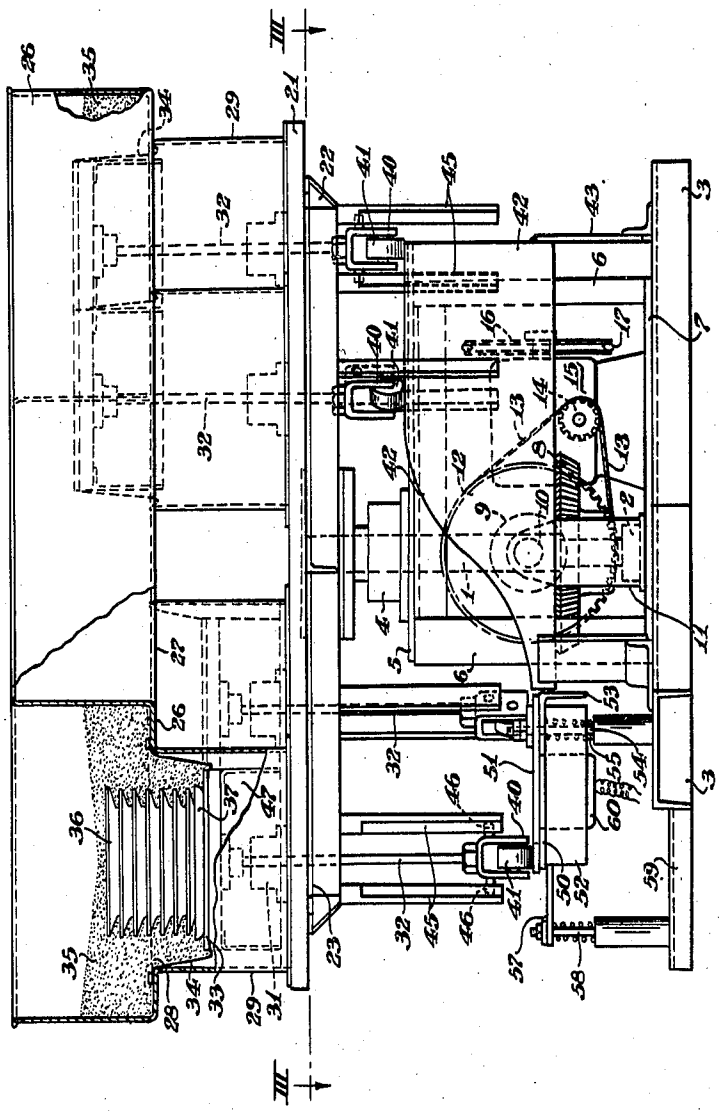


FIG. 2

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CHINA WARE SANDING MACHINE

Filed Jan. 11, 1943 3 Sheets-Sheet 3

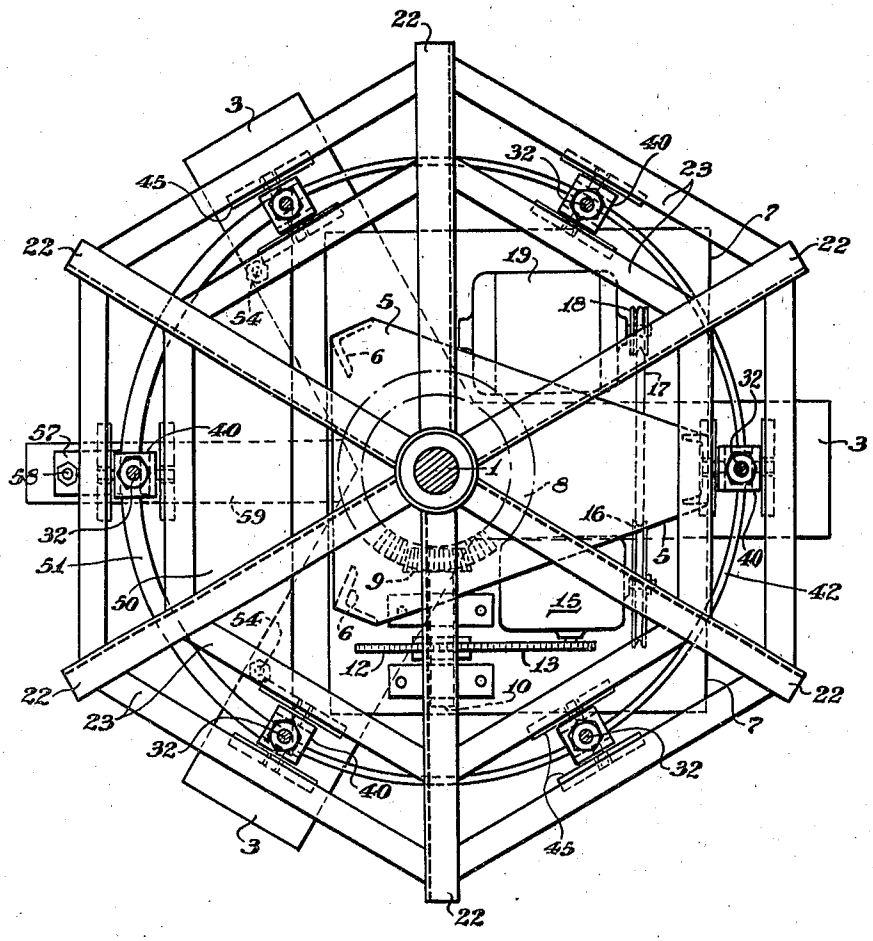


FIG. 3

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UNITED STATES PATENT OFFICE

2,347,940

CHINAWARE SANDING MACHINE

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Application January 11, 1943, Serial No. 471,924

23 Claims. (Cl. 259—72)

This invention relates to apparatus for packing sand between the individual pieces of unfired china dinnerware piled on top of one another in a stack or bung for the first firing. "Sand" as used herein means any material employed for that purpose, such as sand, flint, alumina, bone, talc or any combination thereof.

In the manufacture of vitreous dinnerware, as distinguished from semi-vitreous ware, the ware is fired at such a high temperature that the clay from which it is made becomes so soft that it is necessary to support the ware in such a way that it will not warp or sag out of shape during firing. In the case of flat ware, such as plates, saucers, and shallow bowls, several pieces of the dried ware are piled on top of one another to form a stack called a "bung" which rests on a dish-like refractory tray called a "setter." The foot encircling the bottom of each piece of ware rests in the bottom of the underlying piece and spaces the surrounding brim portions apart. The weight of the brim portion prevents the bottom portion encircled by the foot from sagging during firing, but to prevent the brim portion from sagging, sand or other suitable granular material having a very high fusing point is packed between the brims. This is generally done by placing the bung and its setter on a table, placing an open-ended cylindrical shell over the bung with a space between them all the way around, and then pouring sand into the shell to fill that space and to cover the bung. The table is then vibrated which causes the sand to work into the spaces between the ware brims and pack there. When the vibrating operation is completed, the shell is lifted off the bung and thus releases the remaining sand, which is about 95 per cent of the amount that was dumped into the shell. All of that sand which does not flow off the table is brushed off so that the sanded bung can be removed and replaced by an unsanded bung, whereupon the cycle is repeated. It will be seen that such a sanding operation is crude and slow, and that it is exceedingly wasteful to spill 95 per cent of the sand on the floor after every bung of ware is sanded. This sand has to be shoveled from the floor and cleaned before it can be used again.

It is among the objects of this invention to materially increase the speed of the sanding operation, to eliminate substantially all loss of sand, and to decrease the labor required for sanding.

In accordance with this invention a support for a bung of china ware is disposed in an enclosure that is large enough to leave between it and the bung a space filled with sand. The support is movable vertically in the enclosure, or the enclosure may be moved vertically relative to the support. When the support is in its lower position (assuming that it is the support that is moved) the bung resting on it may be covered as well as surrounded with sand, and the support is vibrated to pack the sand between the pieces of ware forming the bung. After this has happened, the support is raised to a level near the top or above the sand so that the sanded bung can be removed and an unsanded bung placed on the support and lowered into the sand for sanding. The enclosure preferably includes a sand receptacle having in its bottom an opening through which the bung support can be reciprocated. The opening is somewhat larger than the support, and the space between them is closed by a flexible diaphragm. The support is supported in its lower position by vibratory means which most conveniently is kept vibrating continuously so that whenever the support is lowered it automatically starts vibrating.

In order to automatically raise and lower the bung support, continuous relative lateral movement is effected between the support on the one hand and the vibratory means and support-reciprocating means on the other hand. Thus, a circular track may be formed from a vibratory member and a cam having inclined surfaces. The sand enclosure and bung support above this track may be carried around it with the support operatively connected to the track so that while the support is traveling over the vibratory member it is vibrated and then it is raised by the cam through the sand in the enclosure, and again lowered. Or, if desired, the sand enclosure and bung support may be mounted in one position and the track rotated. Preferably, there are a plurality of circumferentially spaced bung supports mounted above a rotating table below which the circular track is disposed. The bung supports are surrounded by a sand receptacle which may be in the form of a circular trough mounted on the table. With this construction, unsanded bungs may continuously be loaded on raised supports from which sanded bungs were just removed while other bungs are being vibrated in the sand on supports that were lowered after leaving the loading station.

The preferred embodiment of this invention is illustrated in the accompanying drawings in which Fig. 1 is a plan view of my sanding machine, Fig. 2 is a side view partly broken away to show part of it in vertical section; and Fig. 3 is a horizontal section taken on the line III—III of Fig. 2.

Referring to the drawings, the lower end of a vertical shaft 1 is rotatably mounted in a bearing 2 disposed at the junction of three horizontal channels or legs 3 joined together at one end. The upper portion of the shaft is supported and journaled in a bearing 4 on a plate 5 mounted on the upper ends of upright members 6. These members are mounted on a rectangular plate 7 resting on legs 3 to which it is secured. Keyed on the lower portion of the shaft is a bevel gear 8 that is driven by a bevel pinion 9 mounted on one end of a horizontal shaft 10 journaled in suitable bearings 11. Between these bearings the horizontal shaft carries a large sprocket 12 that is driven by a chain 13 from a small sprocket 14 rotated by a speed-reducing unit 15. This unit is driven by a large pulley 16 and a belt 17 from a small pulley 18 on the drive shaft of an electric motor 19 (Fig. 3) also mounted on plate 7.

Rigidly mounted on the projecting upper end of vertical shaft 1 there is a table formed from a spider frame that supports a platform 21 of wood or other suitable material. As shown in Fig. 3, the spider consists of a plurality of radiating angle bars 22 connected at their outer ends by pairs of parallel flat bars 23.

The table supports above it a sand receptacle which preferably is in the form of a circular trough 26. That is, it has a circular bottom wall provided with an open central area 27 and side walls extending upwardly from its inner and outer edges. At regular intervals around the trough its bottom is provided with large circular openings 28, there being six in the machine illustrated. A convenient way of spacing the trough from the table is by open-end cylindrical casings 29, each encircling one of the openings in the trough with its lower end mounted on the table.

At the center of each of these casings the table platform 21 is provided with a vertical passage at the top of which a bearing member 31 is mounted. Slidably mounted in each bearing 31 is a rod 32 that extends down below the table where it is supported in a manner that will be described presently. The top of each rod supports a circular pedestal or bung support 33 that is somewhat smaller than the diameter of the surrounding casing 29 and adjacent opening 28. The edge of each of these supports is connected to the bottom of the trough around the adjacent opening by means of a flexible diaphragm 34 which may be made of canvas or some other suitable material that will allow the support to be reciprocated through opening 28. The trough is filled with sand 35 to a level that will cover the bungs 36 of unfired china ware resting on setters 37 on supports 33 when the latter are disposed in their lower position down in casings 29 below the bottom of the trough. When in this position the sand not only covers the bungs but fills the space around them, as shown in Fig. 2.

In order to raise and lower the bung supports in the sand the lower ends of the vertical rods 32 carry bifurcated members 40 in which are journaled rollers 41 that run on an arcuate cam 42 when the table is rotated by shaft 1. The upper surface of this cam has a flat central portion and end portions that incline downwardly toward its opposite ends. The cam is disposed concentric with vertical shaft 1 and is rigidly supported by brackets 43 mounted on legs 3. The lower end of each rod is guided in its vertical movements and is prevented from trying to rotate, by laterally spaced pairs of vertical guide bars 45 that project downwardly from table bars 23 and straddle pins 46 projecting from the opposite sides of the bifurcated member 40 at the lower end of the rod. These pairs of guide bars straddle the cam while the adjacent roller 41 is passing over it. While a roller is traveling over the flat central portion of the cam, the adjoining rod and bung support are held in their upper position which is above the level of the sand in the trough. A bung of ware is set on the support in this position, and then as the table continues to rotate, the roller travels down the inclined exit end of the cam and thereby lowers the support and bung into the sand which fills in the space around the bung and covers it. The bottom of the support may be provided with a depending circular ring 47 that will prevent the diaphragm from folding under it.

The cam extends only part way around the vertical shaft in order to leave a space between its ends for a vibratory member so that the bung supports can be vibrated after their supporting rollers 41 leave the cam. This vibratory member includes a horizontal plate 50 of a size that will provide an arcuate track which forms a continuation of and completes the circle of which the cam forms the larger part. The track on the plate is defined by an arcuate strip 51 of rubber or other suitable sound-deadening material on which the rollers 41 travel while they are being vibrated. Plate 50 is reenforced by depending vertical flanges 52 and 53 and is loosely mounted near its opposite ends on vertical studs 54 projecting upwardly from two of the legs 3. The plate is supported on the studs by coil springs 55 encircling the studs. The central portion of the plate is provided with a laterally extending rigid member 57 likewise loosely mounted on a vertical stud 58 projecting upwardly from a small horizontal channel 59 between the two adjacent legs. The plate preferably is vibrated continuously by an electrical vibrator 60 of any suitable form that may be attached to the bottom of the plate. When the rollers leave the vibratory member they roll onto the entering end of the cam and up its inclined surface to raise the sanded bungs from the sand so that they can be removed and unsanded bungs put in their place.

With the machine described herein operating continuously, and with one worker removing sanded bungs from the raised bung supports and another worker placing unsanded bungs on the supports just unloaded, it will be seen that a great many bungs can be sanded per hour without much manual labor. The unused sand around each bung after it has been vibrated is not lost, but remains in the rotating trough ready to help sand the next bung. The sand that is carried away in the bungs can be replaced periodically by manually dumping or shoveling sand into the trough or by automatically delivering new sand.

According to the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. China ware sanding apparatus comprising an enclosure for a quantity of sand, a support for a bung of ware in the enclosure spaced from

the side of the enclosure, means for moving the support vertically in the enclosure and sand whereby the bung is substantially buried in the sand and then raised therefrom, and means for vibrating the support in its lower position to pack some of the sand between the pieces of ware of the bung.

2. China ware sanding apparatus comprising an enclosure for a quantity of sand, a support for a bung of ware in the enclosure spaced from the side of the enclosure, means for moving the support vertically in the enclosure and sand whereby the bung is substantially buried in the sand and then raised therefrom, and constantly vibrating means on which said support rests in its lower position to pack some of the sand between the pieces of ware of the bung.

3. China ware sanding apparatus comprising an enclosure for a quantity of sand, a vertically movable support for a bung of ware in the enclosure spaced from the side of the enclosure, means for moving the support vertically in the enclosure and sand whereby the bung is substantially buried in the sand and then raised therefrom, loosely mounted means for supporting said support in its lower position, and a vibrator connected to said loosely mounted means to vibrate the bung support.

4. China ware sanding apparatus comprising a casing for a quantity of sand, a support for a bung of ware in the casing spaced from the side of the casing, means sealing the space between said support and the side of the casing, means for moving the support vertically in the casing and sand whereby the bung is substantially buried in the sand and then raised therefrom, and means for vibrating the support in its lower position to pack some of the sand between the pieces of the ware of the bung.

5. China ware sanding apparatus comprising a casing for a quantity of sand, a support for a bung of ware in the casing with the support spaced from the side of the casing, a flexible diaphragm attached to said support and the side of the casing, means for moving the support vertically in the casing and sand whereby the bung is substantially buried in the sand and then raised therefrom, and means for vibrating the support in its lower position to pack some of the sand between the pieces of the ware of the bung.

6. China ware sanding apparatus comprising a casing for a quantity of sand, a support for a bung of ware in the casing with the support spaced from the side of the casing, a flexible diaphragm connected to said support and the side of the casing, means for moving the support vertically in the casing, means for vibrating the support in its lower position, and means below the support preventing the diaphragm from folding under the support as the support is lowered.

7. China ware sanding apparatus comprising a casing for a quantity of sand, a vertically movable support for a bung of ware in the casing with the support spaced from the side of the casing and with the bung substantially buried in the sand, a flexible diaphragm connected to said support and to the side of the casing above the support, means for vibrating said support to pack some of the sand between the pieces of ware on the bung, and means for elevating the support relative to the casing and sand to raise the bung from the sand.

8. China ware sanding apparatus comprising an enclosure for a quantity of sand, a support for a bung of ware in the enclosure spaced from the side of the enclosure, cam means for raising and lowering the support in the enclosure and sand, and means for vibrating the support in its lower position to pack some of the sand between pieces of the ware of the bung.

9. China ware sanding apparatus comprising a table, an enclosure for a quantity of sand mounted on the table, a vertically moving support for a bung of ware in the enclosure spaced from the side of the enclosure, means of rotating the table on a vertical axis spaced from said support, vertically movable means extending through the table from the bottom of said support, a vibratory member below the table and adapted to be engaged by said vertically movable means when said support is in its lower position with the bung substantially buried in the sand, and means for periodically raising said vertically movable means away from said vibratory member to raise the bung from the sand.

10. China ware sanding apparatus comprising a table, an enclosure for a quantity of sand mounted on the table, a vertically movable support for a bung of ware in the enclosure spaced from the side of the enclosure, means for rotating the table on a vertical axis spaced from said support, vertically movable means extending through the table from the bottom of said support, a vibratory member below the table and adapted to be engaged by said vertically movable means when said support is in its lower position with the bung substantially buried in the sand, and a cam below the table and adapted to be periodically engaged by said vertically movable means for raising the latter away from said vibratory member to raise the bung from the sand.

11. China ware sanding apparatus comprising an enclosure for a quantity of sand, a vertically movable support for a bung of ware in the enclosure spaced from the side of the enclosure, means for moving the enclosure in a horizontal path, a vibratory member below said means and extending along a portion of said path, a vertically movable member extending downwardly from said support and adapted to be moved laterally by said means while in engagement with said vibratory member with the bung substantially buried in the sand, and a cam extending along another portion of said path and adapted to be engaged by said vertically movable member after it leaves the vibratory member for raising said support in said enclosure and sand to raise the bung from the sand.

12. China ware sanding apparatus comprising an enclosure for a quantity of sand, a vertically movable support for a bung of ware in the enclosure spaced from the side of the enclosure, means for moving the enclosure in an endless horizontal path, an arcuate vibratory member below said means and extending along a portion of said path, a vertically movable member extending downwardly from said support and adapted to be moved laterally by said means along said vibratory member with the bung substantially buried in the sand, and an arcuate cam extending along the rest of said path and adapted to be engaged by said vertically movable member after it leaves said vibratory member, the opposite ends of the cam being inclined upwardly away from the vibratory member whereby said vertically movable member and support are raised and lowered by the cam to raise and lower the bung in the sand.

13. China ware sanding apparatus comprising a plurality of circumferentially spaced supports

for bungs of ware, means for moving said supports laterally around a common vertical axis, a receptacle surrounding said supports and spaced therefrom to form a receptacle for a quantity of sand around each support, means for moving said supports vertically independently of one another in the sand in the receptacles whereby the bungs are substantially buried in the sand and then raised therefrom, and means for vibrating each support in its lower position to pack some of the sand between the pieces of ware of the bung on that support.

14. China ware sanding apparatus comprising a rotatable member, a plurality of circumferentially spaced supports for bungs of ware disposed above said member and traveling with it, a receptacle for a quantity of sand surrounding said supports and spaced therefrom, means for moving said supports vertically relative to said rotatable member and sand and independently of one another whereby the bungs are substantially buried in the sand and then raised therefrom, and means for vibrating each support in its lower position to pack some of the sand between the pieces of ware of the bung on that support.

15. China ware sanding apparatus comprising a rotatable table, a circular track below the table, a plurality of circumferentially spaced vertical members slidably mounted in the table with their lower ends resting on said track, a support for a bung of ware mounted on the upper end of each of said members, and a receptacle for a quantity of sand surrounding said supports and spaced therefrom, said track including a cam for raising and lowering said supports in said sand whereby the bung is substantially buried in the sand and then raised therefrom, and a vibratory member for vibrating the supports in their lower position to pack some of the sand between the pieces of ware of the bung.

16. China ware sanding apparatus comprising a receptacle for a quantity of sand rotatable on a vertical axis, a plurality of circumferentially spaced supports for bungs of ware disposed in said receptacle and traveling with it, means for moving said supports vertically in the sand in the receptacle independently of one another whereby the bungs are substantially buried in the sand and then raised therefrom, and means for vibrating each support in its lower position to pack some of the sand between the pieces of ware of the bung on that support.

17. China ware sanding apparatus comprising a receptacle for a quantity of sand rotatable on a vertical axis, a plurality of circumferentially spaced supports for bungs of ware disposed in said receptacle and traveling with it, means for moving said supports vertically in the sand in the receptacle independently of one another, a flexible diaphragm attached to each support and the receptacle, and means for vibrating each support in its lower position to pack some of the sand between the pieces of ware of the bung.

18. China ware sanding apparatus comprising a receptacle for a quantity of sand rotatable on a vertical axis and provided in its bottom with a plurality of circumferentially spaced openings, a support for a bung of ware disposed coaxially of each opening and materially smaller than the opening, means for moving each support through the opening with which it is associated to bury the bung in the sand and then raise it therefrom, a flexible diaphragm connecting the support to the bottom of the receptacle to hold the sand therein, and means for vibrating each support in its lower position to pack some of the sand between the pieces of ware of the bung.

19. China ware sanding apparatus comprising a receptacle for a quantity of sand rotatable on a vertical axis and provided in its bottom with a plurality of circumferentially spaced openings, a support for a bung of ware disposed coaxially of each opening and materially smaller than the opening, a vertical member depending from the bottom of each support, means engaging the lower end of each member for periodically raising it to raise the bung from the sand, a flexible diaphragm connecting each support to the bottom or the receptacle to hold the sand therein, and means engaging the lower end of each of said members for vibrating it when it is in its lower position to pack some of the sand between the pieces of ware of the bung.

20. China ware sanding apparatus comprising an enclosure member for a quantity of sand, a support for a bung of ware in the enclosure spaced from the side of the enclosure, a cam member below said support, means for moving one of said members laterally relative to the other to raise and lower said support in the sand in the enclosure member whereby the bung is supported above the sand and then lowered to bury it therein, and means for vibrating the support in its lower position to pack some of the sand between the pieces of ware of the bung.

21. China ware sanding apparatus comprising a table, an enclosure for a quantity of sand mounted on the table, a vertically movable support for a bung of ware in the enclosure spaced from the side of the enclosure, vertically movable means extending through the table from the bottom of said support, a vibratory member below the table and adapted to be engaged by said vertically movable means when said support is in its lower position with the bung substantially buried in the sand, elevating means for periodically raising said vertically movable means away from said vibratory member to raise the bung from the sand, and means for effecting relative rotation between said table and said vibrating member and elevating means.

22. China ware sanding apparatus comprising a plurality of circumferentially spaced supports for bungs of ware, a receptacle surrounding said supports and spaced therefrom to form a a receptacle for a quantity of sand around each support, elevating means for moving said supports vertically independently of one another to raise said bungs from the sand, means for vibrating each support in its lower position to pack some of the sand between the pieces of ware of the bung on that support, and means for effecting relative rotation between said supports as a unit and said elevating means and vibrating means as another unit.

23. China ware sanding apparatus comprising an enclosure for a quantity of sand, a support for a bung of ware in the enclosure spaced from the side of the enclosure, means for effecting relative vertical movement between said support and sand-containing enclosure whereby the bung is substantially buried in the sand and then emerges therefrom, and means for vibrating the support while the bung is buried to pack some of the sand between the pieces of ware of the bung.

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