Oct. 10, 1944. H. V. SCHWEITZER 2,359,879

SANDING MACHINE AND METHOD OF SANDING CERAMIC WARE

Filed Dec. 28, 1943 2 Sheets-Sheet 1

Fig.-1

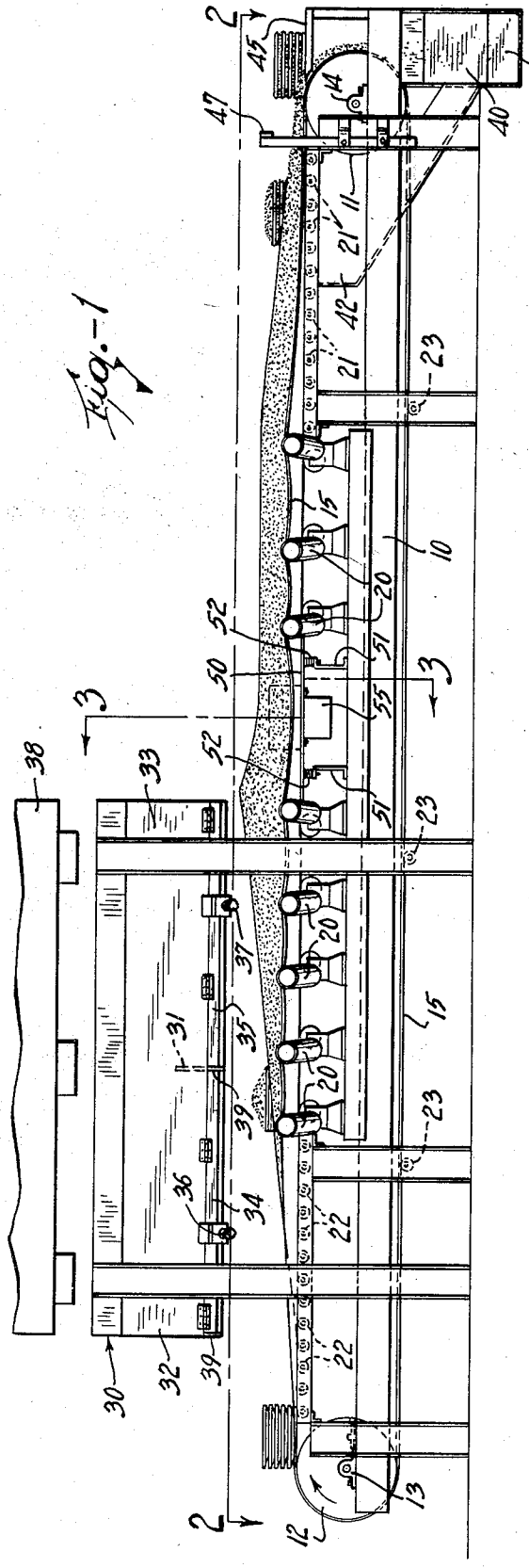
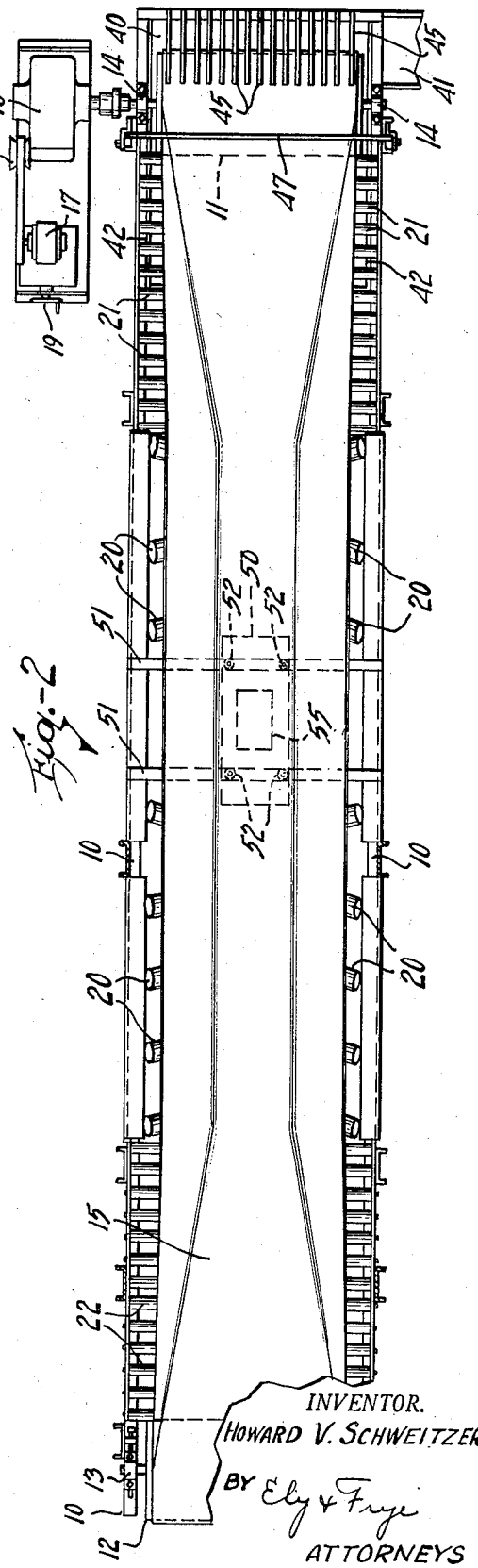


Fig.-2



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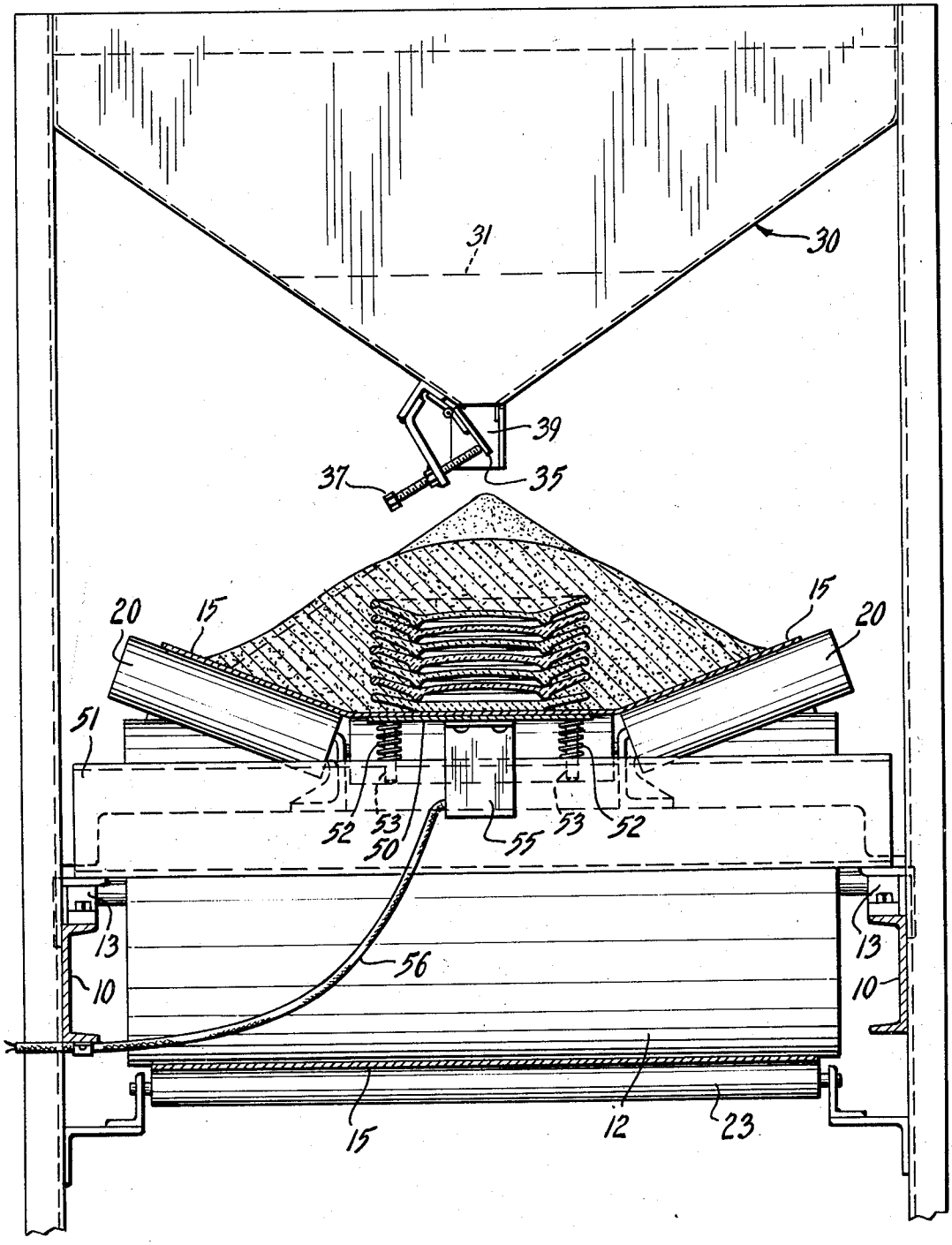

Fig.-3

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SANDING MACHINE AND METHOD OF SANDING CERAMIC WARE

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11 Claims. (Cl. 25—157)

This invention relates to an improvement in sanding machines and, more particularly, to a machine for sanding green dish and similar ceramic ware to prevent warping and sagging in the bisque fire.

Heretofore sanding has been a relatively slow and dusty operation, performed largely by hand. To sand dish ware, for example, a bung of ware was placed within a flask on a table; sand was shoveled into the flask to surround and cover the ware, care being exercised to avoid displacing the alignment of the dishes in the bung; the table was then shaken until, in the judgment of the operator, the sand would be sufficiently compacted between the rims of the dishes and setter making up the bung; the flask was then removed and the sanded bung was removed and placed in a sagger for firing.

The prior practise as outlined above was never wholly satisfactory. If one dish in the bung were displaced by careless loading of the flask, not only the displaced dish but other dishes might be warped when fired. Even if the bungs were not disturbed, there was no uniformity in the degree to which the sand was packed in the bung, thus resulting in a lack of uniformity in the fired ware.

It is an object of this invention to provide a machine which will uniformly sand bungs of green ware without disturbing the bungs. It is another object of this invention to provide a machine which will eliminate the laborious hand operations of the prior practise and which will require only unskilled operators to load and unload the machine. A particular advantage of my invention is that two unskilled operators working on my machine can produce a better product at a production rate equal that of many semi-skilled operators following the prior art practise.

Other objects and advantages of my invention will be apparent from the following specification, claims, and drawings, in which:

Fig. 1 is a side elevation showing in operation a machine embodying my invention.

Fig. 2 is a plan view taken along the line 2—2 of Fig. 1 but from which the fugitive elements of sand and ware have been eliminated.

Fig. 3 is an enlarged detail section and elevation taken along the line 3—3 of Fig. 1.

The machine in the embodiment of my invention disclosed is comprised of a frame having parallel horizontal members 10 which extend the length of the machine. The frame members 10 support a larg flat driving pulley 11, adjacent the discharge end of the machine, and a similar large flat idler pulley 12, at the loading end of the machine. The idler pulley 12 is mounted in adjustable bearings 13 to regulate tension in the endless flat flexible conveyor belt 15 carried by the pulleys 11 and 12. The driving pulley 11 is mounted in fixed bearings 14 and is driven by any suitable speed-change drive, such as the reduction gearing unit 16, driven by the motor 17 through the expansible V-belt pulley 18. The speed of the conveyor belt is varied by operating the handwheel 19 of the motor platform feed screw to vary the distance between the shaft of the motor 17 and the shaft of the expansible V-belt pulley 18 and thereby vary the effective driving diameter of the pulley 18.

The upper conveying run of the belt 15 is supported in the center portion of the run by the several troughing rolls 20 to form the belt 15 into a flat bottomed trough. Between the troughing rolls 20 and flat pulleys 11 and 12 the belt is supported by the flat rolls 21 and 22. The under or return run of the belt 15 is suitably supported by the rolls 23.

A longitudinally extending sand hopper 30 is supported and approximately centered over the belt 15 adjacent the loading end of the machine. In the embodiment disclosed, a partition 31 in the lower portion of the hopper 30 divides the hopper into a light sanding section 32 and a heavy sanding section 33, the light sanding section being located toward the loading end of the machine. The hopper sections 32 and 33 are closed by longitudinal discharge gates 34 and 35, respectively, the rate of discharge past each of the gates being controlled by the adjusting screws 36 and 37, respectively. Sand is supplied to the hopper 30 from the sand reservoir 38. By regulating the opening of the gate 34 so that sand will run from the section 32 at a slow rate of discharge and by opening the gate 35 so that sand will run from the section 33 more rapidly, sand is first fed onto the belt 15 rather slowly and lightly and then rapidly and heavily as the belt progresses under the hopper. To obtain a more gradual change in the rate of feed of sand onto the conveyor belt 15, the number of gates may be increased or the hopper may be closed by a plate adjusted so that the discharge slot from the hopper will be narrow toward the loading end of the machine and wider toward the discharge end. The end wall of hopper 30 located adjacent the loading end of the machine is provided with a tailpiece 39 which prevents a rapid flow of sand from the open end of the gate

34. In the embodiment disclosed, the partition 31 is provided with a similar tailpiece 39.

Sand fed onto the belt 15 is discharged at the discharge end of the conveyor into a collecting hopper 40 having a sloping bottom leading to a sump 41. Sand which may fall off the sides of the belt 15 as the belt flattens in approaching the driving pulley 11 is caught in suitable gutters 42 leading to the collecting hopper 40. Ware carried by the belt 15 is fed onto a suitable grid 45 which is substantially coplaner with the flat center portion of the belt 15. A vertically adjustable scraper 47 extends transversely over the belt 15 adjacent the discharge end of the machine. Sand collected in the sump 41 may be returned to the reservoir 38 by any suitable sand elevating and conveying means (not shown). If it is desired to avoid placing the sump below the floor level, as in the embodiment disclosed, and if the height of the machine is insufficient to permit the bottom of the collecting hopper to be set at sufficient angularity to allow the sand to flow into the sump by gravity, the sloping bottom of the collecting hopper may be provided with vibrators or similar feed means to cause the sand to flow into the sump.

Located between a pair of troughing rolls 20 beyond the sand hopper 30 are a pair of transverse beams 51 which support the vibrator plate 50 through the springs or similar resilient means 52, which urge the plate 50 against the underside of the central flat portion of the troughed belt 15. The plate 50 and the portion of the flexible belt 15 which rests upon the plate are vibrated by the electrical vibrator 55 secured to the underside of the floating vibrator plate 50. In order to reduce the load on the spring guide pins 53, which confine the plate 50 to substantially vertical motion, it is preferable that the vibrator 50 be a synchronous magnetic vibrator rather than a vibrator which operates by virtue of a rapidly rotated eccentric weight. The cord 56, therefore, preferably connects the vibrator 55 to a suitable source of alternating current.

To employ my machine for sanding ware, a bung of green ware, comprising a plurality of dishes stacked foot-in-well on a refractory or other suitable setter, is placed upon the center portion of the conveyor belt 15 at the loading end of the machine. With the gates 34 and 35 set to discharge sand at the desired rate, as the bung of ware is carried under the section 32 of the hopper the bung is sanded lightly. The sand first forms a cone on the top dish and a longitudinal mound between the bungs and then, after the cone on the top dish reaches its maximum altitude, sand builds up around the base of the bung; simultaneously the sides of the conveyor belt are gradually lifted up in approaching the first troughing roll, thus preventing sand from rolling off the belt and, instead, holding the sand against the base of the bung. By the time the bung has reached the first troughing roll and the portion of the belt supporting the bung has passed over the flat rollers 22, the base of the bung is sufficiently surrounded by sand to prevent the bung from being displaced by the slight but appreciable vibrations encountered as the belt passes over the more widely spaced troughing rolls 20, the run of the belt over the closely spaced flat rollers 22 being relatively vibrationless.

As the bung passes the first troughing roll, the bung is sufficiently supported to withstand a more rapid loading of sand and the bung, therefore, is carried under the heavy sanding section 33 of the hopper 30. When the bung is carried beyond the hopper 30, the bung is completely buried under the mound of sand discharged onto the conveyor belt 15. It should be noted that as the increasingly loaded belt passes over the troughing rollers 20 located under the hopper section 33, the slight vibrations imparted by the troughing rollers and the bellying of the sides of the belt between the troughing rollers will tend to gently work the sand around the bung.

As the bung passes beyond the hopper 30, the center portion of the belt upon which the bung rests is slid upon and over the rapidly vibrating vibrator plate 50. The intense rapid vibrations (usually 60 cycles per second) imparted to the belt 15, the bung, and the covering mound of sand thoroughly and uniformly packs the sand between the rims of the dishes in the bung, as shown in Fig. 3 of the drawings. The amplitude of the vibrations may be varied by a suitable rheostat or like control (not shown).

From the vibrator plate 50 the bung is carried beyond the troughing rolls and approaches the discharge end of the machine, the covering mound of sand falling away from the bung as the sides of the belt are lowered in leaving the last troughing rolls and approaching the driving pulley 11. At the discharge end of the machine, the sand (except that supporting the rims of the dishes in the bung) is discharged into the hopper 40 and the sanded bung is fed onto the grill 45, from which the bung is lifted off to be loaded into the saggers for firing.

In order to remove the cone of sand which would otherwise remain on the bung at the discharge end of the machine, the scraper 47 is adjusted so that its lower edge will clear the top dish as the bung passes under the scraper. The scraper 47 is particularly useful when the machine is used for several hours or more to sand ware of the same size and, consequently, being stacked in bungs of approximately equal height. If, as is often the case, the machine is loaded with bungs of different heights, the scraper is set for the tallest bungs or removed altogether, the cones of sand on top of the bungs being brushed off by hand as the bungs are picked up from the grill 45.

The speed at which the belt 15 travels is adjusted so that each bung will remain over the vibrator plate 50 the desired length of time to thoroughly pack the sand in the bung. Once this speed has been determined for a particular run of ware being sanded, it is unnecessary to change it, and, because the speed of the belt is constant, each bung of ware sanded during the run remains over the vibrator plate precisely the same length of time. Thus, all ware is uniformly sanded. In the practical operation of the machine, it is seldom, if ever, necessary to vary the speed of the belt between runs.

The only remaining adjustment to be made on the machine is that of the hopper gates 34 and 35, which are adjusted to discharge sand so that an adequate amount of sand will be discharged from the light sanding section 32 to support the bungs for the loads of sand discharged from the heavy sanding section 33, the amount of sand discharged from the section 33 being such that the largest bung in the run of ware being sanded

will be covered after passing over the vibrator plate 50.

From the foregoing, it is apparent that only three adjustments are necessary for the operation of my machine and that such adjustments may be made by a foreman at the start of each run. No skill on the part of the loader is required in loading sand around an unsanded bung. Nor is any skill required on the part of the unloader in removing sand from around a sanded bung. Because the grill 45 permits sand to fall away from a sanded bung, the unloader simply picks up a bung by the setter. The possibility of disturbing a bung while removing excess sand around the bung is thereby eliminated. Thus, only unskilled labor is needed to load and unload the bungs of ware during the operation of the machine. My machine greatly reduces the amount of time heretofore required for the sanding operation. In normal operation, the machine will sand bungs as fast as an operator can conveniently unload the machine. Due to this increase in output per operator, the sanding operation is greatly reduced in cost.

In the foregoing specification I have disclosed a preferred embodiment of my invention. It is to be understood, however, that my invention is not limited to the embodiment disclosed but may be modified within the scope of the following claims. It is to be understood that in the following claims the term "sand" includes not only the common silica sand but also dry powdered flint, clay, or like pulverant material employed to pack ware prior to firing.

What is claimed is:

1. In a machine for sanding ceramic ware, a ware conveyor for conveying ware from a loading station to an unloading station, means to deposit sand on said conveyor to cover ware conveyed by said conveyor, and means to vibrate said conveyor after ware has been covered with sand to pack the sand around the ware, the ware being removed from said conveyor at the unloading station of said conveyor.

2. In a machine as defined in claim 1, means to receive sand discharged from said conveyor at the unloading station.

3. In a machine for sanding ceramic ware, a ware conveyor for conveying ware from a loading station to an unloading station, means for driving said conveyor, said conveyor being comprised of a center ware-conveying portion which travels between said stations substantially in a single plane and side portions elevatable above the plane of said center portion, means for depositing sand on said center portion in a mound having its apex located vertically above said center portion, means located between said stations for elevating said side portions to impart a flat-bottomed trough-shaped cross section to said conveyor, a vibrator to compact sand carried by said conveyor, means to remove sand from said conveyor at said unloading station, and means to receive sand removed from said conveyor.

4. A machine as defined in claim 3 in which said conveyor is an endless conveyor in which the run from the loading station to the unloading station is the upper horizontal run of the conveyor and in which the means for removing sand at the unloading station comprises a pulley over which the conveyor is turned from its upper run to its lower return run, and a grill to receive bungs of ware from the conveyor and to allow excess sand to fall away from the bungs.

5. In a sanding machine for ceramic ware, an endless flexible conveyor belt, a flat horizontal driving pulley, a flat horizontal idler pulley spaced from said driving pulley, said belt being supported by said pulleys to provide an upper horizontal conveying run and a lower horizontal return run, said conveying run having a loading station adjacent the commencement of the conveying run and an unloading station adjacent the end of the conveying run, troughing rolls supporting said conveyor run of said belt intermediate of said stations and forming said belt into a trough having a flat-bottom center ware-conveying section, a hopper having a discharge opening extending longitudinally of the conveyor run of said belt and located vertically above the center section of said belt, whereby sand discharged from said hopper will form a horizontal mound on said conveyor, the end of said hopper nearer the unloading station being located above said troughing rolls, a vibrator plate located beneath the center section of said conveying run of said conveyor and adjacent the end of said hopper nearer the unloading station, resilient means urging said vibrator plate into engagement with the under surface of said belt, a vibrator to vibrate said vibrator plate, and means to collect sand discharged by said belt adjacent the end of the conveyor run.

6. In a sanding machine for ceramic ware, an endless flexible conveyor, a horizontal driving pulley, a parallel idler pulley, said conveyor being supported by said pulleys to provide an upper horizontal conveying run and a lower return run, means to drive said driving pulley, said conveying run having loading and unloading stations adjacent the commencement and end, respectively, of the conveying run, troughing rolls supporting the conveying run intermediate of said stations and forming said conveyor into a trough having a center ware-conveying section, a hopper having a discharge opening located vertically above the center section of said conveyor, whereby sand discharged from said belt will form a mound on said conveyor, the end of the hopper located nearer the unloading station being located above the trough formed in the conveying run, a vibrator plate located beneath the center section of the conveyor run and adjacent the end of the hopper nearer the unloading station, resilient means urging said vibrator plate into engagement with the under surface of said conveyor, a vibrator to vibrate said plate, means to control said belt drive and means to control the operation of said vibrator, whereby operation of said control means controls the compacting of sand around ware carried by said conveyor, and means to collect sand discharged from said conveyor adjacent the end of the conveyor run.

7. In a machine as defined in claim 5, a scraper extending transversely of said belt adjacent the unloading station and fixed relatively to the length of said conveyor run, and means to adjust the vertical distance between said scraper and the ware-conveying portion of said belt.

8. A method of sanding ceramic ware comprising the steps of placing a bung of ware in the center of a flexible sheet, pouring sand on ware at increasing rates until said bung is buried in said sand, raising the marginal portions of said sheet as sand is poured on said bung to maintain said sand around said bung, flexing said margin portions of said sheet to work said sand surrounding said bung, vibrating said center portion of said sheet to compact sand into the external openings between ware in said bung, and then

lowering said marginal portions to uncover said bung.

9. In a sanding machine for ceramic ware, a conveyor having a conveying run and loading and unloading stations adjacent the beginning and end of the conveyor run, said conveyor including an endless flexible sand-supporting belt and a pair of pulleys supporting said sand-supporting belt, a hopper having a discharge opening located centrally above said belt to discharge sand thereon, means supporting said belt intermediate said pulleys to maintain said belt substantially level under the load of sand discharged thereon, a vibrator plate engaged against the under surface of said belt and adjacent the discharge opening of said hopper, a vibrator connected to said plate to compact sand carried by said belt, means extending beyond said belt to support ware carried by said conveyor and to permit sand to fall away from the ware as the ware approaches the unloading station, and means to collect sand which falls away from the ware.

10. In a sanding machine for ceramic ware, an endless flexible conveyor belt, a flat horizontal driving pulley, a flat horizontal idler pulley spaced from said driving pulley, said belt being supported by said pulleys to provide an upper horizontal conveying run and a lower horizontal return run, said conveying run having a loading station adjacent the commencement of the conveying run and an unloading station adjacent the end of the conveying run, troughing rolls supporting said conveyor run of said belt intermediate of said stations and forming said belt into a trough having a flat-bottom center ware-conveying section, a hopper having a discharge opening extending longitudinally of the conveyor run of said belt and located vertically above the center section of said belt, means to vary the width of said opening to deposit sand on said conveyor at an increasing rate as said conveyor advances toward the unloading station, whereby sand is first lightly and finally heavily discharged from said hopper to form a horizontal mound on said conveyor, the end of said hopper nearer the unloading station being located above said troughing rolls, a vibrator plate located beneath the center section of said conveying run of said conveyor and adjacent the end of said hopper nearer the unloading station, resilient means urging said vibrator plate into engagement with the under surface of said belt, a vibrator to vibrate said vibrator plate, and means to collect sand discharged by said belt adjacent the end of the conveyor run.

11. In a sanding machine for ceramic ware, an endless flexible conveyor belt, a flat horizontal driving pulley, a flat horizontal idler pulley spaced from said driving pulley, said belt being supported by said pulleys to provide an upper horizontal conveying run and a lower horizontal return run, said conveying run having a loading station adjacent the commencement of the conveying run and an unloading station adjacent the end of the conveying run, troughing rolls supporting said conveyor run of said belt intermediate of said stations and forming said belt into a trough having a flat-bottom center ware-conveying section, a hopper having a discharge opening extending longitudinally of the conveyor run of said belt and located vertically above the center section of said belt, a plurality of gates for closing said hopper discharge opening, said gates being located longitudinally of the hopper with respect to each other, and means to vary the degree to which each of said gates closes its hopper discharge opening, whereby sand may be discharged from said hopper to form a horizontal mound on said conveyor at a varying rate, the end of said hopper nearer the unloading station being located above said troughing rolls, a vibrator plate located beneath the center section of said conveying run of said conveyor and adjacent the end of said hopper nearer the unloading station, resilient means urging said vibrator plate into engagement with the under surface of said belt, a vibrator to vibrate said vibrator plate, and means to collect sand discharged by said belt adjacent the end of the conveyor run.

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