Oct. 15, 1946. W. J. MILLER 2,409,221

PUDDLING MACHINE

Original Filed Jan. 8, 1943 4 Sheets-Sheet 1

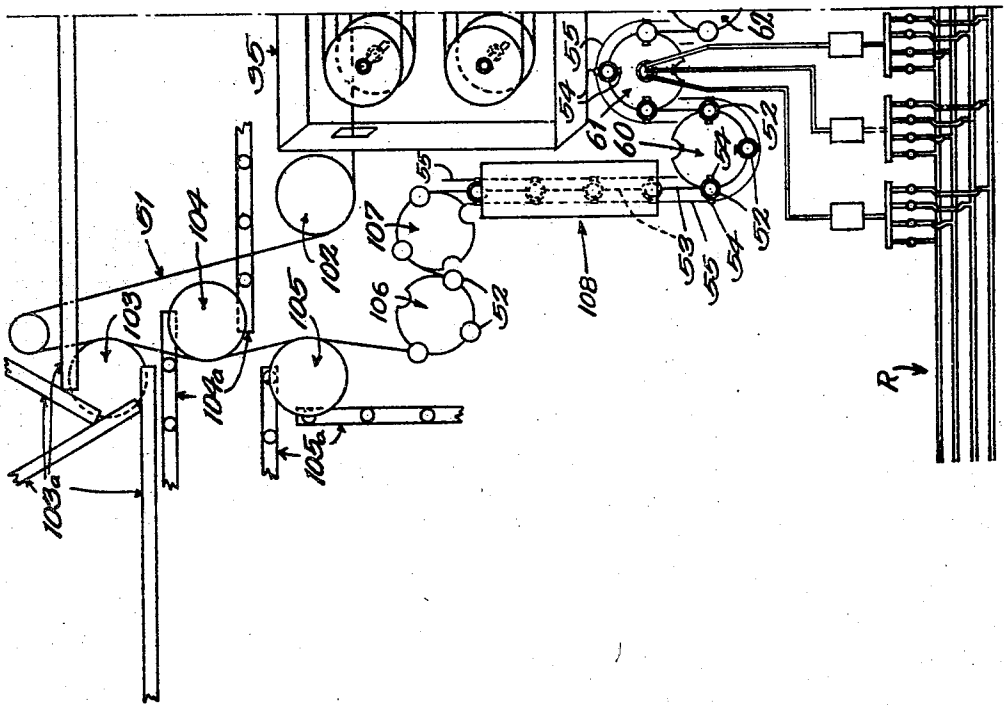


Fig. 1.

INVENTOR
William J. Miller.
BY
George J. Cummings
ATTORNEY

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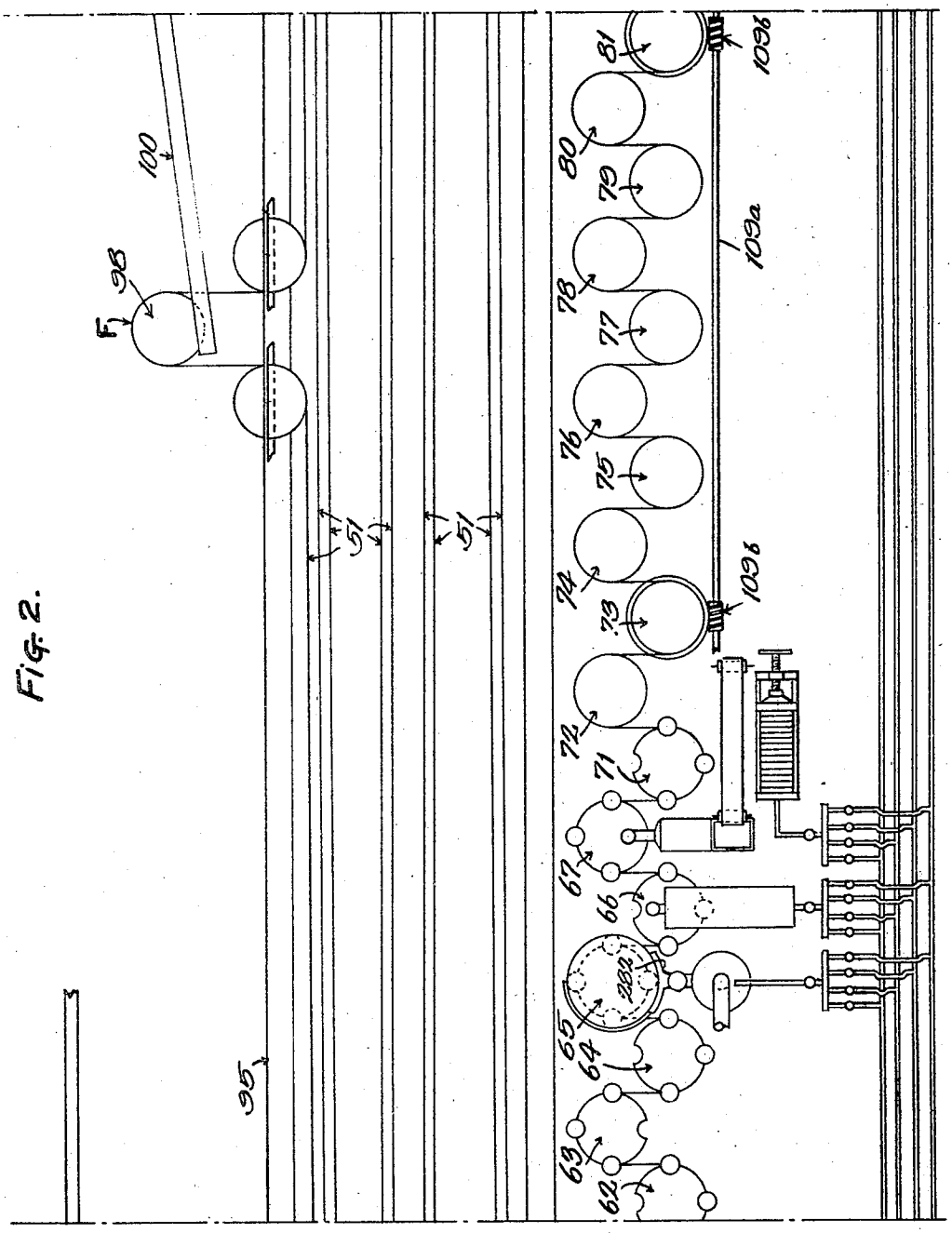


Fig. 2.

INVENTOR.
William J. Miller
BY
George J. Cominger
ATTORNEY.

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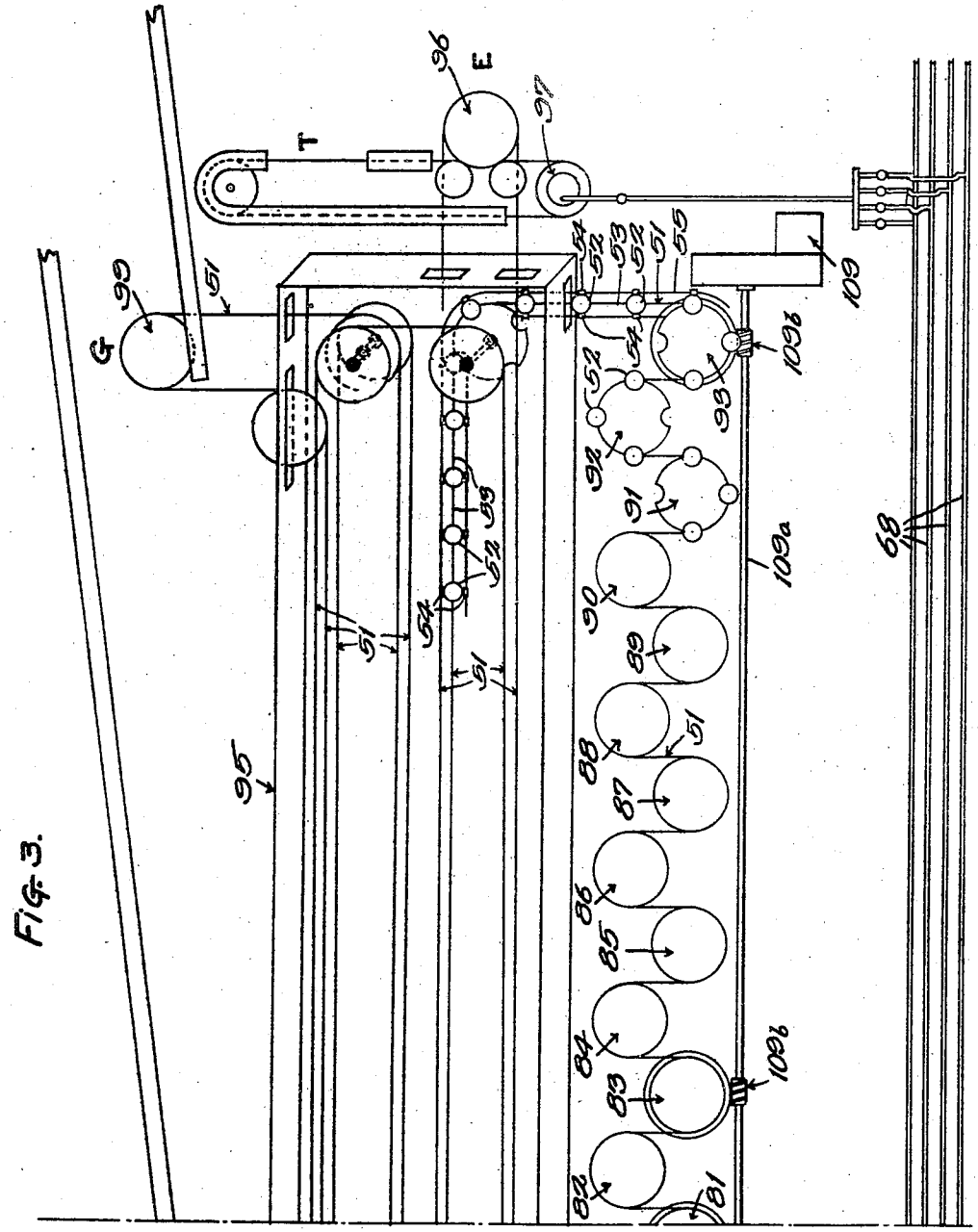


Fig. 3.

INVENTOR.
William J. Miller.

BY
George J. Cosinger
ATTORNEY.

Oct. 15, 1946. W. J. MILLER 2,409,221

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FIG. 4

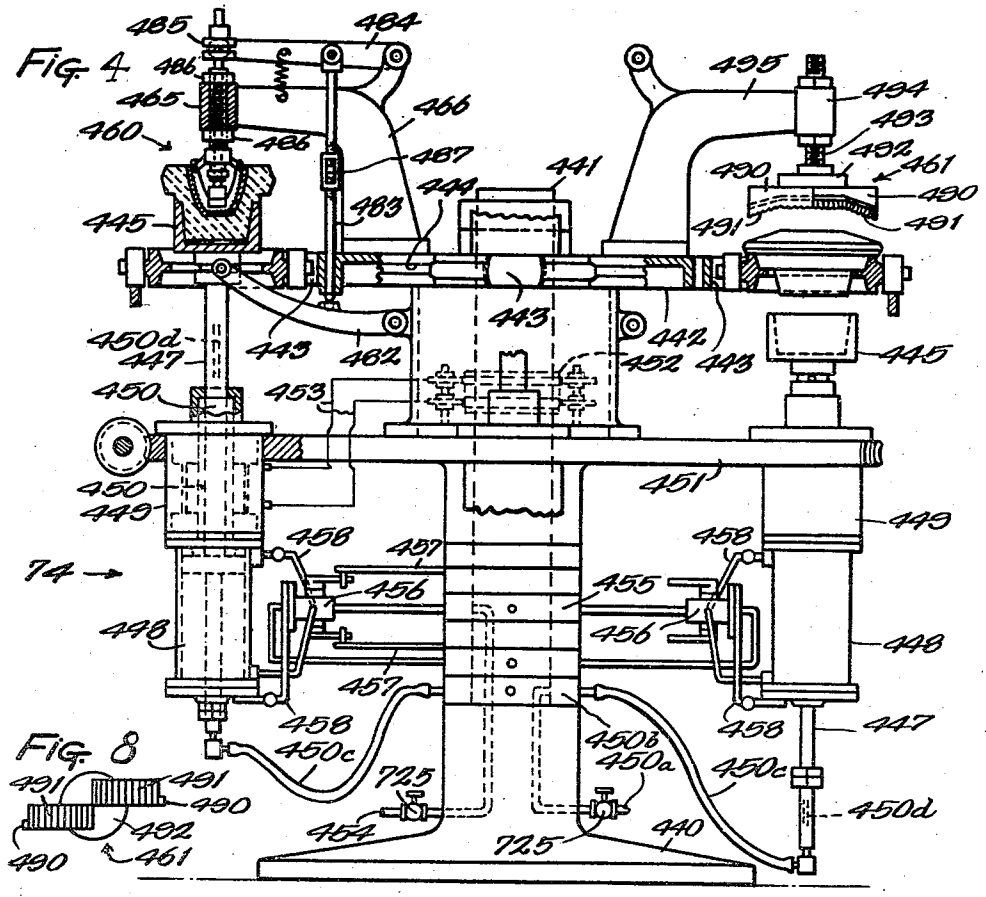


FIG. 8

FIG. 5

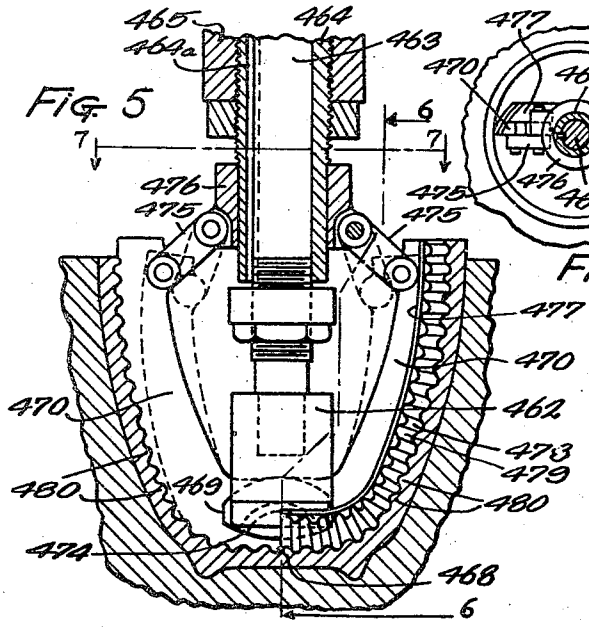
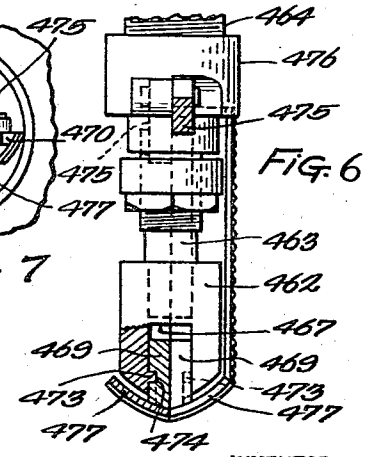


FIG. 7

FIG. 6



INVENTOR.
William J. Miller.
BY
George J. Cuninger
ATTORNEY.

Patented Oct. 15, 1946

2,409,221

UNITED STATES PATENT OFFICE

2,409,221

PUDDLING MACHINE

William J. Miller, Swissvale, Pa., assignor to Miller Pottery Engineering Company, Swissvale, Pittsburgh, Pa., a corporation of Pennsylvania

Original application January 8, 1943, Serial No. 471,704. Divided and this application September 16, 1944, Serial No. 554,509

22 Claims. (Cl. 25—22)

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This application is a division of my co-pending application S. N. 471,704, filed January 8, 1943.

This invention relates to improvements in puddling machine. It has to do particularly with the manufacture of ware such as jiggered dinnerware, for instance, plates, cups and saucers, bowls and the like.

The mass production of pottery ware by automatic machine and processes has involved a certain amount of manual intervention, particularly in the treatment and preparation of raw materials and in certain phases of clay, ware and mold transportation, manipulation and processing.

One of the objects of this invention is to place the manufacture of pottery ware on as near a fully automatic basis as possible all the way from the raw material stage to that of dried product ready for first firing. By substantially eliminating the human element in this respect, it is possible to remove handicaps which have heretofore interfered with the continuity, quality and rate of production.

Another and perhaps more important object of this invention is to provide for making simultaneously several different kinds of ware, that is to say, ware having differences in shape, size, decorative pattern or material and even composition by means of a single, unitary mechanical organization. This invention comprehends machinery capable of performing many and different steps, and combinations of steps in the manufacture of pottery ware some of which are conventional steps or operations and others of which afford new and improved ways and means of making pottery ware of this class.

The machinery of the present invention is so constructed and arranged that different sequences of operations may be performed at the same time and variations in the sequences and procedural steps may be made at will and in some cases while the machinery is in operation. Thus, insofar as production diversification is concerned, it may be varied from one which is highly diversified to one wherein substantially little or no diversification occurs. Thus, I provide in a single unitary installation the means of meeting the daily requirements of the average pottery whether it be for large or small amounts of pottery of given shape or design and it is well known that these requirements may vary widely, particularly if the pottery merchandises a large number of shapes and designs.

Instead of the intermittent fabricating system as illustrated in the patent to Miller No. 2,046,525, I propose to make the present system

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continuous, somewhat as shown in the application to William J. Miller, Serial No. 413,734, filed October 6, 1941. That is to say, from the beginning of fabricating operations to the point when the ware is removed from the dryer and therebeyond, the materials will move in continuous fashion whilst the various fabricating operations are performed. This makes for increased production speeds and raises the capacity of the machinery. Furthermore, clay is supplied to the fabricating portion of the present mechanical organization by a system and apparatus disclosed in application Serial No. 454,716, filed August 13, 1942, to William J. Miller.

In the drawings:

Figs. 1, 2, and 3, taken together to match end to end in their order lengthwise from left to right constitute a diagrammatic view in plan of the entire ware production system of the invention.

Fig. 4 is a sectional elevation of a rotary puddling machine of the system.

Fig. 5 is an enlarged detail section of one of the hollow ware puddling heads seen in Fig. 4.

Fig. 6 is a detail vertical section taken substantially on the section line 6—6 of Fig. 5.

Fig. 7 is a detail plan section of the puddling head of Fig. 5, as taken on the section line 7—7.

Fig. 8 is a bottom plan of the flat ware puddling head seen in Fig. 4.

As illustrated diagrammatically in Figs. 1 to 3, the system includes an endless flexible mold conveyor 51 comprising a series of centrally open mold carriers or positioning rings 52 interconnected in equally spaced relation by flexible links or cable sections 53. The conveyor is maintained in a substantially horizontal plane while travelling continuously in a tortuous path about idler sprockets and rotary machines of the system by having outboard supporting rollers 54 riding on rails 55.

The molds for forming four types of ware are carried in the rings 52 in duplicate successive sets which, in the course of the conveyor, are brought into co-operative relation with a series of rotary machines 60, 61, 62, 63 and 64 designed to respectively condition the molds, treat molds for a certain method of ware decoration, treat molds for another method of ware decoration, further condition the treated molds and treat molds for engobing certain ware. These machines are selectively used.

The molds then continue to a series of rotary machines 65, 66 and 67 designed to selectively feed clay charges of similar or of different composition or conditioned clay bodies to the molds

and puddle and partially form the charges correlatively with respect to the ware forming surfaces of the molds prior to feeding. The charge feeding machines may be supplied from an enclosed clay preparation organization R designed to simultaneously and continuously prepare the various clay bodies desired from the various plastic and non-plastic materials required and selectively feed same to the machine.

After receiving the charges, the molds continue to a series of rotary machines 71 to 93, inclusive, designed to selectively perform various forming, conditioning and decoration operations to produce the ware as more fully hereinafter described.

The molds then pass through a drier 95 for an optimum period to dry to leather hardness certain ware to be appendaged, such as cups or the like, which are then conveyed out of the drier at a take-off station E to a rotary machine 96 which transfers same from an upright position in the molds to an inverted position in co-operative relation with an appendaging machine 97, the transfer machine also being designed to fettle and smooth the ware prior to being transferred.

The molds are then returned into the drier and are conveyed past take-off stations F and G located along the conveyor course and are brought at predetermined points into cooperative relation, respectively with rotary machines 98 and 99 designed to transfer other types of ware, each requiring a different drying period, to suitable conveying apparatus 100 and 101 arranged to convey the ware to suitable locations for further treatment. These machines are also designed to fettle, smooth and reverse or reposition the ware incident to transferring same, if desired.

Upon leaving the drier, the molds are advanced to a rotary machine 102 employed to lay to the molds or reform thereon partly dried ware that may have become slightly distorted during drying and being especially of use as located, in an installation or an adaptation of the system wherein no type of ware is completely dried in the dryer. However, if the system is adjusted so that the ware leaving the dryer is too dry for the reforming operation, said machine 102 or number of same may be disposed along the conveyor course adjacent one or each of the take-off or transfer stations E, G, and F.

From the reforming machine 102, the molds continue to another rotary transfer machine 103 co-operating with a conveying system 103*a* to transfer the various types of ware that may remain on the conveyor to any one or a number of selected locations for further treatment, the machine being designed to fettle and smooth the ware and reverse the position thereof if desired.

Upon leaving the transfer machine 103, the empty molds are advanced to a rotary machine 104 co-operating with a conveying system 104*a* to remove any one or all the molds of each set and transfer same to a suitable location for storage when changing the system over to the production of a different type or types of ware, or when damaged or worn molds require replacement for repair.

The next machine 105 along the course of the conveyor is also of the rotary type designed to co-operate with a conveying system 105*a* for transferring molds for a certain type or types of ware from one or more storage locations and placing same in the emptied mold carriers in any desired order.

The molds then continue to a rotary conditioning machine 106 designed to remove any foreign matter from the molds, and then continue to another conditioning machine 107 employed to apply to all the molds, or only those which have just been placed on the conveyor, a conditioning medium, such as oil. The molds then pass through a conditioning zone 108 comprising a tunnel within which the air is suitably heated or otherwise conditioned to dry or otherwise put the molds in a proper condition as they return to complete another cycle of operation.

Generally, the machines are of the rotary table type, about the tables of which the conveyor meshes to remain in cooperative relation with each machine during a sufficient portion of its rotation to perform the various operations on the molds or ware.

As seen in Figs. 2 and 3, a power unit 109, such as a combination motor and adjustable speed reducer is employed to constantly drive the machines and mold conveyor in synchronism, through a power shaft 109*a* and suitable gearing 109*b* co-operating between same and the rotary machines 73, 81 and 93 which thus serve as driving connections for the conveyor at spaced intervals therealong and whereby the conveyor in turn serves as a driven connection for the rotary machines with which it meshes between said intervals. It is also contemplated that the conveyor and any number or all of the said rotary machines and idlers defining its course may be independently or collectively driven in timed relation.

The molds are advanced on the conveyor to a rotary puddling machine 74 designed to remove any strains, laps or other defects to a substantial depth from the exposed surface of the preformed charges inherent in the clay or created incident to pressing, feeding, or otherwise.

The means of this machine for supporting the conveyor and operating the molds includes (see Figure 4) a base 440 supporting a stationary hollow central shaft 441 on which rotates a table 442 having four equally spaced peripheral positioning pockets 443 and a peripheral groove 444 to respectively receive the mold carriers and cable sections of the mold conveyor.

As the mold conveyor travels about the table 442, each mold is elevated by a mold chuck 445 to bring the preformed charge therein into co-operative relation with puddling head for a given period, and during which time the mold and puddling head are rotated relatively to effect the puddling operation. For operating the chucks, each is mounted on the top end of a vertical piston rod 447 of a cylinder and piston fluid motor 448 secured to the bottom end of an electric motor 449 having a hollow shaft 450 within which the piston rod reciprocates in splined connection to be rotated thereby. When elevated, the chuck is vacuumized to hold the mold fixed therein by being connected with a vacuum line 450*a* through a distributing valve 450*b*, a flexible conduit 450*c* and a central passage 450*d* in the piston rod 447. The electric motors 449 are carried on a wheel 451, spaced below and connected with the table 442, and are energized to rotate the chucks, when raised, from any suitable power lines through a combination distributor and switch 452 on the central shaft and conductors 453 leading therefrom. Each fluid motor 448 is energized from a fluid pressure line 454 by way of a distributor 455 on the central shaft, and a four-way valve 456 operated by arms 457 on the central shaft and connected with the ends of the cylinder of the

motor through valved conduits 458. Generally, the puddling means includes puddling devices 460 and 461 carried on the table 442 and arranged over the pockets 443 to effect the puddling of hollow ware and flat ware shapes respectively (see Fig. 4).

These devices are constructed somewhat in accordance with that part of the invention defined in my co-pending application, Serial No. 443,226, having to do with puddling clay charges.

Each hollow ware puddling device 460 (see Figs. 5, 6 and 7) comprises a central bearing block 462 on the bottom end of a spindle 463 co-axial with the chuck therebelow and mounted for limited reciprocation within a sleeve 464 holding the spindle from rotating through a spline connection 464a, and secured in a bearing 465 of a bracket 466 on the table 442. In the bottom end of the block 462 is a transverse slot 467 within which is mounted to pivot about a horizontal axis and intersecting the axis of the block at a point therebelow, as seen at 468, Fig. 5, the overlapping inner ends 469 of a pair of upwardly and outwardly curved puddling arms 470. The arms are guided to pivot about their common axis by arcuate guide formations 473 formed on the opposed inner walls of the slot 467 and received in arcuate guide grooves 474 formed in the inner ends of the arms. The top ends of the arms 470 are pivotally connected through links 475, with a collar 476 on the bottom end of the sleeve 464 whereby as the bearing block 462 is raised and lowered the arms will expand and contract, as seen in full lines and dot-and-dash lines in Fig. 5.

When a hollow ware mold is raised and rotated, the arms of the puddling device thereover are expanded into engagement with the interior wall of the preformed hollow ware charge in the mold and effect the puddling of same by each arm having a blade 477 with a peripheral puddling edge inclined away from the true circle to effect a trowelling action on the clay, and provided with transverse ridges and grooves 478 and 479 preferably inclined peripherally and horizontally cooperating with those of the other blade to effect a plowing action on the clay. This plowing action is effected by so arranging the ridges and grooves of one blade in staggered relation with those of the other blade whereby ridges 480 (Fig. 5) formed on the clay by the grooves of one blade would be parted and/or shifted laterally by the ridges of the other blade. It is also contemplated that this plowing action could be a back and forth movement of the clay or could be a progressive movement either downward or upward as found best in each instance or condition and which may be determined by the arrangement of the ridges and grooves of the blades.

As the mold is initially, very slowly, lowered, the puddling arms contract away from the preformed charge, and as a result the depth to which the plowing action is effected on the clay gradually decreases until a fairly smooth surface is restored on the clay as the blades finally leave same. The inner ends of the active edges of the blades terminate at the point of intersection of the pivot axis of the blades and the axis of the spindle, whereby the puddling action will occur at said point as well and whereby the ridges at the outer portions of the blades will recede from the inner wall of the hollow ware shape without removing any of the clay.

For operating the puddling arms in timed relation with the raising and lowering of the molds, the piston rod 447 supporting the mold chuck

reciprocates the spindle 463 during the upper portion of its stroke, by way of a lever 482 which oscillates through a push rod 483, a spring-pressed lever 484 in pivotal connection with the spindle.

On the spindle 463 is a stop collar 485 which engages the top of the sleeve 464 to limit downward movement of the spindle, and the sleeve is held in the bearing 465 by having nuts 486 threaded thereon and engaging the ends of the bearing whereby the sleeve is vertically adjustable to adjust the puddling device with respect to the molds when elevated. Accordingly, the push rod 483 may comprise two parts connected by a turnbuckle 487 so as to be adjustable for length in regulating the extent and timing of expansion and contraction of the puddling arms.

While the flat ware puddling devices 461 are designed to perform the same plowing action on the clay as the devices 460, the puddling arms 490 thereof with blades 491 contoured in accordance with the flat ware (see Figures 4 and 8) may be fixedly secured on a base 492 having an upright stem 493 held in a bearing 494 of a bracket 495 on the table 442. However, it may have relatively movable plowing and trowelling blades as shown in my copending application, Serial No. 443,226. The brackets 495 and 466 may be duplicates, as shown, whereby each may support a flat ware or hollow ware puddling device to accommodate the various types of ware produced as well as various arrangements thereof on the conveyor.

The clay ware shape may be puddled again by another puddling machine 78, if desired. The purpose of the puddling machine 78 is to remove any minor, shallow strains that may be set up in the surface of the clay shapes by the press 76 and put the surface in optimum condition for jiggering, and accordingly may comprise a duplicate of the machine 74 with finer ridges and grooves formed in the puddling blades so that the plowing action on the clay thereby will be relatively shallow.

I claim:

1. Dinnerware puddling machinery comprising, in combination, supporting means for carrying pottery molds in a closed path, a puddling implement for puddling clay thereon, an implement support, means for moving the implement support in a closed path to bring the implement into register with successive molds on the mold support, means for moving the puddling implement and molds toward one another to engage the clay during the interval of registration and means for moving one relative to the other to puddle the clay.

2. Dinnerware puddling machinery comprising, in combination, supporting means for carrying molds in a closed path, a puddling implement for puddling clay carried by the molds, an implement support, means for angularly moving the support to carry the implement into register with successive molds on the mold support, means for moving the puddling implement and molds toward one another to engage the clay and implement during the interval of registration and means for moving the implement relative to the clay to puddle the clay.

3. Dinnerware puddling machinery comprising, in combination, supporting means for carrying pottery molds in a closed path, a puddling implement, a rotatable support for said implement, means for continuously rotating said support to carry the implement into a position of registration with a mold and move the same therewith in a

portion of the closed path, means for moving the puddling implement and mold toward one another when in registration to engage the implement with clay carried by the mold and means for moving the implement and clay relative to one another when in engagement to effect the puddling of the clay.

4. Dinnerware puddling machinery comprising, in combination, a support for carrying pottery molds to a puddling zone, a puddling implement for puddling clay thereon, an implement support for carrying the implement through the puddling zone, means for holding the mold support in vertical registration with the implement while traveling through the puddling zone, means for moving the puddling implement and mold to engage the implement with the clay carried by the mold and means for relatively moving the implement and clay when in engagement to effect a puddling operation.

5. Dinnerware puddling machinery comprising, in combination, a conveyor provided with a plurality of mold supports for carrying pottery molds to a puddling zone, puddling implements, movable means for supporting said implements, means for indexing successive mold supports with the puddling implements, means for moving the mold supports and puddling implements through the puddling zone during registration, means for moving the puddling implements and molds towards one another to engage clay carried by the molds with the puddling implements and means for moving the puddling implements and clay relative to one another when in engagement to puddle the clay.

6. Dinnerware puddling machinery comprising, in combination, a conveyor provided with a plurality of mold supports for carrying pottery molds to a puddling zone, puddling implements, means for supporting said implements for movement through the puddling zone, means for holding the mold supports in vertical registration with the implements while traveling through the puddling zone, means for moving the puddling implements and molds towards one another to engage clay carried by the molds with the puddling implements and means for moving the puddling implements and clay relative to one another when in engagement to puddle the clay.

7. Dinnerware puddling machinery comprising, in combination, a support for carrying pottery molds to a puddling zone, a puddling implement for puddling clay in the molds, an implement support for carrying the implement through the puddling zone, means for holding the mold supports in vertical registration with the implement whilst traveling through the puddling zone, and means for lifting the mold out of the support into co-operating relation with the implement when in registration.

8. Dinnerware puddling machinery comprising, in combination, a support for carrying pottery molds to a puddling zone, a puddling implement for puddling clay in the molds, an implement support for carrying the implement through the puddling zone, means for holding the mold supports in vertical registration with the implement whilst traveling through the puddling zone, means for lifting the mold out of the support into co-operating relation with the implement when in registration and means for rotating the mold relative to the puddling implement to effect a puddling operation.

9. Dinnerware puddling machinery comprising, in combination, a support for carrying pottery molds to a puddling zone, a puddling implement for puddling clay in the molds, an implement support for carrying the implement through the puddling zone, means for holding the mold supports in vertical registration with the implement whilst traveling through the puddling zone, means for lifting the mold out of the support into co-operating relation with the implement when in registration, means for rotating the mold relative to the puddling implement to effect a puddling operation and means for gripping the mold to the lifting means during the interval of rotation.

10. Dinnerware puddling machinery comprising, in combination, a support for carrying pottery molds to a puddling zone, an expandible puddling implement for puddling clay on the molds, an implement support for carrying the implement through the puddling zone, with the molds, means for moving into operative adjacency the implement and work and means for expanding the implement to cause the same to engage clay on the mold.

11. Dinnerware puddling machinery comprising, in combination, a support for carrying cavitous pottery molds in a puddling position, an expansible puddling implement for insertion in said cavity to puddle clay therein, a support for said implement, means for moving said implement and mold relative to one another to insert the implement in the cavity, means for expanding the implement into engagement with the clay and means for moving the implement and mold relative to one another to effect a puddling operation.

12. Dinnerware puddling machinery comprising, in combination, a support for carrying cavitous pottery molds in a puddling position, an expansible puddling implement for insertion in the mold cavity to puddle clay therein, a support for said implement, means for raising said mold support to insert the implement in said cavity, and means, operated by the mold lifting means for expanding the implement into engagement with the clay.

13. Dinnerware puddling machinery comprising, in combination, mold supporting means including a plurality of chucks, means for rotating said chucks about a center point, a puddling implement above each chuck, a support for said puddling implements movable with the mold supporting means, means for raising the chucks to elevate molds carried thereby to the puddling implements and means for rotating the chucks and implements, one relative to the other, to effect a puddling operation.

14. Dinnerware puddling machinery comprising, in combination, a plurality of puddling implements arranged to rotate continuously about a common axis, a continuously traveling endless mold conveyor arranged to travel in a path concentric with the axis through a puddling zone to carry molds with clay thereon into registering position relative to the puddling implements and then carry them away after the clay is puddled and means for moving the puddling implements and molds relative to one another when in register to effect a puddling operation.

15. Apparatus for puddling charges of plastic clay on pottery molds comprising, a plurality of rotary puddling machines, each having puddling devices rotatable about the axis of the machine, mold supporting means associated with each machine, and a mold conveyor connected to said machines in driving association therewith for carrying molds to and from said machines.

16. Apparatus for puddling charges of plastic

clay on pottery molds comprising, a plurality of rotary puddling machines, each having puddling devices rotatable about the axis of the machine, mold supporting means associated with each machine and a mold conveyor positioned and arranged for carrying molds to the mold supporting means of each machine and for rotating said machines.

17. Apparatus for puddling charges of plastic clay on pottery molds comprising, a mold conveyor for carrying molds through a puddling zone, a rotary puddling machine in said zone to be driven with said conveyor, puddling implements carried by said machine for movement with said conveyor, and mold lifters below each puddling implement for lifting molds from said conveyor and co-operating them with the puddling implement thereabove.

18. Apparatus for puddling charges of plastic clay on pottery molds comprising, a mold conveyor for carrying molds through a puddling zone, a rotary puddling machine in said zone to be driven with said conveyor, a puddling implement carried by said machine for movement into and out of position over molds on said conveyor, a mold chuck below said implement and means for relatively moving said mold chuck and implement when a mold is in register therewith for performing a puddling operation on clay carried by the mold.

19. A puddling machine comprising a base, a rotary table carried by the base, peripheral recesses in the rotary table for receiving mold carriers, a mold chuck below each recess, a puddling implement mounted above each recess, means for moving the implements and chucks, one relative to the other to effect a puddling operation and means for rotating said table.

20. A dinnerware puddling machine comprising a base, a rotary table carried by the base, a mold chuck carried by the table, means for vertically moving the chuck in a direction parallel to the axis of rotation of the table, a puddling tool above said chuck, a support for said tool carried above the table for rotation about the axis of the table, and means operated by the means for vertically moving the chuck, for actuating said tool.

21. A dinnerware puddling machine comprising, a base, a rotary support carried by said base, a mold chuck carried by the support, a puddling tool having movable puddling members, a support for said tool above and movable with said rotary support, means for moving said chuck and tool relative to one another and means operated by said last named means for moving the puddling members.

22. A dinnerware puddling machine comprising a base, a rotary support carried by said base, a plurality of mold chucks carried by the support, puddling tools, supports for said tools above and movable with said rotary support, some of said tools being formed for puddling flatware and some for puddling hollowware, said latter tools having movable puddling members, means for moving said chuck and tools relative to one another and means, operated by said last named means for moving said puddling members.

WILLIAM J. MILLER.