Oct. 25, 1949. W. J. MILLER 2,486,051

APPARATUS FOR FEEDING CLAY TO POTTERY MOLDS

Original Filed Jan. 8, 1943 7 Sheets-Sheet 1

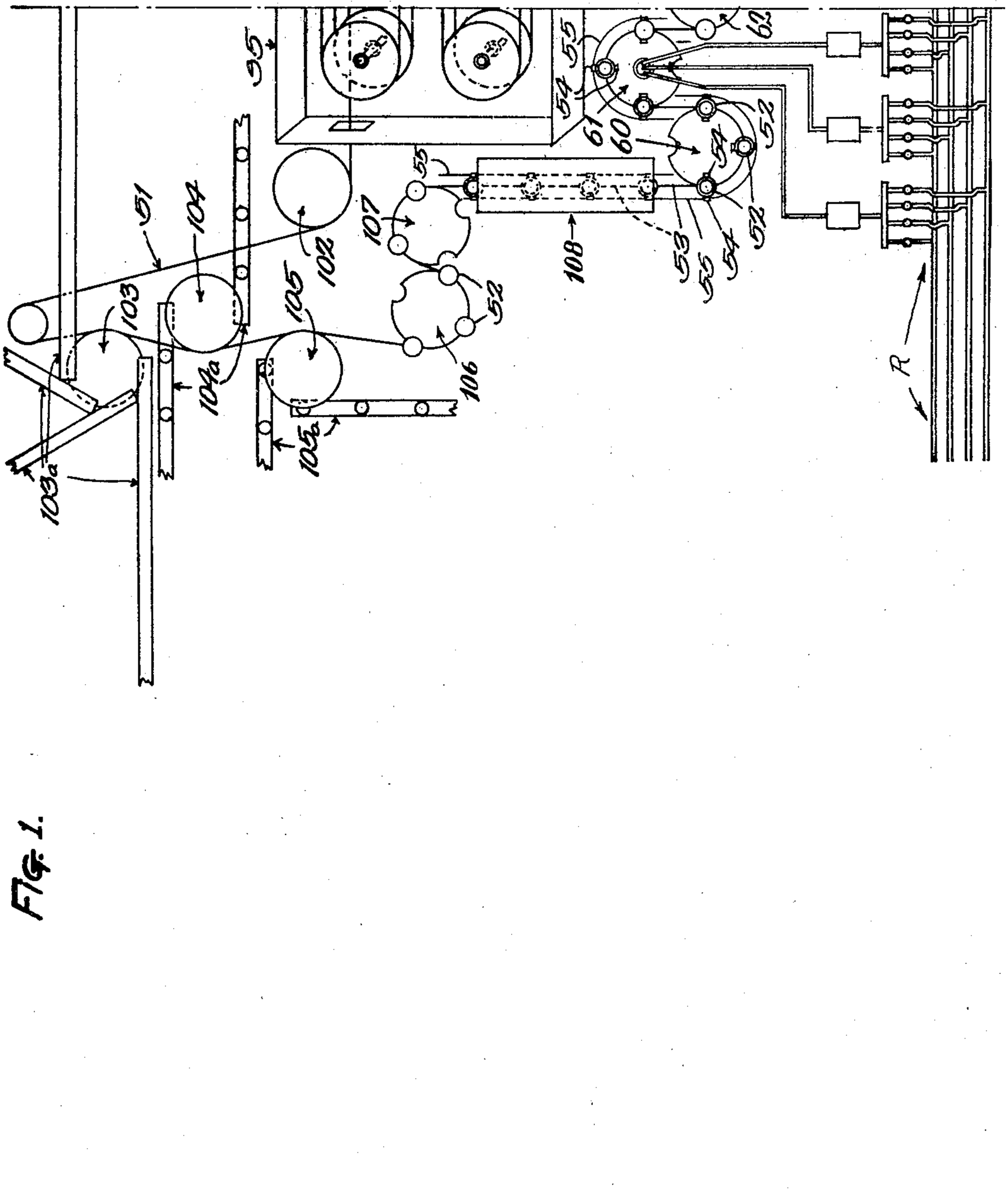

FIG. 1.

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Original Filed Jan. 8, 1943 7 Sheets-Sheet 2

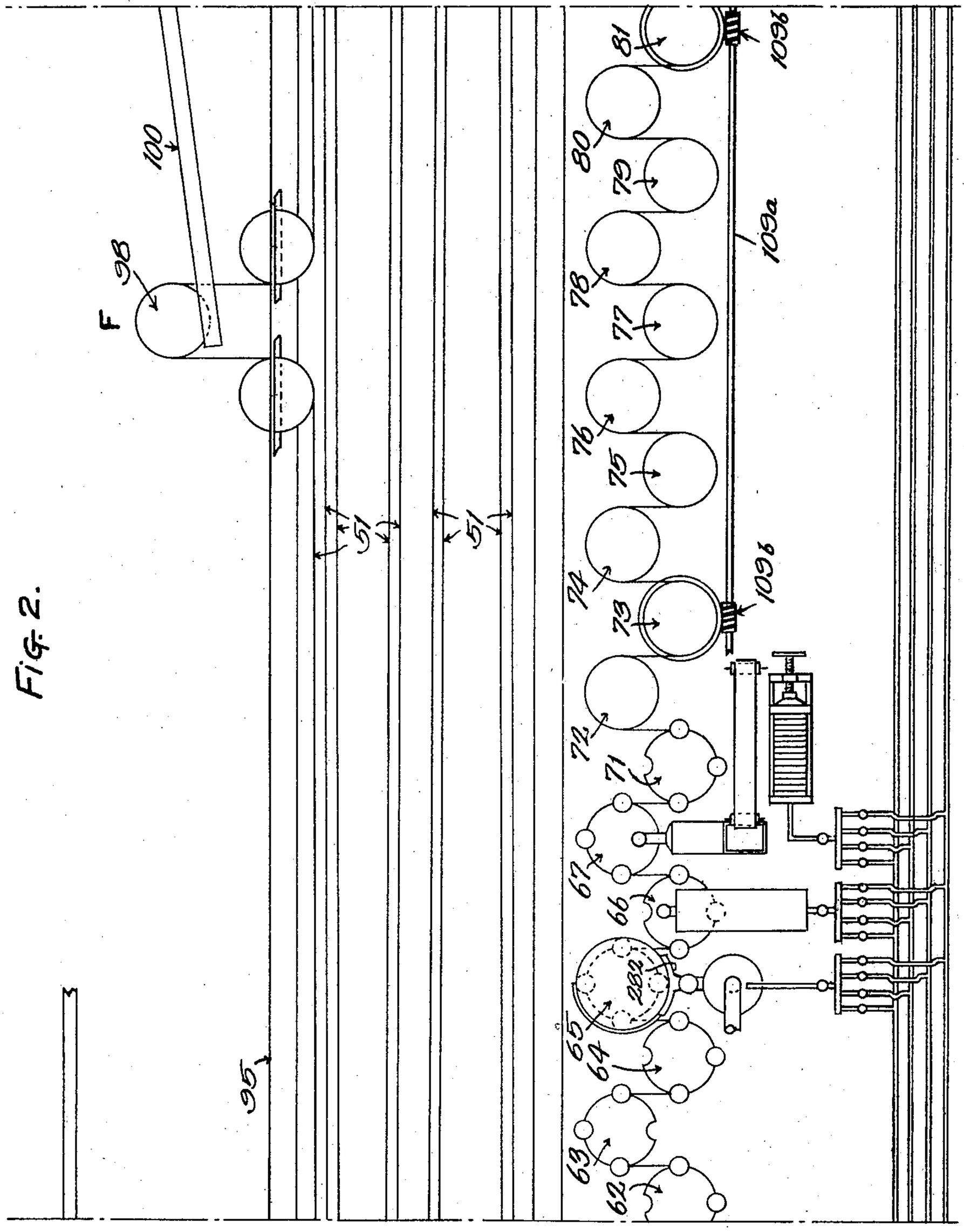

Fig. 2.

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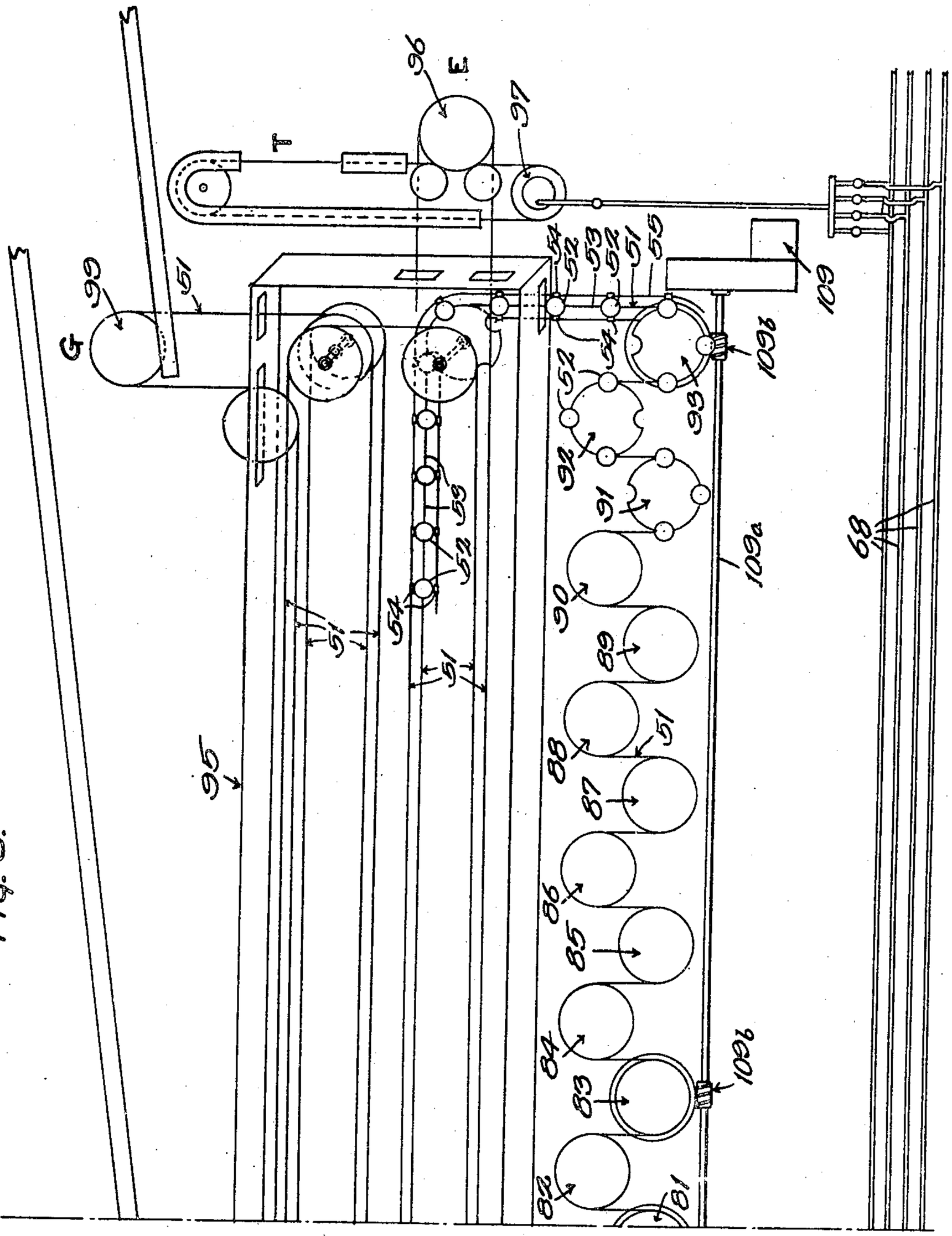

Fig. 3.

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APPARATUS FOR FEEDING CLAY TO POTTERY MOLDS

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FIG. 4.

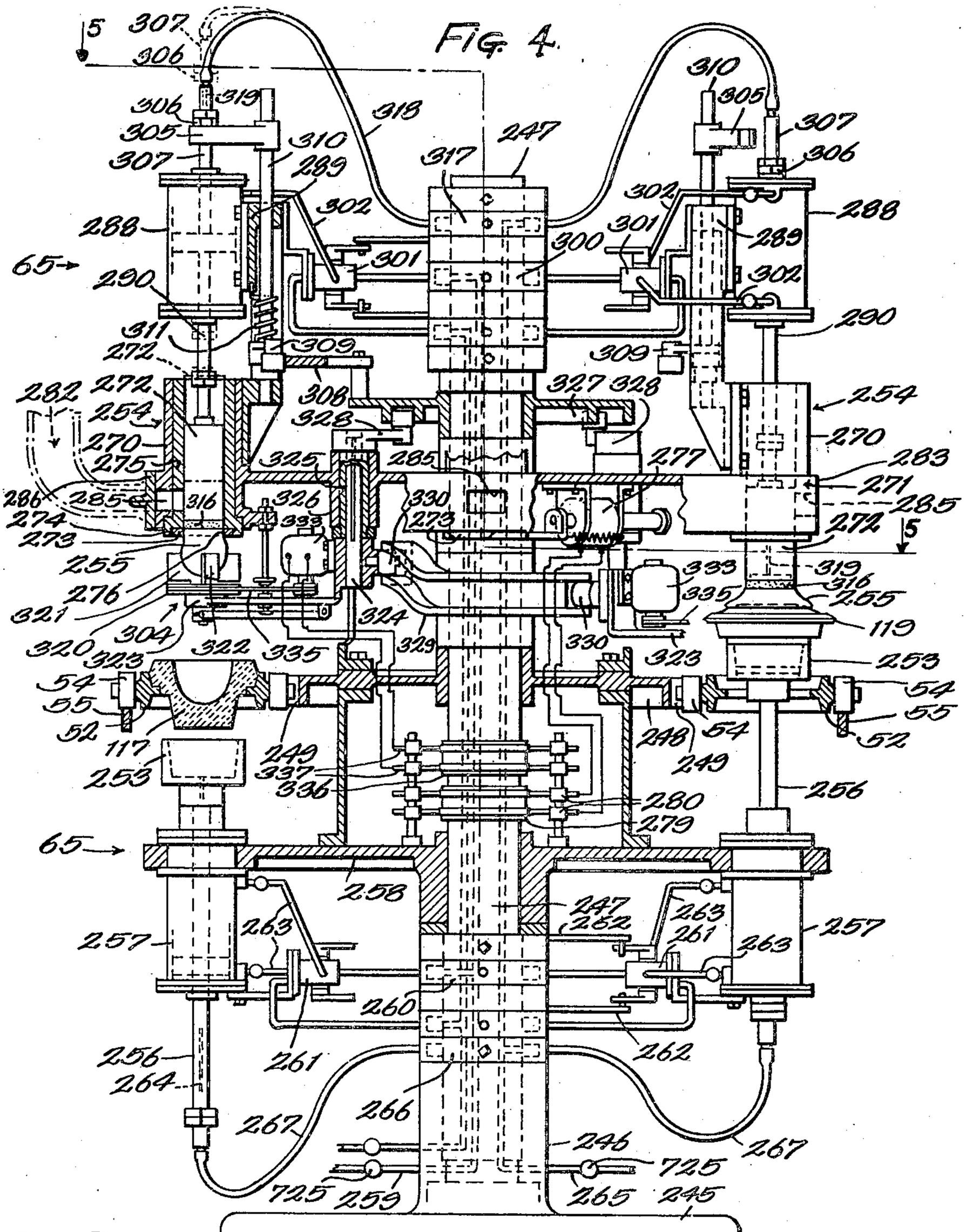


FIG. 7

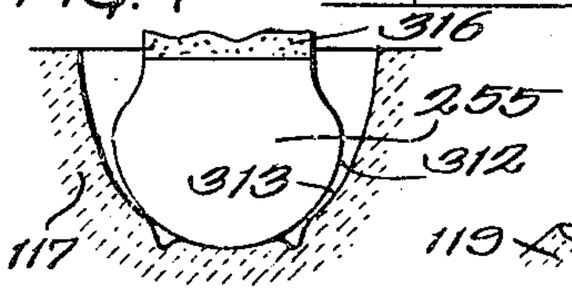
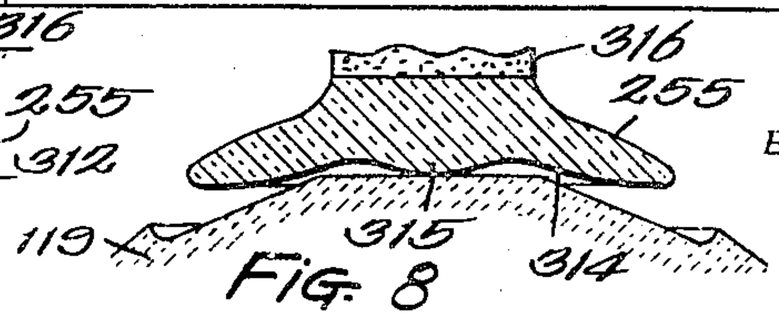


FIG. 8



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APPARATUS FOR FEEDING CLAY TO POTTERY MOLDS

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Fig. 5

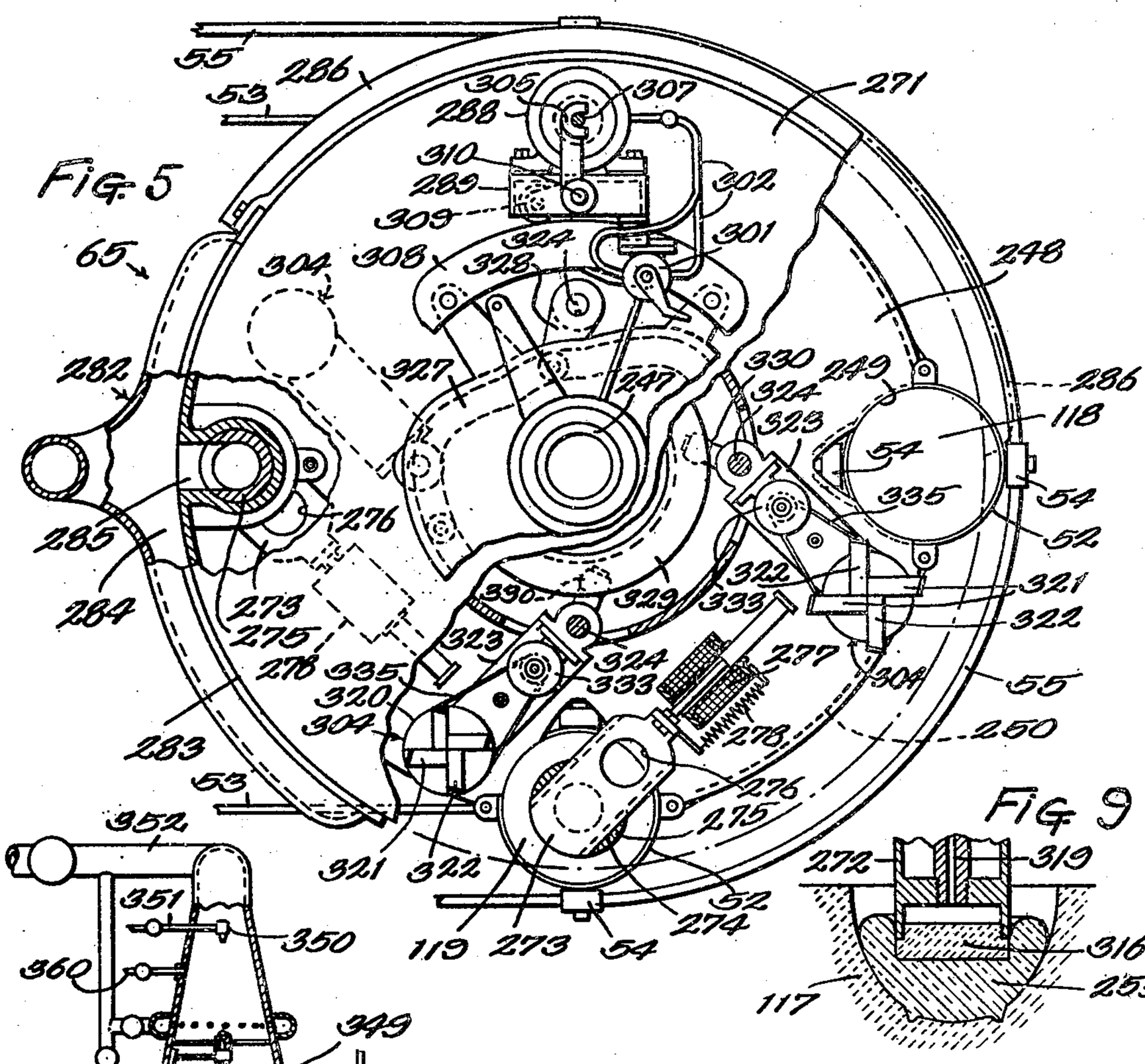

Fig. 9

Fig. 10

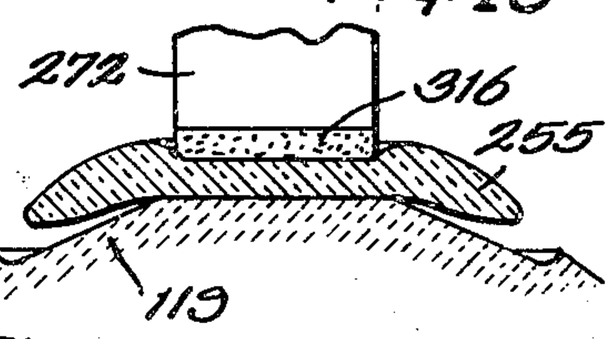

Fig. 6

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APPARATUS FOR FEEDING CLAY TO POTTERY MOLDS

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Fig. 11

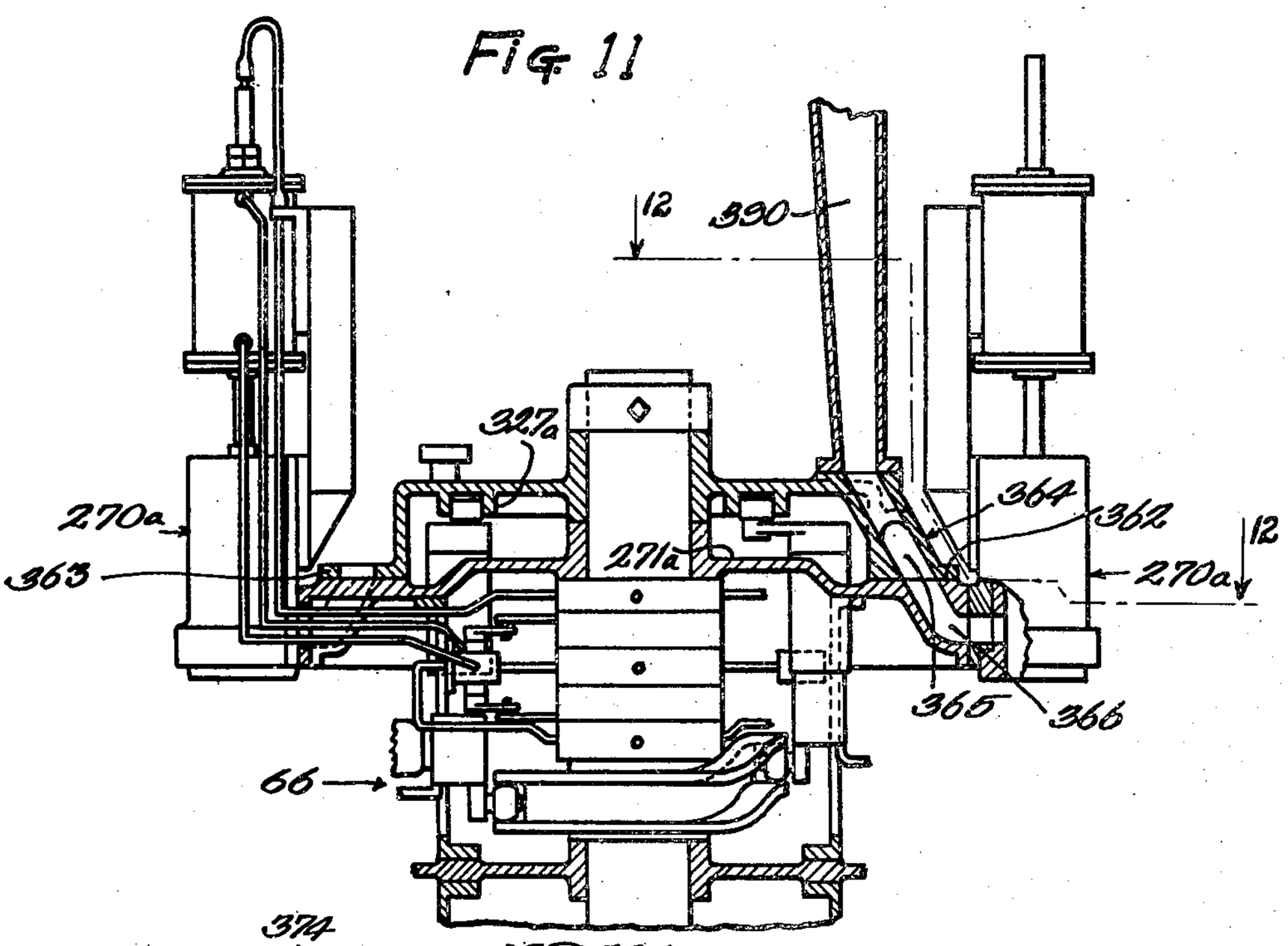


Fig. 13

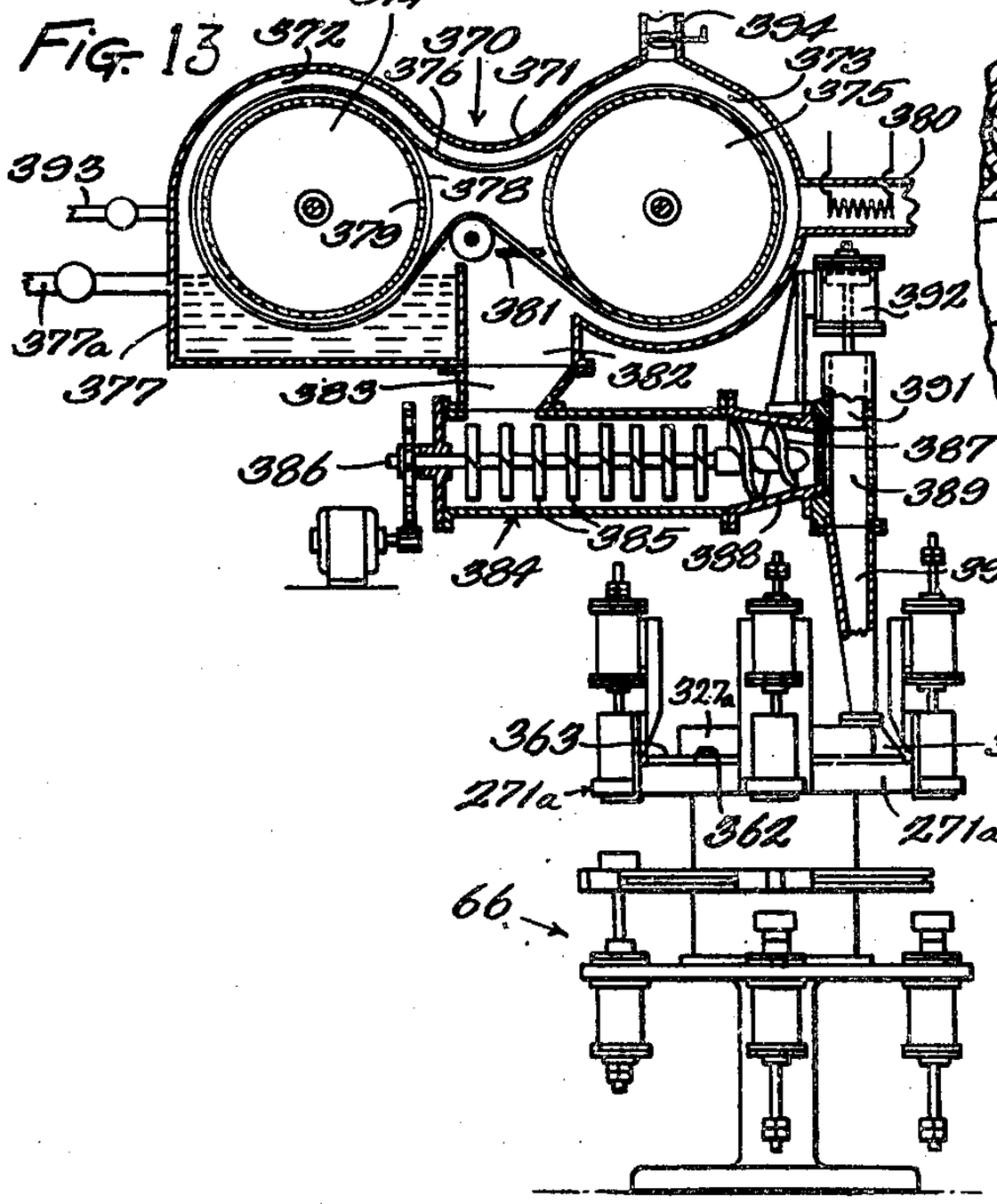
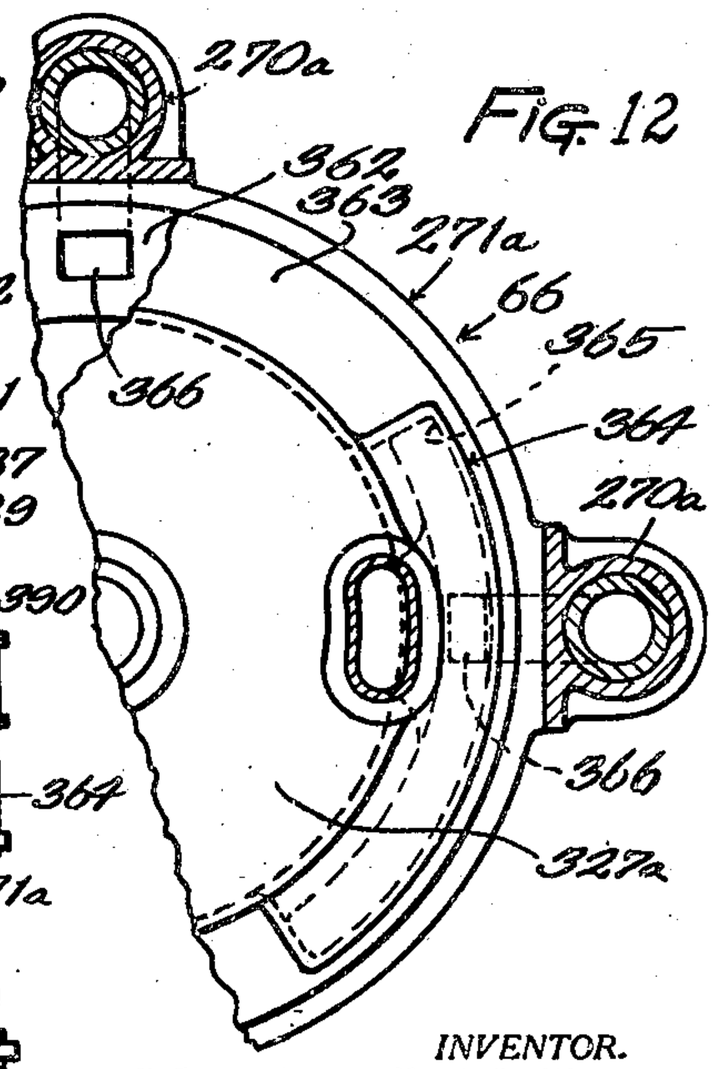


Fig. 12



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APPARATUS FOR FEEDING CLAY TO POTTERY MOLDS

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FIG. 14

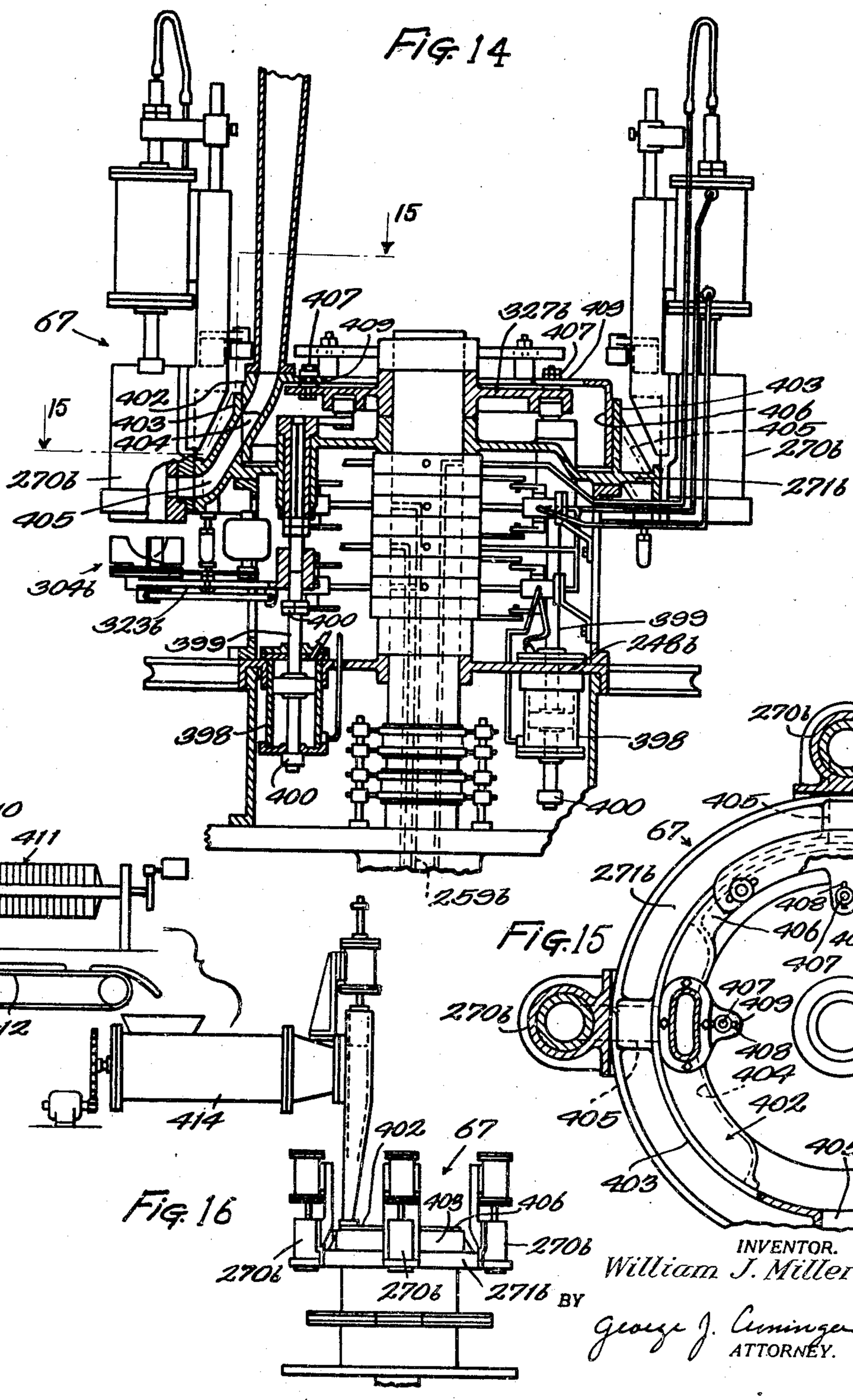

FIG. 16

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Patented Oct. 25, 1949

2,486,051

UNITED STATES PATENT OFFICE

2,486,051

APPARATUS FOR FEEDING CLAY TO POTTERY MOLDS

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 14, 1944, Serial No. 554,115

37 Claims. (Cl. 25—1)

1

This application is a division of application No. 471,704, filed January 8, 1943, now Patent No. 2,407,321.

This invention relates to apparatus for feeding clay to the molds. 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 interferred 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 other 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 merchandizes a large number of shapes and designs.

Instead of the intermittent fabricating system

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as illustrated in the patent to Miller No. 2,046,525, I propose to make the present system continuous, somewhat as shown in the application to William J. Miller, Serial No. 413,734, filed October 6, 1941, now Patent No. 2,409,172. 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, now Patent No. 2,413,330.

In the drawings:

Figures 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.

Figure 4 is a view partly in elevation and partly in section of one of the rotary machines of the system for feeding clay charges to the molds.

Figure 5 is a plan section of the said feeder as taken substantially on the irregular section line 5—5 of Figure 4.

Figure 6 is a view in reduced scale showing the said feeder in supplied association with a clay desiccating device seen in vertical section.

Figure 7 is an enlarged view of certain parts seen in Figure 4 showing a preformed charge for hollow ware about to be initially fed to a hollow ware mold.

Figure 8 is an enlarged view of other parts of Figure 4 showing a preformed charge for flat ware about to be initially fed to a flat ware mold.

Figures 9 and 10 are views illustrating the manner in which the charges seen in Figures 7 and 8 are finally fed to their respective molds.

Figure 11 is a central section of the upper part of another rotary clay charge feeder of the system and constituting a modified form of the feeder of Figure 4.

Figure 12 is a fragmentary plan section of said feeder taken substantially on the section line 12—12 of Figure 11.

Figure 13 is a view in reduced scale showing the feeder of Figure 11 in supplied association with a continuous clay filter.

Figure 14 is a vertical central section of another rotary clay charge feeder of the system.

Figure 15 is a fragmentary plan section of said

feeder taken substantially on the section line 15—15 of Figure 14.

Figure 16 is a view in reduced scale showing the feeder of Figure 14 in supplied association with an ordinary type of pug mill.

As illustrated diagrammatically in Figures 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 traveling continuously in a tortuous path about idler sprockets and rotary machines of the system by having outboard supporting rollers 54 riding on rails 55 (see Figures 1 and 3).

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 various plastic and nonplastic materials required and selectively feed same to the machines.

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 decorating operations to produce the ware.

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 Figures 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 mold charging machine 65 to which the molds are next advanced to be charged, is designed to feed charges of desiccated clay, when this type of clay is desired for the ware. The machine contains features generally characteristic of the feeder forming a part of the subject matter of my co-pending application Serial No. 413,734, filed October 6, 1941, and certain apparatus forming part of the subject matter of my application Serial No. 443,226, filed May 16, 1942 now Patent No. 2,450,437, whereby the charges will be accurately measured and so treated to remove undesirable physical properties therefrom

such as strains, laps or folds which are detrimental to the fabricating, drying and firing behavior of the clay, or appearance thereafter.

As seen in Figures 4 and 5, this machine comprises a base 245 of a pedestal 246 supporting a central hollow shaft 247 on which rotates a turret or table 248. In the edge of the table are four positioning pockets 249 and sheave formations 250 to respectively receive the mold carriers and cable sections of the conveyor as it meshes to a major degree thereabout, during rotation of the table. As the mold carriers travel about the table, the mold on each carrier in succession is elevated and lowered by a vertically reciprocating chuck 253 into and out of cooperative relation with a charging unit 254 of the machine which places and bonds a measured and preformed charge of clay 255 onto the center of the molding surface of the mold.

The mold chucks 253 are mounted on the top ends of vertical piston rods 256 of piston and cylinder type fluid pressure motors 257 secured to a table 258 arranged centrally under the connection with the table 248. Each fluid motor is energized at the proper time from a fluid pressure line 259 through a distributor 260 and a four-way valve 261 operated by adjustable arms 262 on the central shaft 247, and connected with both ends of the motor cylinder by valved conduits 263 to regulate the phase and speed of reciprocation of the chuck. Each piston has a central duct 264 opening into the chuck and connected with a vacuum line 265 through a distributor valve 266 and hose 267 to vacuumize the chuck in holding the mold therein while elevated.

The charging units comprise upright charging cylinders 270 arranged co-axially over the table pockets and carried by a wheel 271 spaced above and supported on the table 248. Within each cylinder reciprocates a charging plunger 272 which, when raised to its upper limit, as seen on dot-and-dash lines in Figure 4, co-operates with a sliding gate 273 at the cylinder discharge end to form a clay charge measuring chamber. The gate for each cylinder comprises a slide plate guided in a guideway 274 across the bottom end of a liner 275 in the cylinder and having an opening 276 arranged to register with the cylinder discharge end when moved to open position. Said liner is open at the lower end to form a discharge orifice or nozzle closed by gate 273 and through which clay is delivered by plunger 272 when the gate is opened. Each gate is opened by a solenoid 277 and closed by a spring 278, the solenoids being carried by the wheel 271 and energized at the proper time from suitable electric power lines by way of a drum type switch 279 on the central shaft 247 co-operating with contacts 280 on the table 258.

Clay is fed into the measuring chambers, during a given portion of rotation of the table, from a stationary feeder head 282 comprising an arcuate feeder channel forming with the edge 283 of the wheel a feeding chamber 284 from which the clay is directed under pressure into the measuring chambers successively by way of radial ports 285 in the wheel edge. From the time the ports 285 leave the feeder head 282 until the charges in the cylinders thereof are discharged, they are closed by an arcuate guard 286 engaging the wheel edge to prevent the escape of clay, as seen in Figure 5.

Each plunger is reciprocated by a cylinder and piston fluid pressure motor 288 mounted on a bracket 289 of the wheel 271 and having a depending piston rod 290 connecting with the plunger. The fluid motors are energized to operate the plungers at the proper time by means substantially the same as that employed for the motors 257 and including a distributor 300, four-way valves 301 and valved conduits 302 co-operating between the motors and the air pressure line 259.

After each charging cylinder has been filled by the feeding head 282, its gate is opened and the plunger lowered to a position intermedate its feeding stroke to bring the bottom end of the charge into operative relation with a device 304 which puddles, smoothes and preforms the charge and correlatively with the contour of the mold surface for which it is intended, while a small portion of the charge remains in the measuring chamber or slide valve port 276 to prevent displacement thereof on the plunger (see left side of Figure 4). Halting of each plunger is effected by a movable stop 305 which oscillates into and out of the path of an adjustable abutment 306 on the upper extension 307 of the piston rod 290 carrying the plunger. The stops are moved into stopping position by a stationary cam segment 308 co-operating with arms 309 on upright shafts 310 carried by the brackets 289 and on which the stops are secured, the stops being moved out of operating position by coiled springs 311 co-operating between the brackets and the arms.

Generally, preforming of the charges consists in producing a mold engaging surface on same that will be at least partially correlatively shaped with respect to the ware forming surface of the molds, to initially engage the surface at the center thereof and then progressively engage same radially thereof to force out any air that may otherwise be trapped therebetween when spread thereover. Accordingly, a hollow ware, or cup charge, Figure 7 may have a smaller arcuately contoured bottom surface 312 than the arcuate contour of the molding surface 313 of the cup mold, and the flat ware or plate charge, Figure 8, may have a dished bottom surface 314 provided with a central bulge 315.

After the charge has been preformed, the puddling and preforming device is lowered therefrom and swings out of its path, and the stop 305 is retracted, whereupon the plunger completes its feeding stroke and the mold is elevated to compress the central portion of the charge onto the center of the ware forming surface of the mold, as seen in Figures 9 and 10, whereby the charge will firmly adhere or be bonded to the mold central therewith while being transported to the press. The charge is prevented from adhering to the plunger on its return stroke by the plunger having a permeable bottom end 316 through which, at the proper time, air under pressure is forced from the pressure line 259 by way of a distributor 317 on the central shaft 247 and a flexible conduit 318 connecting same with a central duct 319 continuing through the plunger and piston rod supporting same.

Each puddling device 304 is constructed substantially in accordance with my application Serial No. 443,226, and generally includes a rotating head 320 supporting suitably formed puddling and troweling tools 321 and 322. The base is rotatably mounted at the outer end of a horizontal frame 323 whose other end is secured to the bottom end of a vertical shaft 324 in tele-

scoping keyed connection with a sleeve **325** supported in a bearing **326** of the wheel **271**. The sleeve is oscillated to swing the puddling head laterally into and out of central alignment with a charge of clay thereunder, by a stationary cam **327** on the central shaft **247**, co-operating with a lever **328** on the sleeve. The shaft **324** is reciprocated, to raise and lower the head into and out of contact with the charge, by a cam **329** on the central shaft co-operating with a roller **330** on the frame **323**.

When elevated, each head **320** is rotated, to effect the puddling and preforming operation, by an electric motor **333** on its frame **323** having driving connection with a sheave formation **334** of the head through a pulley and belt drive **335**, the motors being energized at the proper time from suitable power lines by way of a drum type switch **336** on the central shaft and co-operating contacts **337** on the table **258**.

Conditioned clay is supplied to the clay feeding head **282** from a desiccator **348** into which a desired type of clay slip is fed from the clay preparation system R (see Figure 6). While this desiccator may be of any suitable type, it is preferable to employ the desiccator forming part of the subject matter of my co-pending application Serial No. 454,716.

Briefly, the desiccator includes an upright shell **349** into which is sprayed the clay slip from an atomizer **350** in controlled supplied communication with the clay preparation system to be supplied with the desired type of clay slip, by way of a valved pipe **351** and other means later described. As the atomized clay falls, it is dehydrated by hot, dry air admitted into the shell, from any suitable source, by way of a valved conduit **352**. The dehydrated clay falls onto the bottom **353** of the shell from which it is progressed by a rotating snail or deflector **354** through the shell outlet **355** and into a charging cylinder **356**. From the charging cylinder, the clay is forced into the feeding head **282** by way of a conduit connection **357** therebetween and a reciprocating plunger **358** in the cylinder operated by a fluid pressure motor **359**. The desiccator and charger being in closed communication, prevents contamination of the clay by foreign matter, and to further prevent air entrapment in the clay, the desiccator may be vacuumized by having connection with any suitable vacuum source through a valved conduit **360**.

The next machine **66** to which the molds are advanced is provided to feed charges of filtered clay if so desired, and for this purpose may comprise a duplicate of the machine **65**, to which the filtered clay may be supplied from a continuous filter. However, as seen in Figures 11 to 12, this machine constitutes a modified form of the machine **65**, with parts similar to those of the latter being designated by like reference characters with an exponent *a*.

In this form of the charger, the wheel **271***a* has a flat concentric annular top surface **362** engaged by a peripheral flange formation **363** of the stationary cam **327***a*. In this flange is formed a clay feeding head **364** comprising an arcuate channel section forming with said surface **362** a clay feeding chamber **365** from which clay is forced into the charging cylinders **270***a* by way of ports **366** continuing from the surface.

As a result, this form is more compact than the first form and less wear will occur between the contacting surfaces of the wheel and feeder head because of the lesser amount of surface required on the wheel nearer the axis thereof in co-operating to form the clay feeding chamber, and the comparatively reduced extent of travel thereof.

For supplying clay to the feeding head (see Figure 12), a continuous clay filter **370** is employed comprising an enclosed housing **371** including a filter chamber **372** and a drying chamber **373** within which are arranged, respectively, a rotating filter drum **374** and a rotating dryer drum **375** about which are supported a series of endless parallel cords **376**. The filter drum is partly submerged in clay slip contained in a tank formation **377** of the casing supplied from the clay preparation system R by way of a valved conduit **377***a*. As the clay is built up on filter cloth **378** covering the permeable wall **379** of the drum **374**, by vacuum created in the drum, it is carried by the cords **376** about the dryer drum **375**. After being sufficiently dried on the dryer drum by heated air supplied to the drying chamber **373**, through a conduit **380**, the clay is stripped from the cords by a stationary comb **381** to fall through a bottom outlet **382** of the housing which connects with the feed hopper **383** of a pug mill **384**. The filtered clay is then mixed into a homogeneous mass as it is progressed in the pug mill by the usual blades **385** on a central rotating shaft **386** having an auger **387** which forces the clay from the discharge end **388** of the pug mill into a feed cylinder **389** connected therewith. From the feed cylinder, the clay is forced into the feeding head **364** by way of a connecting conduit section **390** and a reciprocating plunger **391** in the cylinder operated by a suitable fluid pressure motor **392**.

The structure just described thus provides an enclosed clay treating system between the clay preparation system R and the feeder head **364**, to prevent contamination of the clay by foreign matter. To further prevent air entrapment in the clay, it is contemplated to vacuumize the filter chamber and the drying chamber by connecting same with a suitable vacuum source by way of valve conduits **393** and **394**, respectively, and whereby the desired degree of vacuum may be maintained therein.

The machine **67** to which the molds are next advanced is provided for use in feeding charges of a certain type of clay wherein it is desired or essential that the clay be filtered by an ordinary filter press.

While this machine could be a duplicate of the charger **65**, as seen in Figures 14 to 16, it comprises another modified form thereof with parts similar to those of the first form being designated by like reference characters having an exponent *b*.

In this form of charger, each charge puddling and reforming device **304***b* is raised and lowered into and out of engagement with a charge by a cylinder and piston type fluid motor **398** supported on the table **348***b* and having its piston rod **399** connected with the frame **323***b* carrying the device. On the piston rod may be adjustable stop collars **400** for alternate engagement with end bearings of the motor cylinder to regulate the upper and lower limits of movement of the device with respect to the charges. The motors **398** may be energized from the air pressure line **259***b* to operate the devices **304***b* at the proper time, by means similar to that employed to energize the motors **257** and **288**.

The charging cylinders **270***b* may be supplied from a clay feeding head **402** supported on the cam **327***b* and comprising a channeled arcuate

segment forming with the inner wall of a concentric upright annular wall **403** of the wheel **271***b*, a feeding chamber **404** from which the clay is fed to the cylinders by way of passages **405** continuing from said wall. While the charges are being ejected from the charging cylinders, the passages **404** may be closed, to prevent the escape of clay, by an arcuate guard extension **406** of the feeder head (Figure 15). The feeder head is mounted on the cam **327***b* by means of bolts **407** passing through elongated slots **408** in lugs **409** of the head to permit adjustment of same and guard extension thereof into sealing engagement with the wall **403**.

As seen in Figures 2 and 16, the clay to be supplied to the feeder head **402** may be derived from the clay preparation system R by way of a valved conduit **410** leading to an ordinary filter press **411** of the bag and frame type. As the filter cakes are removed from the frames of the press, they are placed on a conveniently located conveyor **412** which discharges them into the hopper of a pug mill **414**, similar to the pug mill **384** of the second form of charger, and from which the thoroughly homogenized clay is fed to the feeder head by way of means similar to that employed in association with said latter pug mill.

I claim:

1. Apparatus for feeding clay to a line of molds comprising, in combination, a stationary conduit having an outlet, an angularly movable nozzle through which clay may be fed to the molds, a clay passage for the nozzle leading back to an inlet, means for moving the nozzle in an endless circular path into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when not in register with the inlet, and means for supplying clay to said conduit.

2. Apparatus for feeding clay to a line of molds comprising, in combination, a stationary conduit having an outlet, a plurality of movable nozzles through which clay may be fed to the molds, a clay passage for each nozzle leading back to an inlet, means for moving the nozzles in an endless, circular path into and out of register with molds therebelow and the inlet of each nozzle into and out of register with the outlet, means for closing the outlet when not in register with an inlet, and means for supplying clay to said conduit.

3. Apparatus for feeding clay to a moving line of molds comprising, in combination, a stationary conduit having an outlet, a movable nozzle through which clay may be fed to the molds, a clay passage for said nozzle leading back to an inlet, means for moving the nozzle in an endless path, continuously, into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when not in register with the inlet and means for supplying clay to said conduit.

4. Apparatus for feeding clay to a line of molds comprising, in combination, a movable nozzle supported for rotation about an axis through which clay may be fed to molds therebelow, a clay passage for the nozzle leading back to an inlet which opens outwardly away from the path of travel of the nozzle, a conduit arranged externally of the path of travel of the nozzle having an outlet, means for moving said nozzle in an endless, circular path into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when the inlet is out of register therewith, and means for supplying clay to said conduit.

5. Apparatus for feeding clay to a line of molds comprising, in combination, a movable nozzle supported for rotation about an axis through which clay may be fed to molds therebelow, a clay passage for the nozzle leading back to an inlet which opens inwardly toward the center of the path of travel of the nozzle, a conduit arranged inside of the path of travel of the nozzle having an outlet, means for moving said nozzle in an endless, circular path into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the oulet when the inlet is out of register therewith, and means for supplying clay to said conduit.

6. Apparatus for feeding clay to a line of molds comprising, in combination, an angularly movable nozzle through which clay may be fed to molds therebelow, a clay passage for the nozzle leading back to an inlet, a stationary conduit having an outlet, means for rotating the nozzle in a circular path about an axis to move the nozzle in an endless, circular path into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when the inlet is out of register with the outlet, and means for supplying clay to said inlet.

7. Apparatus for feeding clay to a moving line of molds comprising, in combination, an angularly movable nozzle through which clay may be fed to molds therebelow, a clay passage for the nozzle leading back to an inlet, a stationary conduit having an outlet, means for rotating the nozzle continuously in a circular path about an axis to move the nozzle with and into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when the inlet is out of register with the outlet, and means for supplying clay to said inlet.

8. Apparatus for feeding clay to a moving line of molds comprising, in combination, a stationary conduit having an outlet, a plurality of angularly movable nozzles through which clay may be fed to the molds, a clay passage for each nozzle leading back to an inlet, means for rotating the nozzles in a circular path, about an axis to move the nozzles with, and into and out of register with molds therebelow and the inlet of each nozzle into and out of register with the outlet, means for closing the outlet when not in register with an inlet, and means for supplying clay to said conduit.

9. Apparatus for feeding clay to a moving line of molds comprising, in combination, a stationary conduit having an outlet, a plurality of angularly movable nozzles through which clay may be fed to molds therebelow, a clay passage for each nozzle leading back to an inlet, means for rotating the nozzles, continuously, about a given axis to move the nozzles with, and into and out of register with the molds and the inlet into and out of register with the outlet, means for closing the outlet between registration with the several inlets and means for supplying clay to said conduit.

10. Apparatus for feeding clay to a moving line of molds comprising, in combination, a stationary conduit having an outlet, a movable nozzle through which clay may be fed to the molds, a clay passage for the nozzle leading back to an inlet, means for moving the nozzle with, and into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when not in register with the inlet, and means for supplying clay to said conduit including a pipe to be filled with

clay and a plunger movable axially of the pipe to force clay therefrom into said conduit.

11. Apparatus for feeding clay to a line of molds comprising, in combination, a stationary conduit having an outlet, a movable nozzle through which clay may be fed to the molds, a clay passage for the nozzle leading back to an inlet, means for moving the nozzle into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when not in register with the inlet, and means for supplying clay to said conduit including a pipe to be filled with clay connected to the conduit and means for dehydrating clay.

12. Apparatus for feeding clay to a moving line of molds comprising, in combination, a stationary conduit having an outlet, a movable nozzle through which clay may be fed to the molds, a clay passage for the nozzle leading back to an inlet, means for moving the nozzle with, and into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when not in register with the inlet, and means for supplying clay to said conduit including a pipe to be filled with clay, connected to the conduit, and a pug mill connected to the pipe.

13. Apparatus for feeding clay to a line of molds comprising, in combination, a stationary conduit having an outlet, a movable nozzle through which clay may be fed to the molds, a clay passage for the nozzle leading back to an inlet, means for moving the nozzle into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when not in register with the inlet, and means for supplying clay to said conduit including a pipe to be filled with clay connected to said conduit, a pug mill connected to said pipe and a dehydrator having an outlet discharging directly into said pug mill.

14. Apparatus for feeding clay to a line of molds comprising, in combination, a stationary conduit having an outlet, a movable nozzle through which clay may be fed to the molds, a clay passage for the nozzle leading back to an inlet, means for moving the nozzle into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when not in register with the inlet, and means for supplying clay to said conduit including a pipe to be filled with clay connected to said conduit, a desiccator having a discharge outlet directly connected to said pipe.

15. Apparatus for feeding clay to a moving line of molds comprising, in combination, a stationary conduit having an outlet, a movable nozzle through which clay may be fed to the molds, a clay passage for the nozzle leading back to an inlet, means for moving the nozzle with, and into and out of register with molds therebelow and the inlet into and out of register with the outlet, means for closing the outlet when not in register with the inlet, and means for supplying clay to said conduit including a pipe to be filled with clay connected to said conduit, a pug mill directly connected to said pipe, and a conveyor for delivering filter cakes to said pug mill.

16. Apparatus for feeding clay to a moving line of dinnerware molds comprising, in combination, a support for carrying molds through a feeding zone, a plurality of nozzles above said support mounted to move therewith in register with molds therebelow, a passage for each nozzle leading back to an inlet, a source of clay supply including stationary clay conducting means, having an outlet for co-operation with the several inlets in the feeding zone, a plunger for each nozzle for ejecting clay therethrough and plunger actuating means operable to effect the discharge of clay through said nozzles in the feeding zone.

17. Apparatus for feeding clay to a moving line of dinnerware molds comprising, in combination, a support for carrying molds through a feeding zone, a plurality of nozzles above said support mounted to move into and out of register with molds therebelow, a passage for each nozzle leading back to an inlet, a clay feeding head adjacent the line of travel of the nozzles having an outlet, means for moving said nozzles to bring the inlet of each nozzle, successively into register with the outlet, a pipe connected to the clay feeding head having a passage leading back to an inlet, a chamber connected to said last named inlet, means in said chamber for progressing clay therefrom into said pipe, and a plunger movable axially of said pipe for forcing clay therefrom into said clay feeding head.

18. Apparatus for feeding clay to a moving line of dinnerware molds comprising, in combination, a support for carrying molds through a feeding zone, a plurality of nozzles above said support mounted to move therewith in register with molds therebelow, a passage for each nozzle leading back to an inlet, a source of clay supply including stationary clay conducting means having an outlet for co-operation with the several inlets in the feeding zone, a plunger for each nozzle for ejecting clay therethrough, plunger actuating means operable to effect the discharge of clay through said nozzles in the feeding zone and mold lifters below said support operable to raise molds therefrom up to the nozzles in timed relation with the operation of said plunger.

19. Apparatus for feeding clay to a moving line of molds comprising a plurality of nozzles through which clay may be fed to molds therebelow, means for continuously moving the nozzles in a closed path, a stationary clay container formed with an outlet arranged to discharge clay into said nozzles at a given location in their path of travel, means for sealing the outlet against leakage of clay between nozzle filling operations and means for applying pressure to the clay in said container to effect the discharge thereof into said nozzles.

20. Apparatus for feeding clay to a moving line of molds comprising a plurality of nozzles through which clay may be fed to molds therebelow, means for continuously rotating said nozzles about a center point, and a stationary clay container, curved as the path of travel of the nozzles formed with a discharge outlet through which clay is supplied to said nozzles at a given location in their path of travel.

21. Apparatus for feeding clay to pottery molds comprising, a support for carrying molds through a clay feeding zone, a clay feeder in said zone including a plurality of clay discharge nozzles rotatable about a common axis, each nozzle having a clay passage leading back to an inlet, a stationary clay supplying member having an outlet positioned so as to register with each inlet during a predetermined number of degrees of rotation about the axis, and conveying means for carrying empty molds to said support and for removing charged molds therefrom.

22. Apparatus for feeding clay to pottery molds comprising, a support for carrying molds through a clay feeding zone, a clay feeder in said zone including a plurality of clay discharge nozzles ro-

tatable about a common axis, each nozzle having a clay passage leading back to an inlet, a stationary clay supplying member formed with an elongated outlet extending for several degrees of rotation of the discharge nozzles and positioned so as to register with each inlet during a predetermined number of degrees of travel about the axis, and conveying means for carrying empty molds to said support and for removing charged molds therefrom.

23. Apparatus for feeding clay to pottery molds comprising, a plurality of clay discharge nozzles rotatable about a common axis, a mold lifter below each nozzle and movable therewith, a clay passage for each nozzle leading back to an inlet, a stationary clay supplying member having an outlet adapted to register with the inlet for each nozzle means for sealing each inlet relative to the outlet when in register and drive means for rotating said nozzles and supports about said axis.

24. Apparatus for feeding clay to pottery molds comprising, a plurality of clay discharge nozzles rotatable about a common axis, a mold lifter below each nozzle and movable therewith, a clay passage for each nozzle leading back to an inlet, a stationary clay supplying member having an outlet adapted to register with the inlet for each nozzle, means for sealing each inlet relative to the outlet when in register and drive means for continuously rotating said nozzles and supports about said axis.

25. Clay feeding apparatus comprising, a clay discharge nozzle, means for angularly moving said nozzle with, and into and out of register with a traveling mold therebelow, a clay passage for said nozzle leading back to an inlet, a stationary clay supplying member having an outlet adapted to periodically register with said inlet, fluid pressure operated means for forcing clay through the outlet into said inlet when the two are in register and a valve for controlling the operation of said fluid pressure operated means.

26. Apparatus for feeding clay to a moving line of molds comprising, in combination, a stationary conduit having an outlet, a movable nozzle through which clay is fed to molds, a clay passage for the nozzle leading back to an inlet, means for moving the nozzle with, and into and out of register with molds therebelow and the inlet into and out of register with the outlet, and means for supplying clay to said conduit.

27. Apparatus for feeding clay to pottery molds comprising, a mold charging means having a clay passage leading back to an inlet, a clay dryer employing hot air as the drying medium having an outlet in closed communication with said inlet and means for forcing dried clay from the dryer through the outlet into the inlet.

28. Apparatus for feeding clay to pottery molds comprising, a mold charging means having a clay passage leading back to an inlet, means for forcing clay through said passage, a clay dryer employing hot air as a drying medium having an outlet in closed communication with said inlet and power driven means for forcing clay from said dryer through the outlet into the inlet.

29. Apparatus for feeding clay to pottery molds comprising a mold charging means having a clay passage leading back to an inlet, means for forcing clay through said passage, a clay dryer employing hot air as a drying medium having an outlet in closed communication with said inlet and rotatable, power driven means for forcing clay from said dryer through the outlet into the inlet.

30. Apparatus for feeding clay to pottery molds comprising, a mold charging means having a clay passage leading back to an inlet, a plunger for forcing clay through said passage, a clay dryer employing hot air as a drying medium having an outlet in closed communication with said inlet and power operated means for forcing clay through said outlet into said inlet.

31. Apparatus for feeding clay to pottery molds comprising, mold charging means having a clay passage leading back to an inlet, a pug mill having an outlet connected to said inlet, and an opening through which clay is received and a clay dryer arranged to discharge clay through the opening into the pug mill.

32. Apparatus for feeding clay to pottery molds comprising, mold charging means having a clay passage leading back to an inlet, a power driven pug mill having an outlet connected to said inlet, a plunger for forcing clay received from the pugmill through the passage, and a clay dryer arranged to discharge clay directly into said pug mill.

33. Apparatus for feeding clay to pottery molds comprising, mold charging means having a clay passage leading back to an inlet, a pug mill having a discharge outlet connected to the inlet, means for forcing clay from the pug mill through the passage and a continuously operating clay dryer arranged to discharge clay directly into said pug mill.

34. Apparatus for feeding clay to pottery molds comprising, means for charging molds having a clay passage leading back to an inlet, a pug mill having a discharge outlet connected to the inlet, means for forcing clay from the pug mill through the passage and a clay dryer having an endless member from which dried clay is removed arranged with the removal zone in register with the feed opening of the pug mill.

35. Apparatus for feeding clay to pottery molds comprising, a source of supply of liquid slip, a feed nozzle through which plastic clay is fed to molds therebelow in closed communication with the source of liquid slip and means operable upon the liquid clay between the source and the outlet for extracting moisture from the slip and reducing the same to plastic consistency suitable for jiggering.

36. Apparatus for feeding clay to pottery molds comprising, a source of supply of liquid slip, a feed nozzle through which plastic clay is fed to molds therebelow in closed communication with the source of liquid slip, means operable upon the liquid slip between the source and the outlet for extracting moisture from the slip and reducing the same to plastic consistency suitable for jiggering and means for moving the material between the source of supply to the feed outlet.

37. Apparatus for feeding clay to pottery molds comprising, a source of supply of liquid slip, a pugmill, a feed nozzle through which plastic clay is fed to molds therebelow having a passage leading back to and in closed communication with clay pugging and extruding means, a filter press in closed communication with the source of liquid slip and means for receiving plastic clay discharged from the filter press and depositing the same in the pugmill.

WILLIAM J. MILLER.

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Certificate of Correction

Patent No. 2,486,051 October 25, 1949

WILLIAM J. MILLER

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 12, for "intermedate" read *intermediate*; column 8, line 44, for the word "valve" read *valved*; line 59, for "reforming" read *preforming*; column 10, line 35, and column 13, line 50, after "with" insert a comma;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of February, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.