W. STUBBS.

APPARATUS FOR CASTING HOLLOW AND OTHER WARES OF CHINA AND OTHER MATERIALS.

APPLICATION FILED MAR. 11, 1909.

**934,231.**

Patented Sept. 14, 1909.

4 SHEETS—SHEET 1.

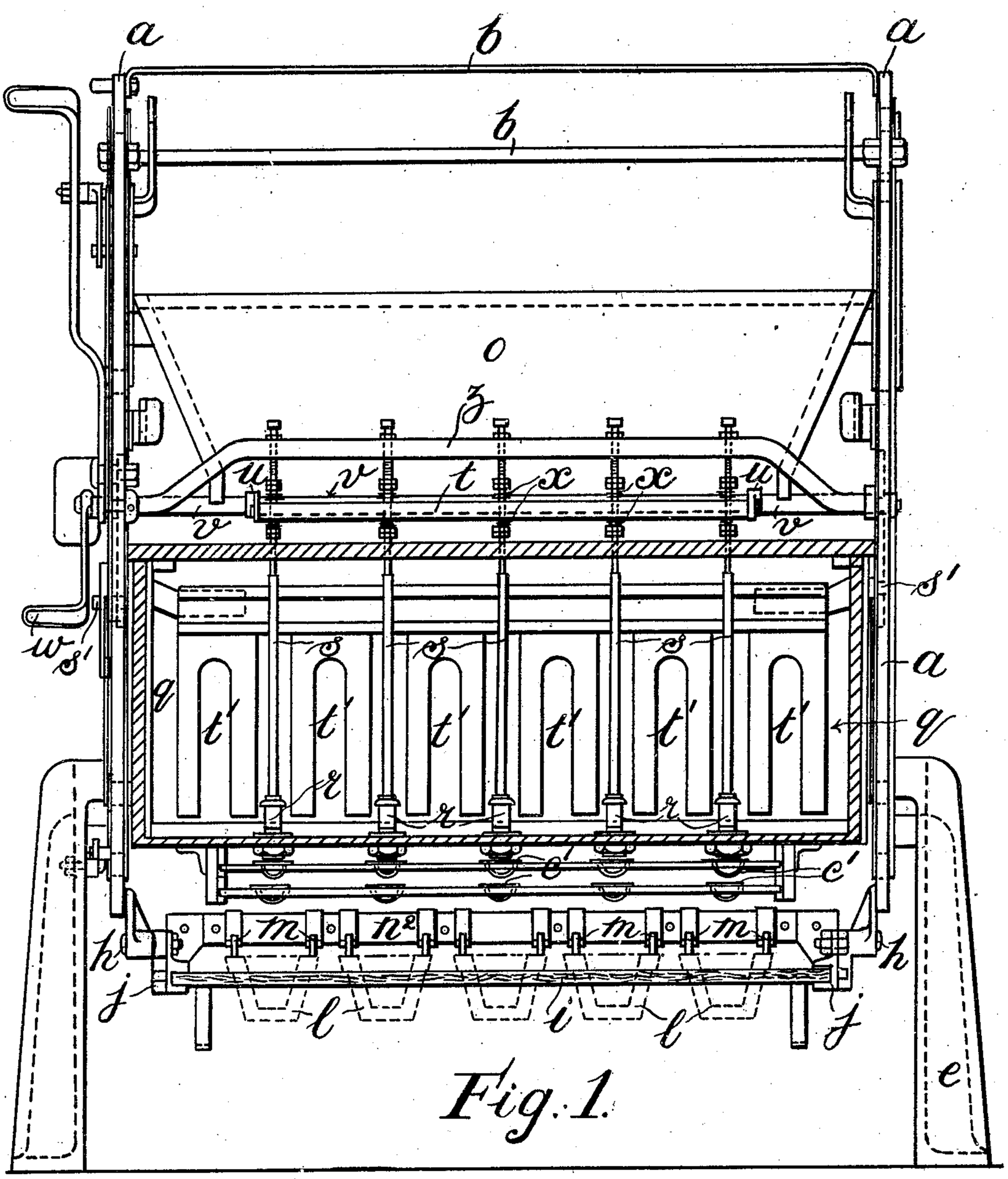


Fig. 1.

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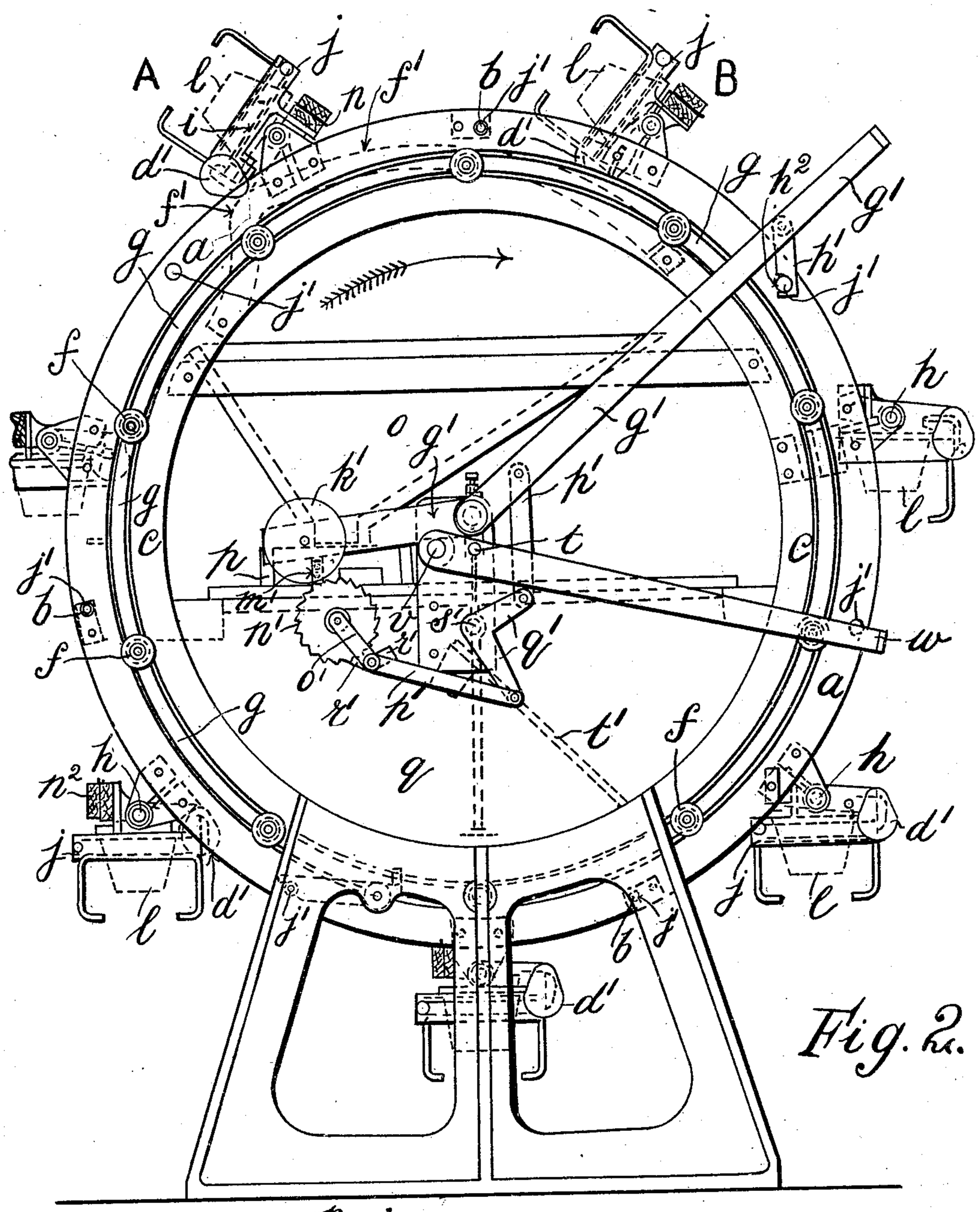


Fig. 2.

Fig. 3.

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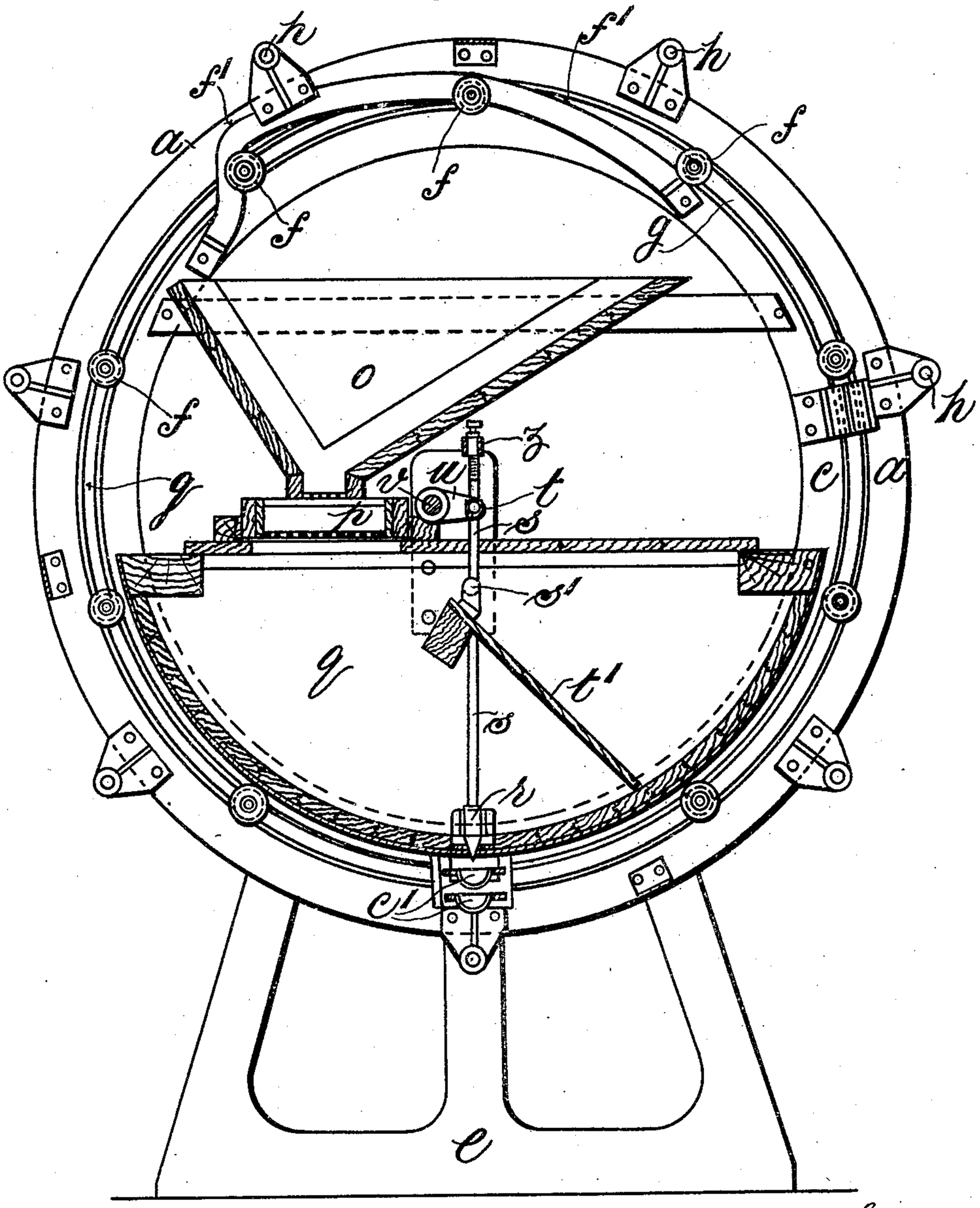
4 SHEETS—SHEET 3.

*Fig. 4.*

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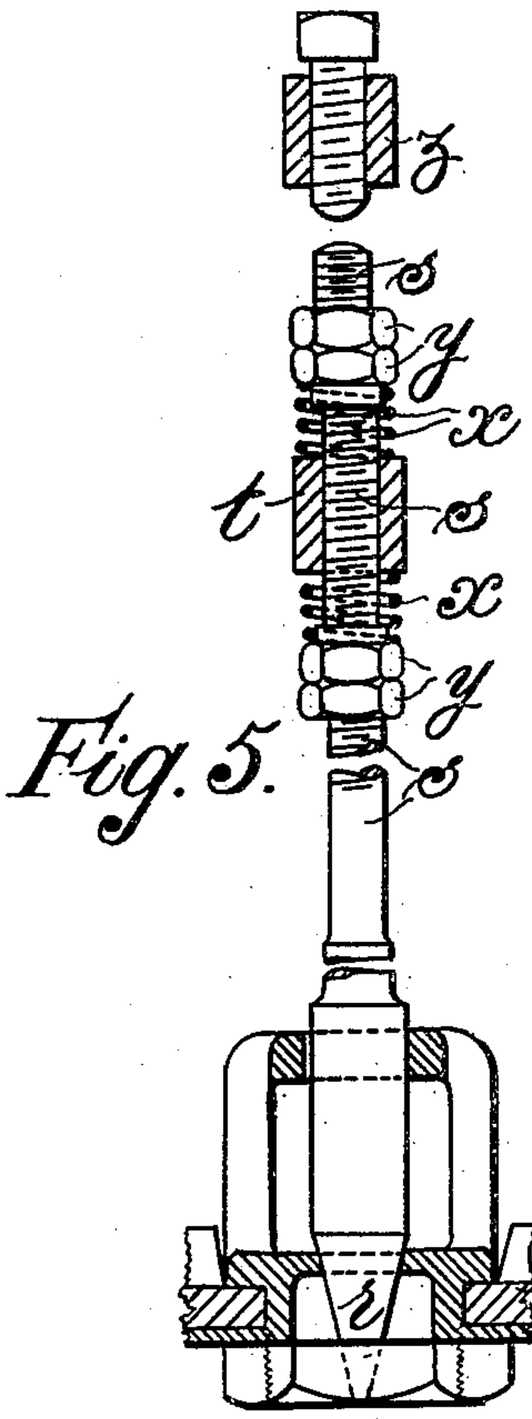


Fig. 5.

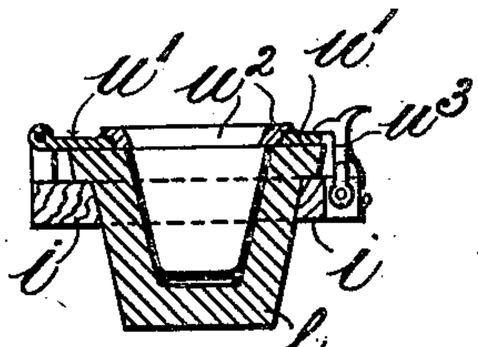


Fig. 8.

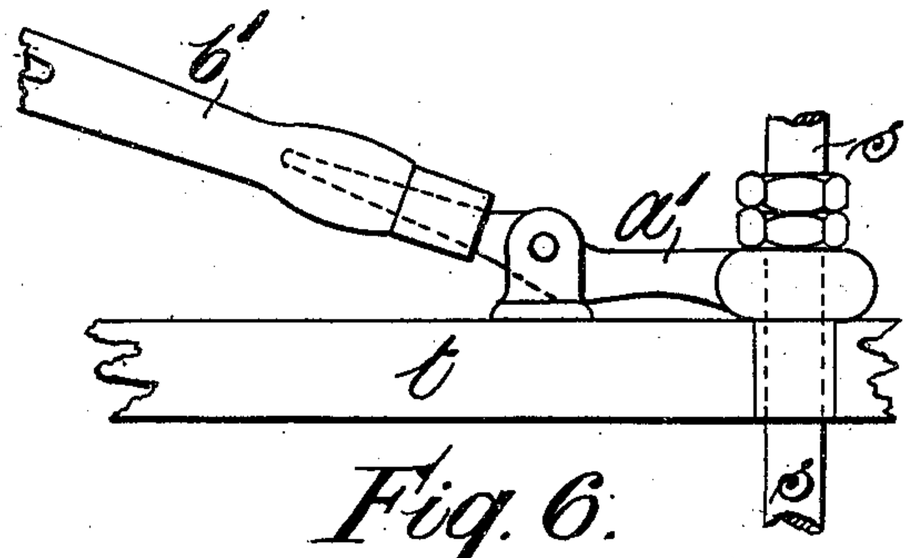


Fig. 6.

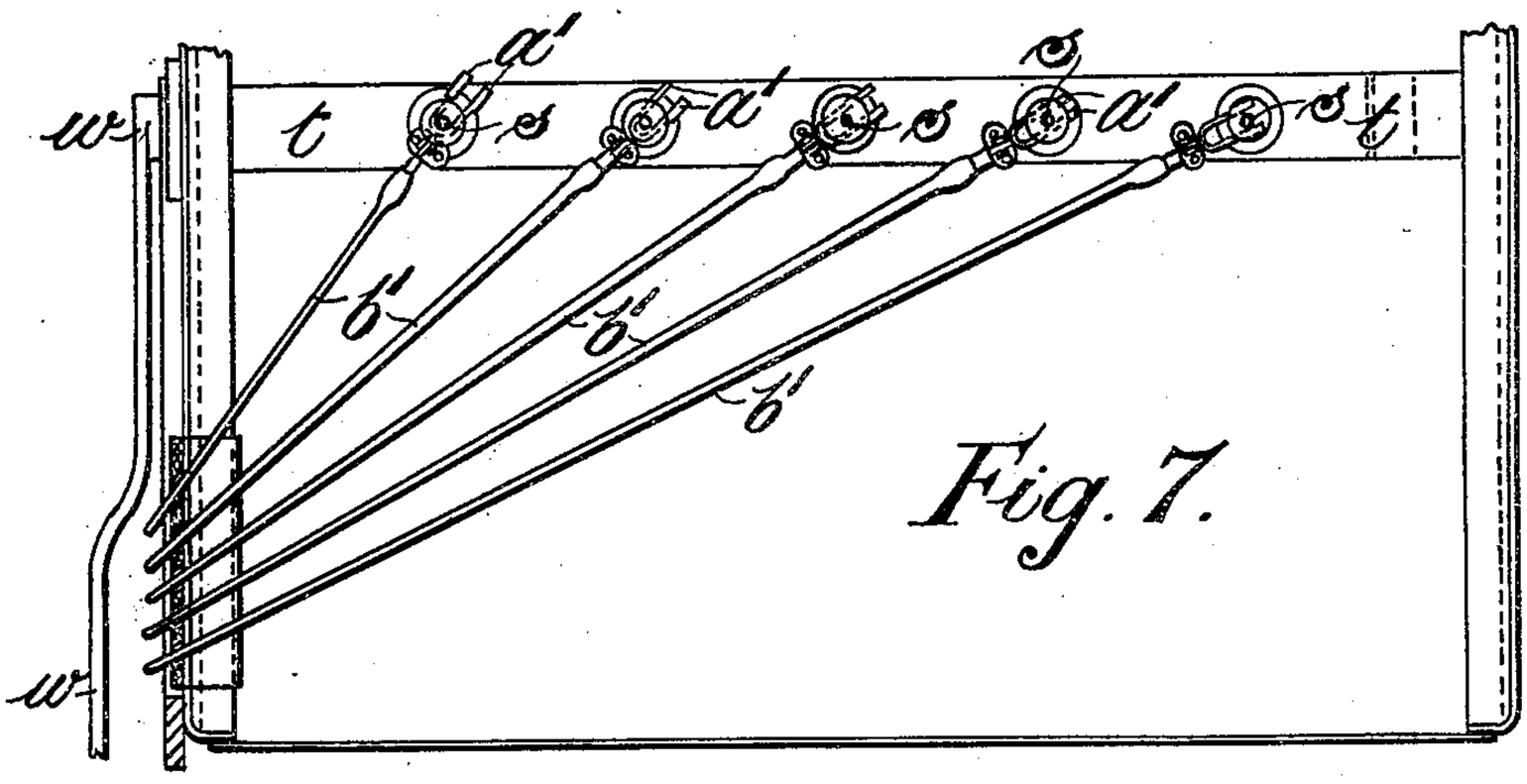


Fig. 7.

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# UNITED STATES PATENT OFFICE.

WILLIAM STUBBS, OF STOKE-UPON-TRENT, ENGLAND.

## APPARATUS FOR CASTING HOLLOW AND OTHER WARE OF CHINA AND OTHER MATERIALS.

934,231. Specification of Letters Patent. **Patented Sept. 14, 1909.**

Application filed March 11, 1909. Serial No. 482,799.

*To all whom it may concern:*

Be it known that I, WILLIAM STUBBS, a subject of the King of Great Britain and Ireland, and resident of Stoke-upon-Trent, in the county of Stafford, England, china manufacturer, have invented certain new and useful Improvements in Apparatus for Casting Hollow and other Ware of China and other Materials, of which the following is a specification.

My invention relates to an improved machine or apparatus for casting hollow pottery ware of china, porcelain, or earthenware such as cups, jugs, and similar vessels, the object being to provide a machine which is easy to operate and manipulate both in charging it with the molds in which the objects are to be cast and in removing such molds with the cast objects, a further object being to obviate the necessity for the use of pumps or the like for returning the surplus slip back to an elevated tank.

My invention consists essentially of a frame or frames adapted to be rotated about a horizontal axis, means for giving to such frame or frames, a step-by-step motion to enable the molds to be fed thereto and removed therefrom, to enable the slip to be fed to the molds and to allow the latter time to absorb sufficient of the moisture in the slip to cast the ware, means to hold the slip, means for controlling the passage of the slip from the holding means to the mold, means for holding the molds, means for tipping or turning the molds to remove the surplus slip and means for agitating the slip in the holding means.

My invention will be fully described with reference to the following drawings in which,

Figure 1 is a front elevation with part of the trough for holding the slip removed to show the internal mechanism, Fig. 2 end elevation of the machine, Fig. 3 section of the frame for holding the molds, Fig. 4 sectional end elevation of the machine, Fig. 5 sectional elevation showing a form of valve for controlling the passage of the slip from the holding tank to the molds, drawn to an enlarged scale, Fig. 6 partial side elevation showing means for operating each slip valve independently, drawn to an enlarged scale and Fig. 7 plan partly in section, of the combined means for operating the valves either simultaneously or independently and Fig. 8 view of mold detail.

In carrying out my invention I provide a suitable frame *a* preferably consisting of two end frames of circular character which are braced together by stay rods or cross rails *b* and supported upon stationary circular frames *c* such stationary frames being finally supported upon end frames *e* mounted upon a suitable bed or floor. I may interpose between the rotatable frame anti-friction bowls or rollers *f* which may be either journaled in the fixed circular frames or may have pivot pins passed through them and through links *g* so forming an endless chain of a comparatively frictionless character which can move along with the circular frames *a*, if required. In either case the bowls *f* are preferably flanged as indicated in the drawings.

Between the frames *a* I mount, on brackets, pivots *h* carrying mold boxes, frames or troughs *i* which are adapted to always retain by gravitation a horizontal position about such pivots during the greater portion of the rotation of the frame *a* of the apparatus. The mold boxes or frames, each, preferably, consist of a board capable of being slid in and out of channel brackets *j*, in which they can be retained in normal working position by turn catches *k*.

*l* indicates molds which are made of porous plaster or a plaster or material of an absorbent character, as will be well understood by potters. Any suitable number of molds may be arranged in each board or plate and may be secured in position by rubber or other flexible projections which engage with the upper edges of the molds. When of rubber I prefer these projections to be in the form of rubber disks *m* carried by spring arms *n* the rear ends of which are secured to a frame $n^2$ attached to the bracket *j* carrying the mold box. The rollers bear on the upper edges of the molds and securely retain them in position but do not interfere with the insertion in and taking out of the boards carrying the molds.

The means for holding the slip consist of a chamber or trough *o* of a stationary character and suitably supported, such trough being open at the top to enable the slip to be fed thereto but particularly to allow the surplus slip, after casting, to be discharged into

it. The base or discharge side of the trough consists of a sieve through which the slip may filter into a second trough $p$ below it mounted upon the edges of the main slip trough $q$ which is secured to the stationary frame of the machine, the second trough $p$ being also provided with a sieve to enable the slip to be filtered prior to its final discharge into the bottom trough. These three troughs virtually form the whole of the slip-holding means and are in reality one chamber with sieve devices to filter the slip. At its lower side the bottom trough is provided with a number of valves $r$ corresponding in number to that of the molds in each supporting board, these valves being designed to enable the slip to be discharged into the molds $l$, such a discharge taking place as each trough or mold frame reaches a point immediately below the slip trough of the machine. The valve seatings and valves may be of any suitable character found most effective for the purpose. In the drawings I have shown conical valves fitting into corresponding seatings secured in a liquid-tight manner at the base of the slip trough. The valves may be operated automatically during the rotation of the frame $a$ but at present I prefer to operate them by hand either all of them simultaneously or separately. For this purpose the valves are secured to rods $s$ which extend upwardly and freely through holes formed in an operating bar $t$ secured to levers $u$, the other ends of which are fixed upon a shaft $v$ one end of which carries an operating lever $w$ by which the valves can be opened or closed. On either side of the operating rod $t$ and on the valve spindles are springs $x$ adjusted by nuts $y$ so as to enable the valves to be operated in an elastic manner and enable each of them to give somewhat in case any obstruction is found in any of the valve seatings. Above the bar $t$ is a second fixed bar $z$ carrying set-screws which form steps and determine the upward stroke or lift of the valve spindles. By the arrangement described the whole of the valves can be operated simultaneously so as to allow the slip to pass into the porous molds. As, for many reasons, the valves may not allow of the slip to flow in equal quantities in the same time it is desirable to provide means to enable each valve to be operated independently so that it may be closed when the particular mold it is used in connection with is quite full or to be opened to enable a little more slip to be passed into the mold when the latter is not quite full. For this purpose the arrangement shown in Figs. 6 and 7 is employed. That is to say, I employ a lever $a^1$ pivoted to the rail or frame through which the valve spindles are passed namely to the bar $t$. One end of each lever is forked to pass under one of the nuts on each valve spindle while the other end is extended in the form of a long arm $b^1$ which, as will be seen from Fig. 7, passes toward the side of the machine near to the lever $w$ which operates all the valves simultaneously. Each arm $b^1$ may be normally held in a raised position by a spring. By depressing the long arm of each lever each valve can be opened while on releasing the lever the valve automatically closes. Immediately below the valves and preferably at the exterior of the slip trough I arrange in a fixed frame one or a plurality of series of sieves $c^1$ through which the slip is again filtered just prior to its discharge into the molds.

The rotation of the main frame $a$ of the apparatus is, preferably, an intermittent one to allow of the insertion and withdrawal of the mold frames $i$ from the brackets supporting them and also to enable the requisite quantity of slip to be passed into the molds, as hereinbefore described, and, further, to allow time for the molds to absorb a portion of the moisture from the slip to form a layer of clay prior to the discharge of the surplus slip back again into the upper slip trough $o$. In order to effect such discharge the brackets $j$ are each provided with an extending arm $d^1$ adapted to come in contact with a stationary projection preferably in the form of a fixed cam surface $f^1$, anti-friction rollers or bowls being carried by the arm if necessary for ease of movement. The engagement of the parts referred to causes the mold frame to be tilted in the manner shown in the upper portion of Fig. 2, so that the slip runs out of the molds into the slip trough $o$ and after passing the projection $f^1$, the mold frames each right themselves to the horizontal position as shown in the center and bottom sides of Fig. 2.

The intermittent motion of the main frame $a$ may be effected by suitable means, such means being designed to rotate the frame a predetermined portion of a revolution at each stroke. In order to effect this I employ simple means consisting of a lever $g^1$ the rear end of which is pivoted to a suitable stationary part of the supporting frame while its free end extends forward toward the front of the machine and has pivoted to it a pawl $h^1$ adapted to engage with studs or projections $j^1$ on the frame $a$ thus forming a ratchet device. The lever $g^1$ is shown at Fig. 2 in its highest or top position with the pawl $h^1$ engaging with one of the studs $j^1$, so that when the lever $g^1$ is pulled down, the mold carrying frame $a$ is partly rotated. The lower end of the pawl $h^1$ is notched at $h^2$ to engage with one of the studs $j^1$ on the rotatable mold carrying frame $a$. When the frame $a$ has been partly rotated or moved one step, the pawl $h^1$ is caused by its own weight to leave the stud $j^1$ when the lever $g^1$ and pawl $h^1$ are free to move upward in their highest position the latter to

again engage with another stud $j^1$ to enable the frame to be moved another step. By this means a step by step motion is given to the mold carrying frame. The lever may be counter-weighted at the opposite side of its center as at $k^1$, the weight being preferably adjustable or a spring may be employed to return the lever to the top position. Each movement of the lever brings a mold frame to the lowermost position directly beneath the axis of the frame $a$ and in correct position to enable the molds to receive the slip as before described. The movement of the lever $g^1$ is taken advantage of to simultaneously effect a vibratory movement of the sifting trough $p$ which, for this purpose, is provided with a projecting arm $m^1$ adapted to normally rest on the teeth of a ratchet wheel $n^1$ journaled on a stud secured to the side of the main slip trough $q$, the boss of such ratchet wheel having mounted on it a lever $o^1$ connected by links $p^1$ to the arms of a bell crank lever $q^1$, the uppermost link being, in turn, coupled to the operating lever $g^1$. The movement of the latter and the links connected to it operates a weighted and pivoted pawl $r^1$ to rotate the ratchet wheel $n^1$ thus vibrating the trough $p$ by giving it an up and down motion such as will effect the movement of and filtering of the slip. The movement of the lever $g^1$ also effects a further operation namely the agitation of the slip in the bottom trough $q$. To this end the bell crank lever $q^1$ is secured to the end of a shaft $s^1$ journaled in the ends of the trough $q$, to which is secured a number of arms $t^1$. These arms are given a reciprocatory motion forward and backward in the slip trough so as to keep the slip in a constantly agitated condition to prevent the heavier ingredients or sediment settling.

At a suitable point after the discharge of the surplus slip, the rough upper edge of each cast vessel may be automatically removed by a revolving scraper device suitably supported and driven, or such rough edges may be removed in the ordinary way well known to potters either prior to the mold frames being removed from the machine or immediately after. Or I may employ instead of the rubber disks carried by spring arms as hereinbefore described for keeping the molds in the frames, a hinged cover $u^1$, as indicated in Fig. 8, such cover being pivoted to the mold carrying frame. This cover is provided with a number of rings $u^2$ made of either porcelain, glass, or polished metal let into the cover $u^1$. The hole in each ring is preferably counter-sunk and is in axial line with the mold, the bottom portion of the cover or ring resting snugly on the top of the mold and forming a tight joint therewith. A spring catch $u^3$ may be employed to hold the cover in position thus the molds may be filled quite to the top or a little above the bottom side of the rings $u^2$, the latter forming a finished edge to the cast ware. When the mold frames are removed from the machine the covers $u^1$ are first turned up out of the way and any surplus slip removed from them, though usually such slip runs away when the mold frames are tilted as hereinbefore described.

The operation of the machine is as follows:—Filtered slip is run into the bottom trough $q$, the slip valves being meanwhile closed. The revoluble frame $a$, together with the pivoted mold-carriers $i$ and molds $l$, is revolved step by step, and when one mold-carrier arrives at the bottom of the machine under the slip valves, the latter are lifted to allow the slip to pass to and fill the molds. This being done the valves are closed again and the frame $a$ again moved forward so as to bring another set of molds beneath the valves. This operation is effected in connection with each series of molds and by the time each set of molds reaches position A, Fig. 2, the mold frame is tilted so as to discharge the surplus slip into the upper trough through which it may pass to the filtering devices and back again into the bottom trough for re-use. The entire discharge of slip is effected by the time each series of molds reaches position B, when each mold frame on the next movement rights itself to the horizontal position and by the time further movement is effected to bring it to the starting point the mold frame with the cast ware is removed and a frame with empty molds substituted when the same cycle of operations is gone through. The complete movement of the frame $a$ from the point at which the molds are filled with slip to the point at which the surplus quantity of the latter is discharged is timed to enable the requisite absorption of moisture to take place to form the requisite thickness of ware.

I would have it understood that the machine may be driven by power to effect the requisite step-by-step motion to enable the operations referred to, to be effected and that, a virtually continuous motion of the frame may be employed, if required, I would further have it understood that I do not confine my invention to the exact details hereinbefore described, as such may be modified without departing from the essential and characteristic features of my invention. Nor do I confine myself to the casting of hollow ware such as cups, and jugs or the like, as the machine may be employed for casting any other ware it is capable of dealing with.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a casting-machine, the combination, with a stationary support, of a revoluble frame journaled in the said support, mold-

carriers pivoted at the periphery of the said frame, and a trough for holding slip arranged inside the said frame and provided with valves for filling the molds at the lower part of the frame, said trough being arranged to receive the surplus slip from the molds when the said mold-carriers are tilted over at the upper part of the frame.

2. In a casting-machine, the combination, with a stationary support, of a revoluble frame journaled in the said support, mold-carriers pivoted at the periphery of the said frame, a trough for holding slip arranged inside the said frame and provided with discharge-valves for filling the molds at the lower part of the frame, and trip-mechanism for tilting the mold-carriers automatically at the upper part of the frame to permit the surplus slip to run from the molds into the said trough.

3. In a casting machine, the combination, with a stationary support, of a revoluble frame journaled in the said support, mold-carriers pivoted at the periphery of the said frame, ratchet-mechanism provided with an operating-lever for revolving the said frame step by step, and a trough for holding slip arranged inside the said frame and provided with valves for filling the molds at the lower part of the frame and receiving surplus slip from the molds when the mold-carriers are tilted over at the upper part of the frame.

4. In a casting-machine, the combination, with a stationary support, of a revoluble frame journaled in the said support, mold-carriers pivoted at the periphery of the said frame, a trough for holding slip arranged inside the said frame and provided with discharge-valves for filling the molds at the lower part of the frame, and agitating devices arranged in the said trough and provided with driving mechanism which operates them automatically as the said frame is revolved.

5. In a casting-machine, the combination, with a stationary support, of a revoluble frame journaled in the said support, mold-carriers pivoted at the periphery of the said frame, a trough for holding slip arranged inside the said frame and formed of superposed sections one of which is movable and provided with a filtering screen, and driving devices for oscillating the movable section of the trough as the said frame is revolved.

In testimony whereof I have hereto set my hand in the presence of two witnesses.

WILLIAM STUBBS.

Witnesses:

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JOHN H. COPESTAKE.