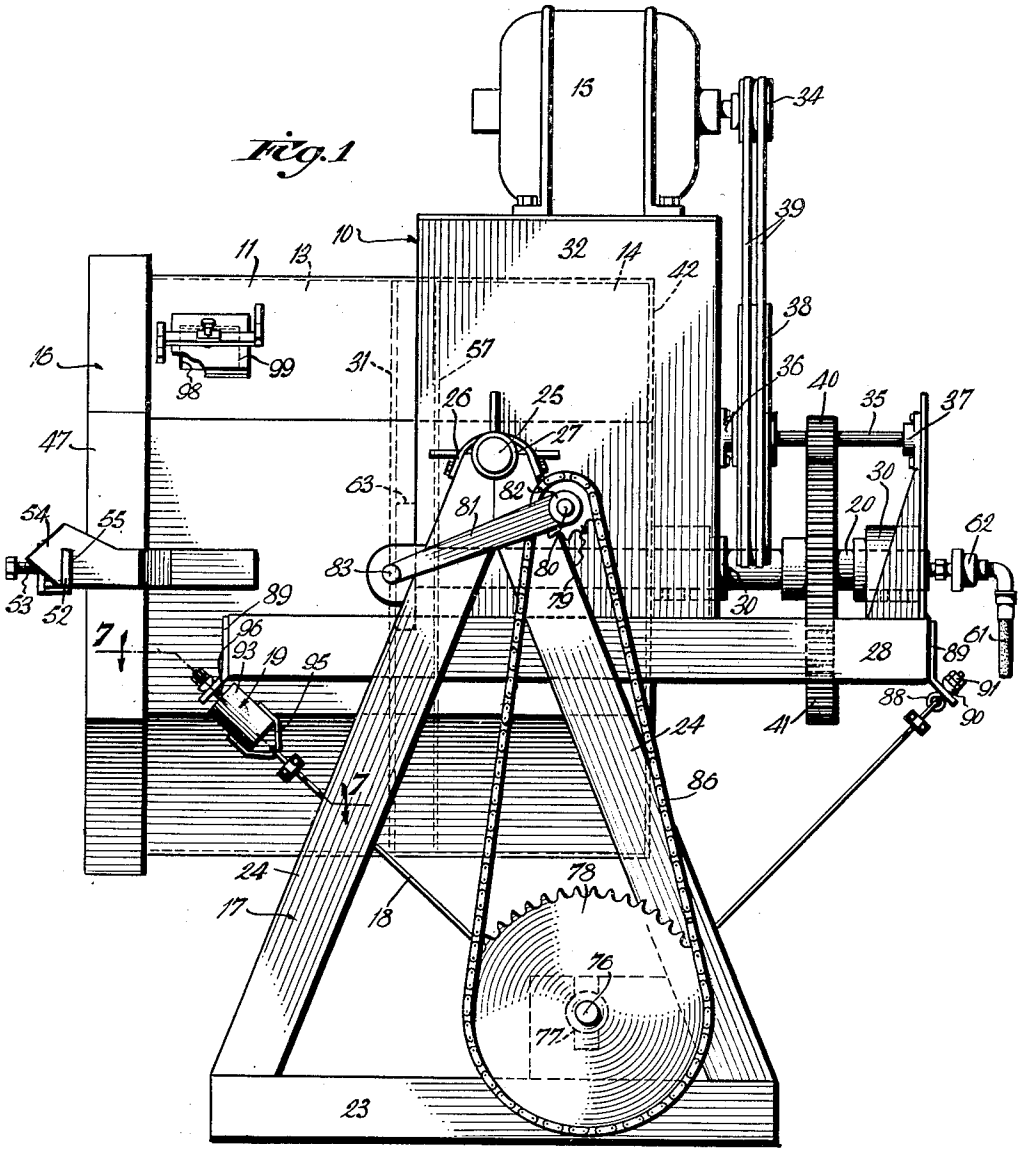
May 24, 1938. N. RANSOHOFF 2,118,227

TUMBLING MILL

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Fig. 1



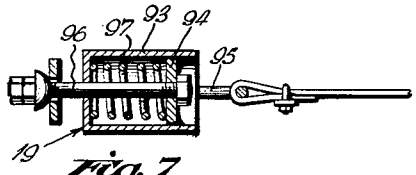




Fig. 7

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Fig. 2

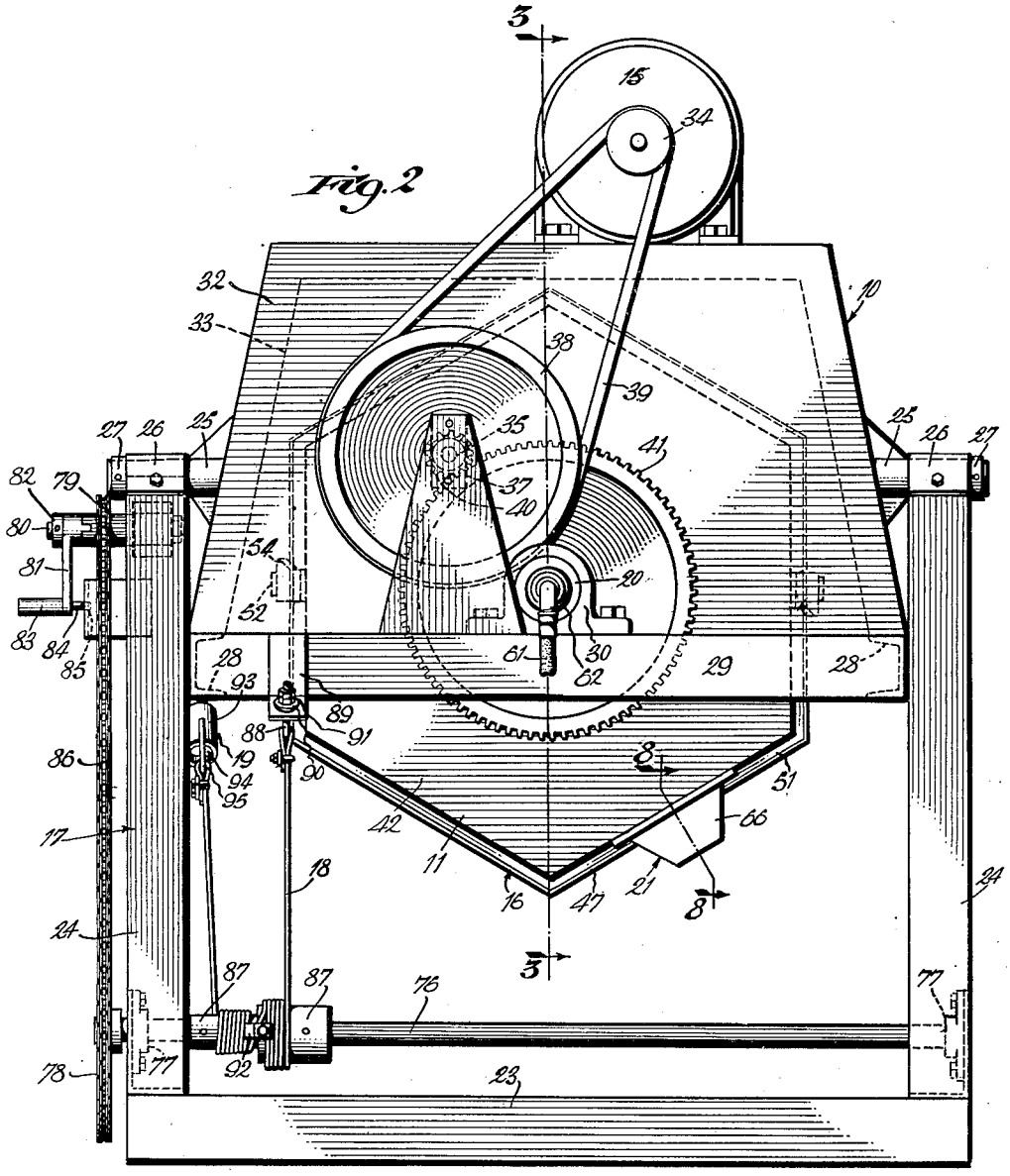
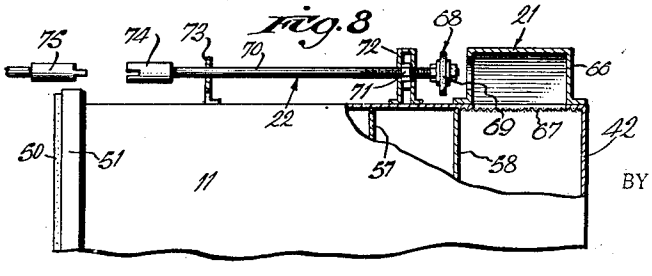



Fig. 3




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TUMBLING MILL

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Fig. 3

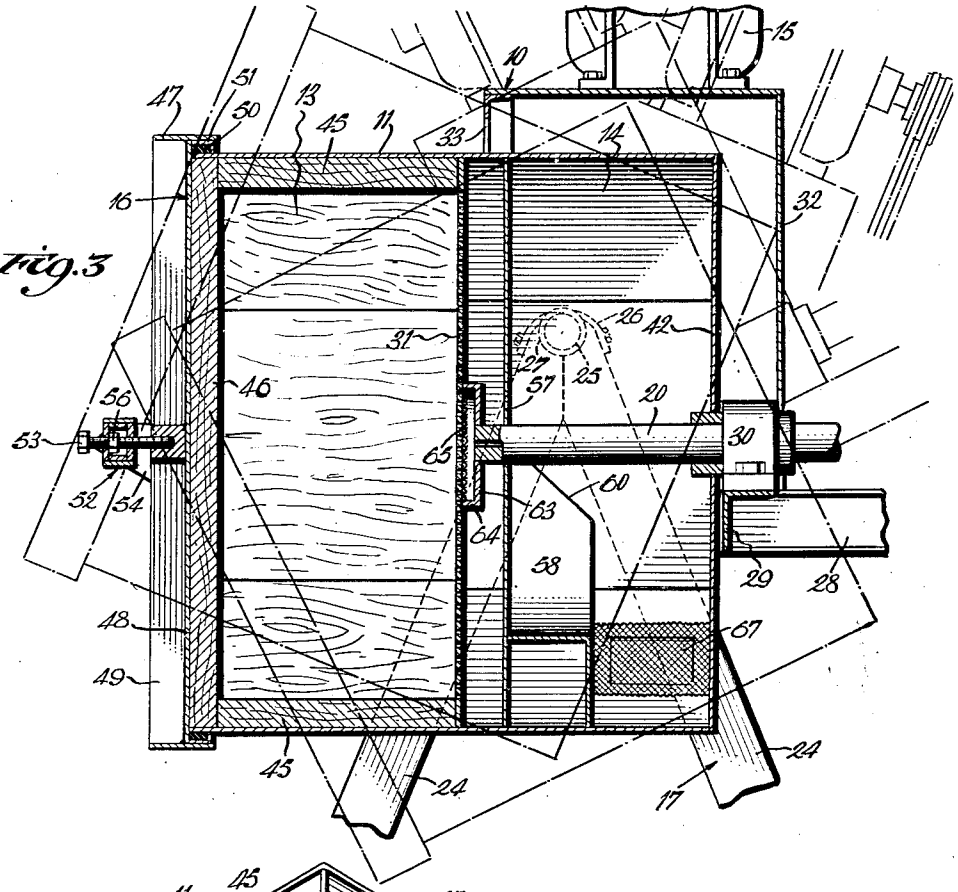
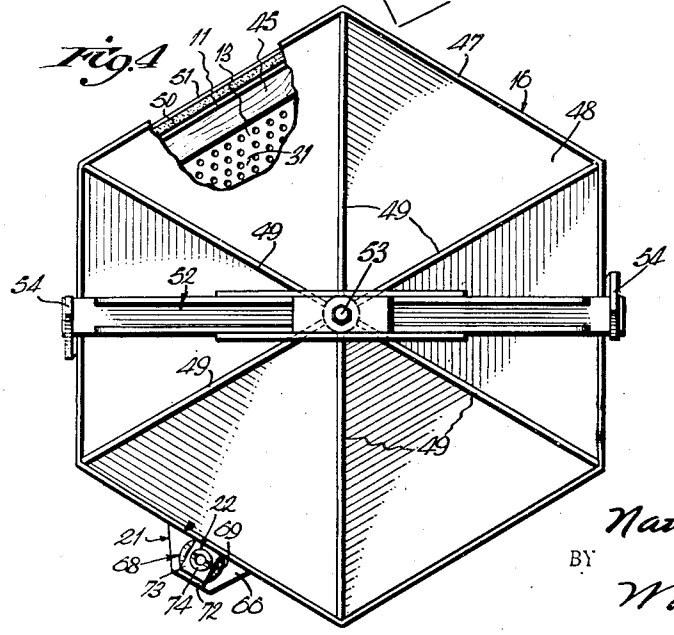



Fig. 4




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Fig. 5

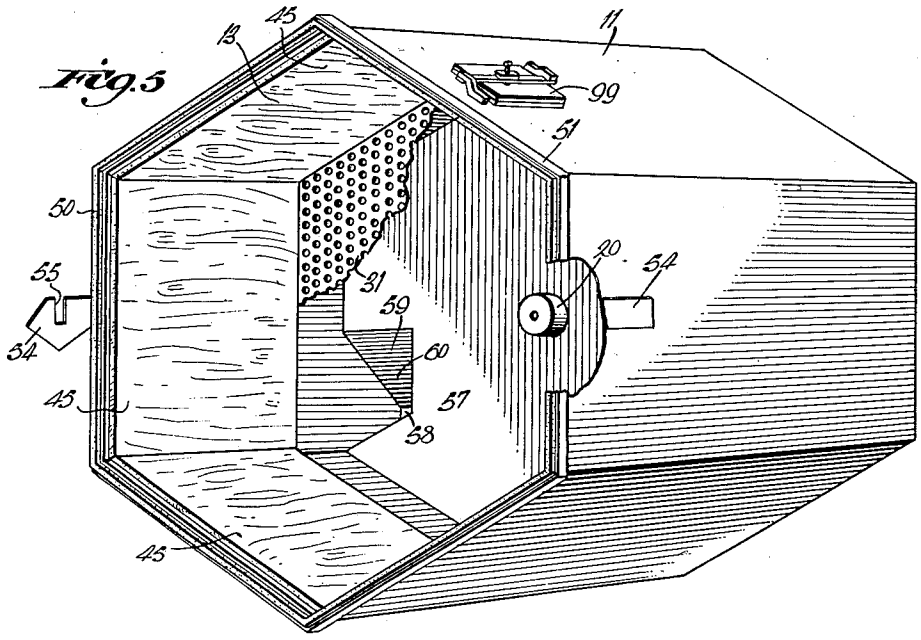
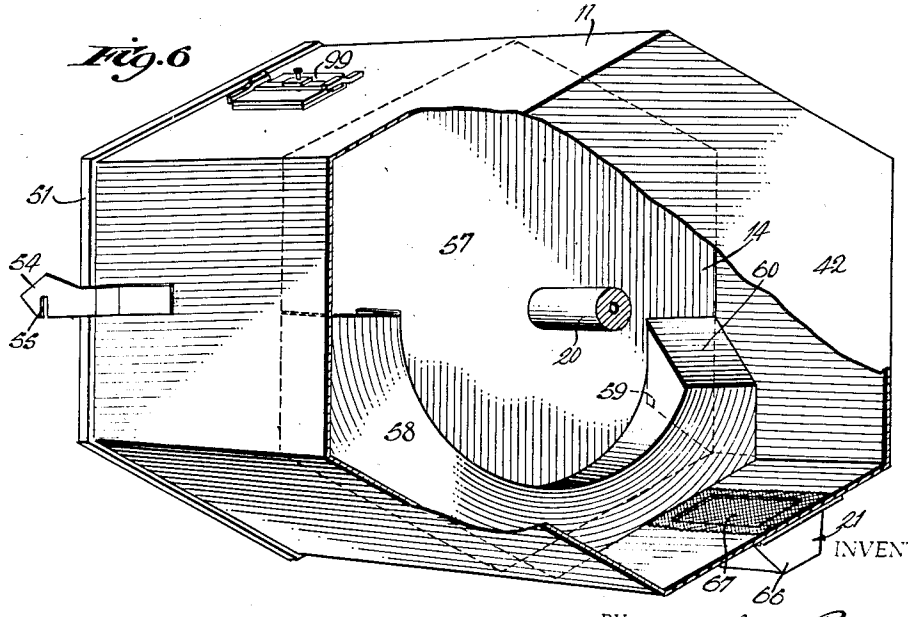



Fig. 6




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Patented May 24, 1938 2,118,227

# UNITED STATES PATENT OFFICE

2,118,227

## TUMBLING MILL

Nathan Ransohoff, Cincinnati, Ohio

Application June 26, 1935, Serial No. 28,495

13 Claims. (Cl. 51—164)

This invention relates to apparatus for cleaning or burnishing objects such as castings, and is particularly directed to a tumbling mill of the character utilizing burnishing or abrading elements and/or cleaning or polishing material in a tumbling barrel or cylinder. This type of mill includes chambers for the castings or elements to be cleaned or burnished and the abrading or burnishing elements respectively with appropriate means for co-mingling the abrading or burnishing elements with the castings or other objects to be tumbled and burnished and separation of the same at will after a given tumbling operation.

It is an object of the invention to provide a tumbling mill of this character in which improved valve or separator means is provided, both for controlling the introduction of the abrading or burnishing elements into the tumbling chamber and for efficiently separating the same from the castings or cleaned objects after the burnishing or polishing operation.

It is a further object of the invention to provide a tilting mechanism for the tumbling barrel in conjunction with the aforesaid control means for aiding in the operations of introducing the abrading elements and separating the cleaned and polished objects and abrading or burnishing elements, which tilting means is also useful in dumping or discharging the product from the apparatus after the abrading elements have been separated, and which tilting means is effective for these purposes in conjunction with the rotation of the tumbling barrel.

It is a further object of this invention to provide, in conjunction with the tilting mechanism of the tumbling mill, an efficient stabilizing means for the tumbling barrel, whereby the tumbling barrel is accurately and firmly maintained in tilted or horizontal position and in conjunction with which a convenient operating means for the tilting mechanism is employed.

It is a still further object of the present invention to provide an efficient closure means for the tumbling chamber which has the advantages, of quick release for permitting discharge of the finished product and, of positive clamping and sealing action.

It is a still further object of the invention to provide a novel means for introducing the cleaning or polishing liquid into the tumbling chamber and an effective and easily controlled drainage means in conjunction therewith for discharging the liquid from the tumbling chamber and the apparatus after the completion of the tumbling operation.

Other objects and certain advantages will be more fully apparent from a description of the accompanying drawings, in which:

Figure 1 is a side view of the complete tumbling mill.

Figure 2 is an end view looking at the power end of the mill.

Figure 3 is a sectional view taken on line 3—3, Fig. 2, showing the interior construction of the tumbling cylinder and showing the tilted positions for dumping the castings and separating the abrading elements in dot and dash lines.

Figure 4 is a view showing the closure end of the tumbling chamber.

Figure 5 is a perspective view of the tumbling cylinder showing the closure means removed.

Figure 6 is a perspective view looking at the storage chamber for the abrading elements of the mill, a portion of the outer wall of the cylinder being broken away for illustrating the discharge chute for the abrading elements.

Figure 7 is a sectional view taken on line 7—7, Fig. 1, detailing the stabilizing or tensioning means in the barrel tilting control.

Figure 8 is a sectional view taken on line 8—8, Fig. 2, illustrating the liquid discharge outlet and control valve therefor.

Describing the apparatus in general, a tiltably mounted tumbling unit 10 is provided. This unit includes a rotatable burnishing cylinder 11 divided into two chambers 13, 14, the first of which may be referred to as a tumbling chamber and the other as an abrading element storage chamber. A reversible electric motor 15 is employed for rotating the cylinder under power. A removable head 16 is provided for the cylinder at the tumbling chamber end.

A framework 17 tiltably supports the unit 10. On this framework a tilting mechanism is supported and suitably connected to the unit by a cable 18 incorporating a device 19 for maintaining the cables in taut condition at all times. A liquid circulating system is embodied, the liquid coming through the power shaft 20 and leaving by way of a discharge spout 21 employing a valve 22.

Referring to the drawings, it will be observed that the supporting frame 17 incorporates a base element 23 and spaced standards 24, which parts may be of wood. The standards are formed of two pieces inclined toward each other and abutting at their upper ends.

This framework or support is the entire mount-

ing for the tumbling unit 10 and its operating mechanism. The tumbling unit incorporates trunnions 25 which project outwardly from its framework at each side thereof. Each trunnion rests directly on or is cradled in a groove in the upper end of the particular standard. Each is held in position against upward displacement by means of a strap 26. Abutment collars 27, 27, pinned to the extreme ends of the trunnions prevent axial movement of the trunnions on the standards.

The framework for the cylinder is thus tiltably mounted by means of trunnions. A platform 28 is included in this unit formed mainly of a peripheral channel iron beam. The platform is of general U-shape form. The arms thereof are disposed parallel with the axis of the burnishing barrel or cylinder and straddling the same. Angle iron cross beams 29 connect the side arms of the platform and provide a forwardly projected throat portion.

The supporting and driving shaft 20 is provided for the tumbling or burnishing barrel. A pair of spaced bearings 30, 30, are fixed to the top side of the platform, one on each angle iron cross beam 29. The shaft projects forwardly beyond these bearings and over the throat of the platform, The extreme inner end of the shaft is disposed against a perforated septum or partition plate 31 disposed intermediately of the length of the burnishing barrel.

The shaft is secured to the end wall of the cylinder for the purpose of the driving connection thereto. A collar $20^a$ is shrunk on the shaft and the wall is welded to the collar. The shaft also passes through and is welded as at $20^b$ to another plate hereinafter described. This with the collar $20^a$ provides spaced points of support for the cylinder.

The motive power for the tumbling barrel is provided by the reversible electric motor 15. The details of the reversing control of the motor are not disclosed since they are well understood in the art. The motor is mounted on a raised platform 32 formed of heavy sheet metal welded to the main platform of the cylinder supporting structure. The motor supporting platform is open at the forward end so as to clear the tumbling barrel. An angle iron frame 33 is provided for supporting the forward ends of the top and sides of the motor support.

The motor 15 is suitably bolted to the top plate of this structure and includes a belt pulley 34. An intermediate speed reduction shaft and gearing are provided. This shaft 35 is journalled at one end in a bracket 36 fixed to the rear wall of the motor support platform and a bracket 37 mounted on the main platform. The shaft carries a large pulley 38 driven from the motor pulley by means of belts 39 and a small pinion gear 40 which meshes with a large gear 41 fixed on the tumbling barrel shaft 20. Thus the speed ultimately delivered by the motor to the tumbling barrel is greatly reduced, being whatever speed is appropriate for efficient tumbling operations.

Referring to the details of the tumbling cylinder the following is found. The cylinder itself is formed of sheet metal and is generally hexagonal. Its rear end wall 42 is of metal and provides a complete integral closure head. The forward end of the barrel includes the removable closure head 16.

The central partition 31 divides the tumbling barrel into two chambers, one of which is the tumbling chamber, and the other of which is the abrading element storage chamber. The tumbling chamber may be wood lined, as at 45, reducing the possibility of damage to the castings or parts being polished and greatly lowering the noise attendant the operation of the mill. The removable closure head 16 is formed of a hexagonal ring 47, a steel head 48 having radial ribs 49 and a hexagonal wood liner 46. This liner is of the same general dimension as the interior of the cylinder, that is, hexagonal, and readily enters the end of the cylinder as the head is placed in position.

A sealing gasket 50 is provided around the forward end of the tumbling barrel, being held in position by means of a steel ring 51. This gasket projects outwardly a sufficient distance so as to abut or snugly engage the enclosure head when it is placed in position. As shown in Figure 3, the steel ring 47 of the closure head engages over the gasket retainer ring 51.

A locking bar 52 is disposed diametrically across the closure head being rotatively mounted on the axis of the head by means of a screw 53 loosely engaged in a plain bore in the removable head. Hooks 54 are fixed on the opposite sides of the drum or barrel, each including a notch or slots 55. These slots open in opposite directions and receive the respective ends of the locking bar when it is rotated in the appropriate direction.

The locking bar can be adjusted or spaced relative to the closure head to assure firm clamping pressure on the head when the lock bar is set. The screw passes loosely through the lock bar and threaded through a nut 56 held against rotation within the lock bar. The nut lies against the bar. By rotating the screw the nut is pressed against the bar and the screw in turn is pressed against the head firmly pressing the same against the end of the cylinder and the gasket.

In normal operation, the castings and abrading or burnishing elements, such as small metal balls, are co-mingled in the forward or tumbling chamber. When the castings are fully polished, the abrading elements may be quickly separated from the castings and returned to the storage chamber.

In conjunction with the tilting of the barrel the following mechanism is provided. When the barrel is tilted so as to raise the tumbling chamber, the balls first pass through the perforations of the septum 31 heretofore described. After they have passed through this plate they are scooped and delivered through a passageway to a storage chamber. This action is not only effected by tilting but by proper rotation of the barrel, that is, rotation in a direction reverse to the normal tumbling direction.

The scoop and passageway arrangement incorporates a second partition plate, namely 57, slightly spaced from the perforated plate 31. A tube 58 lies around the inner periphery of the storage chamber as a part of this plate extending approximately half way around the cylinder. One end of this tube is directed to an opening 59 in the plate (see Figures 5 and 6). The other end of the tube opens within the storage chamber. The first end includes a sloping end wall 60 inclined to the opening for the purpose of directing the balls into the channel or passageway.

Therefore, looking at the forward end of the tumbling cylinder, clockwise rotation of the tumbling barrel accompanied by appropriate tilting will bring about the scooping action, delivering the balls from the space between the plates into

the storage chamber. The perforated plate is heavy and forms a solid end wall for the tumbling chamber and at the same time protects the scoop mechanism. The openings permit the passage of the abrading elements only. It also causes a segregation of the balls within the space between the plates and assures efficient scooping action for returning the balls to the storage chamber. The plate with its one direction scoop prevents movement of the balls into the tumbling chamber even upon tilting of the barrel as when the castings are dumped from the tumbling chamber, with the barrel at rest, or in case the barrel is being rotated in reverse direction from the tumbling rotation.

A flushing or cleansing liquid is introduced into the tumbling chamber by way of a hose 61 connected to the outer end of the shaft by a swivel 62 which may be of any commercial form. The shaft 20 is tubular and the liquid passes through the shaft into the tumbling chamber. The inner end of the shaft includes a cup-shaped head 63 having its rim 64 abutting the perforated plate 31.

A screen 65 is fixed between the plate and the cup-shaped head of the shaft, necessitating passage of the liquid therethrough as it passes to the tumbling chamber and preventing the movement of the abrading elements or castings being cleansed against the water discharge orifice. The liquid is discharged from the tumbling chamber by the same mechanism returning the balls to the storage chamber and passes from the separating chamber by way of a discharge spout 66, the entrance to which is covered by means of a screen 67. This spout 66 includes an opening in its end wall, which opening is closed by means of a valve 68.

The valve (see Figure 8) consists of a rubber or leather disc 69 fixed on the end of a rod 70, which rod is screw-threaded through a nut 71 fixed against rotation in a bracket 72. The outer end of the rod is supported in another bracket 73 and includes a specially formed head 74 operated by a specially formed tool 75 for moving the leather disc toward and from the opening for seating the same about the periphery of the opening.

The tiltable unit 10 is rotated on its trunnions 25 for tilting purposes by means of the following mechanism. A shaft 76 is journalled at the base of the main frame in brackets 77, 77. The extended end of this shaft carries a sprocket gear 78 and a smaller sprocket gear 79 is fixed on a stub shaft 80 journalled in the standard of the frame slightly above the elevation of the axial mounting of the cylinder. A sprocket chain 86 connects the gears 78 and 79. A lever 81 is mounted on this stub shaft and is held in toothed engagement with the small sprocket by means of a collar 82 pinned on the stub shaft. The handle 83 at the outer end of the lever is slidable on its axis and carries a detent pin 84 cooperating with an aperture 85 in a plate fixed to the standard. Thus upon each rotation of the handle the tiltable unit may be set in position by means of the detent. Each rotation raises or lowers the respective ends of the tiltable unit between 2 and 3 inches.

Cable winding drums 87 are pinned to the shaft. The cable 18 is wound about these drums and has its ends secured to the respective ends of the platform 28 of the tilting unit. One end is secured by means of an eye bolt 88 passing through a plate 89 secured to the platform. A washer 90 is interposed between the nuts 91 of the eye bolt and the plate having a rounded face engaging the plate 89 to provide a flexible connection.

The cable is wound around the larger drum 87 and from the end of the larger drum is wound around the smaller drum and has its other end connected to the other end of the tiltable platform. A clip 92 is secured to the larger drum end, which clip includes offset portions engaging the endmost coils of the cable on the respective drums. Drums having different diameters are used for the reason that the pivot or trunnion center for the platform is offset in relation to the center of the unit. This is done in order to balance the tiltable unit considering it in loaded condition. Therefore, as the shaft is rotated a greater amount of cable must be wound or taken up on the one side than on the other. For this same reason and due to the fact that the cables may not wind properly each time and also for the reason that the cable must be kept taut for the purpose of stabilizing the tiltable unit in any position, the tensioning device 19 is provided. This device, besides tensioning, permits whatever lengthening of the cable may be necessary due to the fact that the ends of the unit have different arcs of travel when improper winding occurs, that is, when the coils may happen to superpose.

The tensioning device (see Figure 7) includes a cylinder 93 and a piston 94. The cylinder has an eyelet 95 at its open end to which the end of the cable is attached. The piston includes a rod 96 extending through the closed end of the cylinder and through an aperture in another attaching bracket 89 for attachment in the same manner as that of the other cable's terminal.

A coil spring 97 under compression is placed between the piston and the end of the cylinder. It will be seen that this spring maintains the cable in taut condition and yet permits stretching thereof where necessary.

An opening 98 is provided in the barrel entering the tumbling chamber and is closed by means of a cover plate 99 of the same character as that used for the main closure door 16. This opening or the open end having the removable head 16 may be used for loading or discharging, depending on the size of the objects to be tumbled.

The operation of the mill is as follows: The castings or objects to be cleaned or burnished are placed in the tumbling chamber 13 of the barrel 11 through the opening 98 provided for this purpose, or through the open end of the cylinder, the closure or head 16 being thereafter rigidly secured in position by means of the clamping bar 52. The motor is then started and is operated in a direction for turning the barrel in anticlockwise direction as viewed from the removable head end thereof. At the same time the barrel is tilted for lowering the tumbling chamber. The abrading or burnishing elements are therefore disposed toward the plate upon which the scoop is formed.

As will be apparent, the scoop is then effective for moving or transferring the burnishing or abrading elements to the tumbling chamber, the elements passing through the perforated plate. During the duration of the tumbling operation the mill may be left in this tilted position or may be operated with its axis in a strictly horizontal plane.

After completion of the tumbling operation

the barrel is tilted to lower the abrading elements storage chamber 14 and raise the tumbling chamber, and the direction of rotation is reversed. The burnishing or abrading elements can then pass through the perforated plate and be taken up by the scoop and returned to the storage chamber. After sufficient rotation in this direction for separating and returning the abrading elements, the removable head is taken from the barrel after rotation of the lock plate thereof from its latch connections and the barrel is tilted to lower the forward or tumbling chamber end for dumping the castings or objects, which have been polished, therefrom.

Having described my invention, I claim:

1. In a tumbling mill, a support frame, a tiltable unit pivotally mounted on said support frame, a tumbling barrel rotatively mounted in said tiltable unit, reversible means for rotating said tumbling barrel, said barrel including a tumbling chamber and a chamber for storing burnishing or abrading elements, tilting mechanism for positioning the tiltable unit, and valve means between said chambers, said valve means effective for separating and returning the burnishing or abrading elements to the storage chamber when the tumbling barrel is tilted and rotated in a particular direction.

2. In a tumbling mill, a framework, a tiltable unit pivotally mounted on said framework, a tumbling barrel rotatably mounted on said tiltable unit, a reversible motor for driving said tumbling barrel, an operating and stabilizing means for said tilting unit, a perforated partition disposed crosswise in said tumbling barrel and dividing the same into a tumbling chamber and storage chamber for burnishing or abrading elements, a plate spaced from the partition in the abrading element chamber including a scoop-like tube effective for scooping up and returning the burnishing or abrading elements to the storage chamber when the cylinder is tilted to lower the storage chamber and rotation of the cylinder is in the direction for operating the scoop.

3. In a tumbling mill, a supporting frame, a tiltable frame pivotally mounted on said supporting frame, a tumbling cylinder rotatably mounted on said tiltable frame, a reversible motor for driving said cylinder, said cylinder divided into a tumbling chamber and a storage chamber for burnishing or abrading elements, and means between said chambers for separating and returning the burnishing or abrading elements to the storage chamber when the cylinder is rotated in one direction, and delivering the burnishing or abrading elements to the tumbling chamber when the cylinder is rotated in the other direction.

4. In a tumbling mill, a supporting frame, a tumbling cylinder rotatably mounted on said frame, a reversible motor for driving said cylinder, said cylinder divided into a tumbling chamber and a storage chamber for burnishing or abrading elements, and means between said chambers for separating and returning the burnishing or abrading elements to the storage chamber when the cylinder is rotated in one direction, and delivering the burnishing or abrading elements to the tumbling chamber when the cylinder is rotated in the other direction.

5. In a tumbling mill, a supporting frame, a tiltable frame pivotally mounted on said supporting frame, a tumbling cylinder rotatably mounted on said tiltable frame, a motor for driving said cylinder, said cylinder divided into a tumbling chamber and a storage chamber for the burnishing or abrading elements, and means between said chambers for separating and returning the abrading elements to the storage chamber when the cylinder is tilted in one direction, and delivering the burnishing or abrading elements to the tumbling chamber when the cylinder is tilted in the other direction.

6. In a tumbling mill, a rotatably mounted cylinder, reversible means for driving said cylinder, said cylinder including a perforated septum intermediate its ends and crosswise to its axis, a second plate slightly spaced from the first including a conveyer tube disposed peripherally interiorly of the cylinder on the outer side of the plate away from the perforated plate and communicating with the space between the plates at one end and with the outer side of the plate at the other end, said plates dividing said cylinder into a tumbling chamber and a storage chamber for burnishing or abrading elements respectively and said conveyer tube effective for transferring the burnishing or abrading elements from one side of the plate to the other dependent on the rotation of the cylinder.

7. In a tumbling mill, a rotatably mounted cylinder, a reversible means for driving said cylinder, said cylinder including a perforated plate intermediate its ends, a conveying tube disposed peripherally interiorly of the cylinder at one side of the perforated plate, said plate dividing said cylinder into a tumbling chamber and a storage chamber for burnishing or abrading elements respectively, and said conveyer tube effective for transferring the burnishing or abrading elements from one side of the plate to the other dependent on the rotation of the cylinder.

8. In a tumbling mill, a rotatably mounted cylinder, reversible means for driving said cylinder, said cylinder including a perforated plate intermediate its ends, a conveying tube disposed peripherally interiorly of the cylinder at one side of the perforated plate, said plate dividing said cylinder into a tumbling chamber and a storage chamber for burnishing or abrading elements respectively, said conveyer tube effective for transferring the abrading elements from one side of the plate to the other dependent on the rotation of the cylinder, and means for tilting said cylinder for assisting in the transfer of the burnishing or abrading elements to and from the chambers.

9. In a tumbling mill, a rotatably mounted closed cylinder, said cylinder including a tumbling chamber and a storage chamber for burnishing or abrading elements, a shaft mounted and fixed to said cylinder for rotating the same, a passageway extending through said shaft and entering the tumbling chamber, a connection for delivering liquid through said passageway, a valve controlled outlet spout for the cylinder, said spout including a screen for preventing discharge of the abrading elements, a conveyer tube disposed circumferentially inside of the cylinder and connecting the tumbling chamber and storage chamber for controlling the passage of the burnishing or abrading elements to and from the tumbling chamber dependent on the direction of rotation of the cylinder, and a device for tilting said cylinder.

10. In a tumbling mill, a rotatable cylinder, means for driving said cylinder, said cylinder divided into a tumbling chamber and a storage chamber for abrading elements, said tumbling chamber being wood-lined and including a wood-

lined removable closure head, a sealing gasket for said closure head, and a clamping means for holding said head rigidly in position during the tumbling operation.

11. In a tumbling mill, a rotatable cylinder, a U-shaped tiltable platform disposed substantially horizontally, a tumbling cylinder supporting and driving shaft mounted on the tiltable platform and including a portion extended over the throat of the platform, said shaft disposed substantially horizontally in parallel with the platform, said tumbling cylinder mounted on said extended portion and rotatable within the clearance afforded by the throat, a framework pivotally supporting said platform, and said tumbling cylinder including means for introducing and separating abrading elements from the objects tumbled therein.

12. In a tumbling mill, a framework including side standards, a tiltable platform including trunnions supported on said standards, a rotatable cylinder journalled on said tiltable platform, means for driving said cylinder, said cylinder divided into a tumbling chamber and a storage chamber for burnishing or abrading elements, conveyer means for moving the burnishing or abrading elements to and from the tumbling chamber, said means controlled by the direction of rotation and tilted position of the cylinder, a shaft mounted in the framework, a cable drum fixed on the shaft, said cable having its respective ends secured to the opposite ends of the tiltable platform, and the intermediate portion thereof wound around the drum, a crank handle for rotating said shaft, detent means on the frame and crank arm respectively, said detent means positioned for holding the crank handle in position.

13. In a tumbling mill, a support frame, a tumbling cylinder rotatably mounted on said support frame, reversible power means for rotating said cylinder, a partition separating said cylinder into a tumbling chamber and a storage chamber for burnishing or abrading elements, a tube providing a passageway between said chambers, said tube being circumferentially disposed within the storage chamber and including a scoop end within the storage chamber and a lateral passageway entering the tumbling chamber, and means within the tumbling chamber for moving the burnishing or abrading elements toward said lateral passageway.

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