Nov. 18, 1941. E. S. CORNELL, JR 2,263,206

BURNISHING MACHINE

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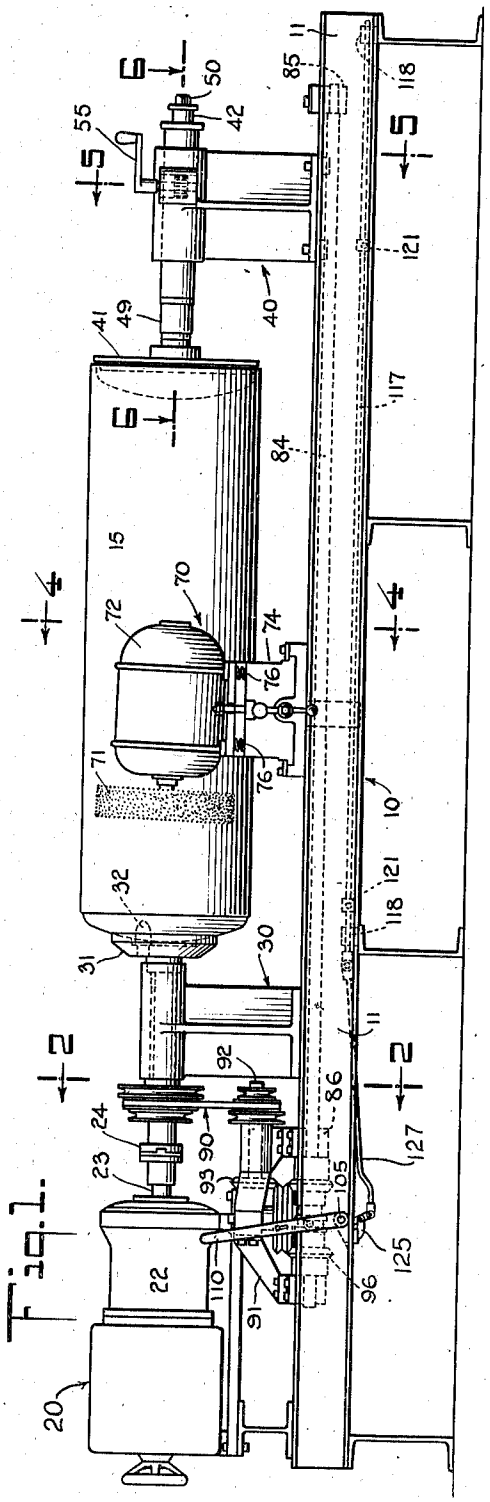


Fig. 1.

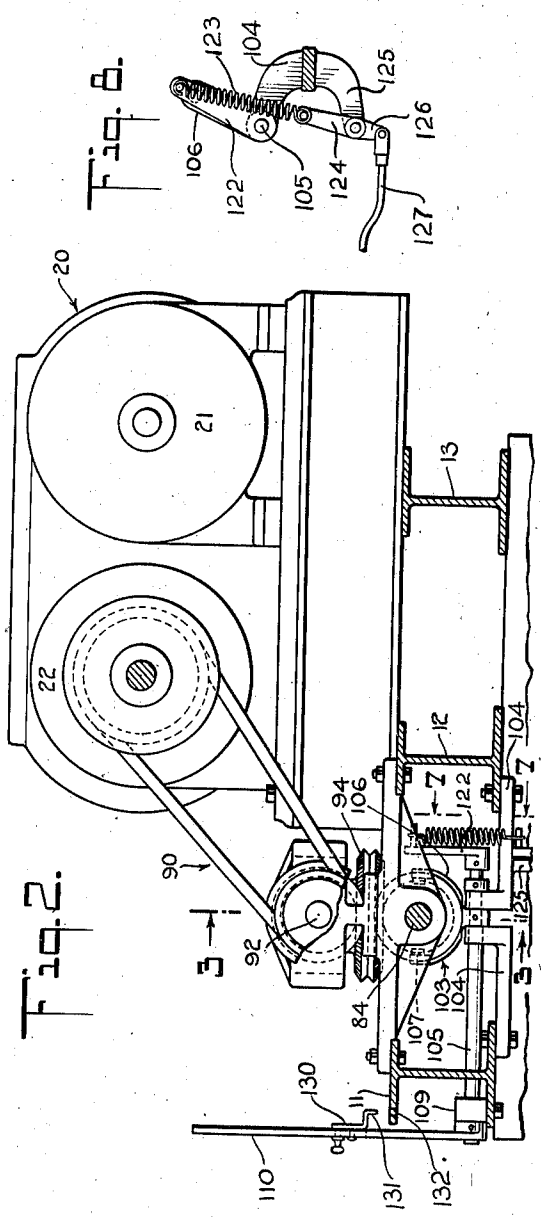


Fig. 2.

Fig. 4.

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Fig. 3.

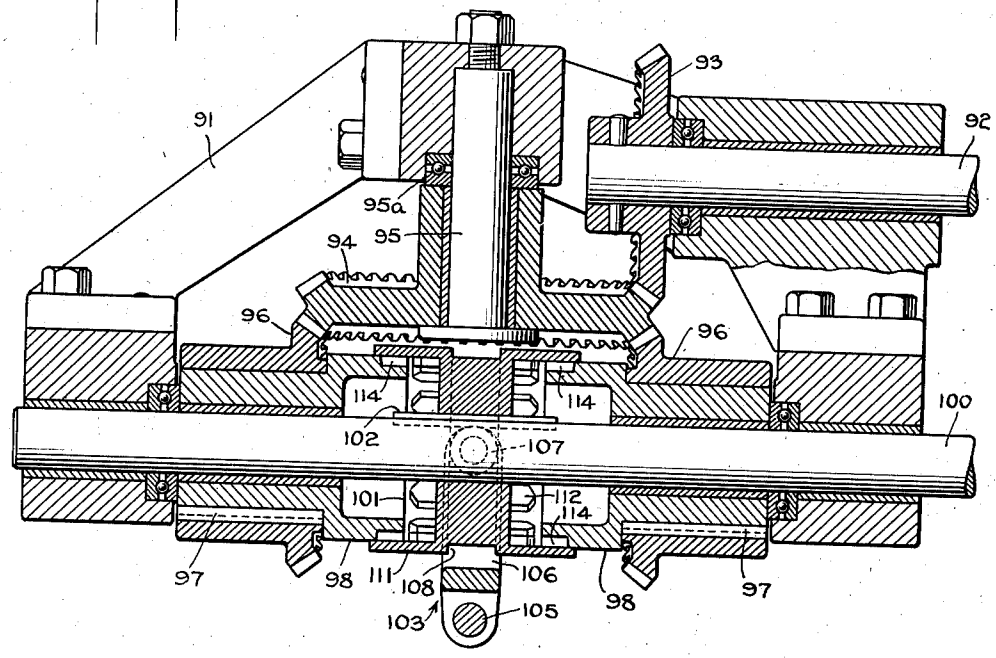
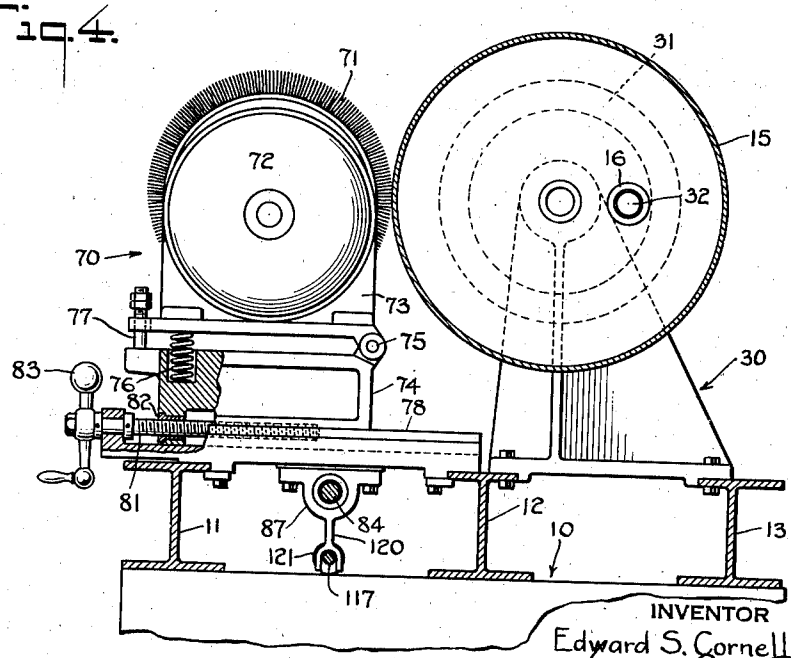


Fig. 4.



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Fig. 5.

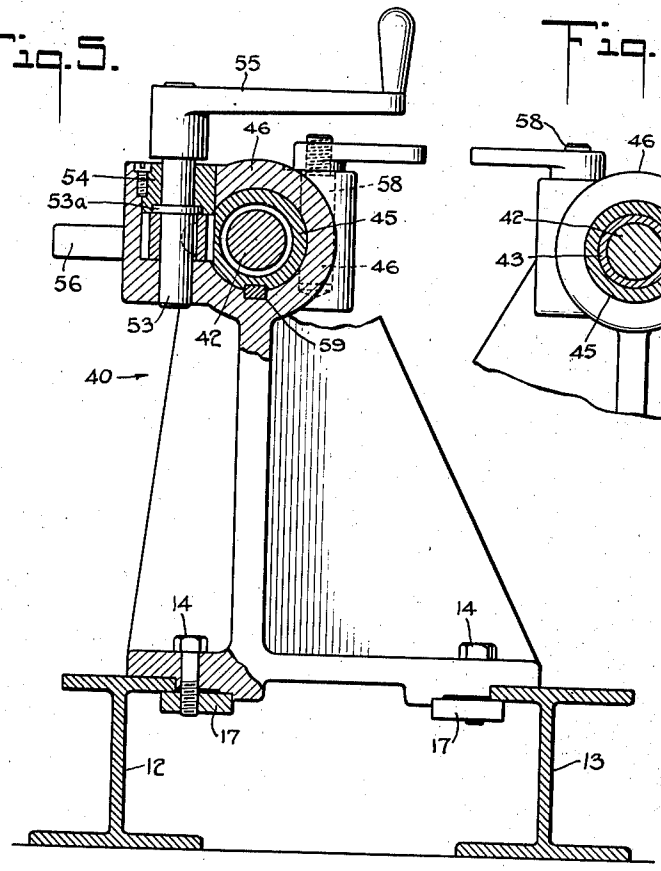


Fig. 7.

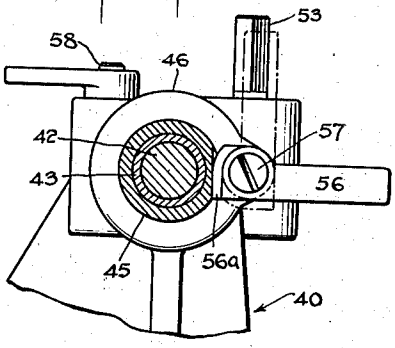
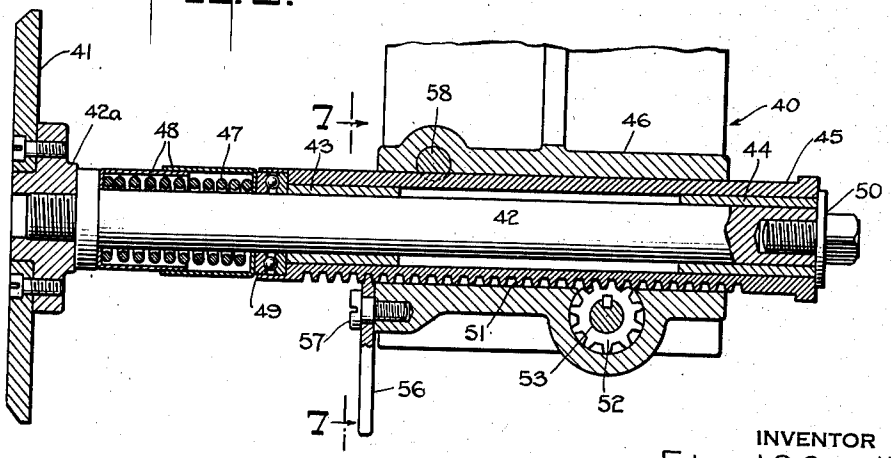


Fig. 6.



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UNITED STATES PATENT OFFICE

2,263,206

BURNISHING MACHINE

Edward S. Cornell, Jr., Larchmont, N. Y.

Application July 29, 1938, Serial No. 221,926

4 Claims. (Cl. 29—90)

This invention relates to burnishing machines.

An object of the invention is to provide means for automatically burnishing cylindrical objects of substantial diameter and substantial length, such as domestic water storage tanks and the like.

It has been found that in burnishing a cylindrical object, the same surface speed of the object with respect to the burnishing means will not give optimum results for all types of materials; in other words, each material has characteristics calling for a surface speed peculiar to it. For example, with the silicon-iron-phosphorous-copper alloy described and claimed in my United States Letters Patent #2,017,025, granted October 8, 1935, said alloy being well adapted for fabricating water storage tanks and the like, and utilizing a motor driven brush 15 inches in diameter and operating at a speed of 710 R. P. M., the surface speed of the object, as it is rotated by the burnishing machine to expose its complete periphery to the burnishing brush, should be about 1400 inches per minute.

In the present invention, the tank or other work to be burnished is mounted for rotation at a speed best suited for the material being operated upon. A burnishing brush, which preferably is driven by power means independent of the tank rotation means, is arranged to bear against the surface of the object with a substantially constant, but yielding, pressure. The burnisher motor and brush assembly are mounted on a carriage arranged for slidable movement axially of the tank and conjointly with the rotation of the tank, the movement of the burnisher carriage being effected by a lead screw operated by the tank rotation drive means. Means are provided for the automatic or manual reversal of the direction of travel of the burnisher carriage, thus affording means whereby any portion of the work may be given special burnishing treatment. The facility with which the burnishing carriage may be reversed makes the machine immediately available for use, regardless of the location of the burnishing wheel on the machine at the time of insertion of new work.

As it is well known that tanks are made in various diameters and lengths, the present invention is featured by means for accommodating such variant lengths and diameters, and, further, for rotating the work at a rate which will result in the preferred surface speed of rotation. Thus, in a circumstance in which the diameter of the object may change at a point intermediate of its length, the speed of rotation of the tank may be suitably altered.

It will be obvious that the normal path traced on the surface of the object by the burnish wheel will be a helix, because the object is being rotated, and simultaneously, the burnishing brush is being moved axially of the rotating tank. It is yet another feature of this invention that the plane of the burnish wheel is inclined with respect to the longitudinal axis of the tank, such inclination negativing any deleterious effect of a helically traced impression of the burnish brush, and insuring a high degree of polish.

Other features and advantages will hereinafter appear.

In the accompanying drawings:

Figure 1 is an elevation of my burnishing machine, illustrating an object in the process of being burnished;

Figure 2 is a vertical section of the machine illustrating the driving means and the drive connection with the burnisher lead screw;

Figure 3 is a detail sectional view on **3—3** of Figure 2, illustrating the clutch means for changing the direction of rotation of the lead screw;

Figure 4 is a vertical section, illustrating the relationship of the burnisher to the object, and adjustment means for the burnisher carriage;

Figure 5 is a sectional detail of the tailstock control structure;

Figure 6 is a sectional view on the lines of **6—6** of Figure 1, illustrating, in plan view, the means disclosed in Fig. 5 for adjusting the span between the headstock and tailstock of the machine;

Figure 7 is an elevation, partially in section, illustrating means for locking the tailstock in the desired longitudinal position; and

Figure 8 is a detail of a portion of the means for automatically reversing the direction of burnisher travel.

Referring to Figure 1, the burnishing machine comprises a frame **10** supporting drive means **20**, headstock **30**, tailstock **40**, an operatively independent burnisher **70**, and means for causing a longitudinal travel of the burnisher with respect to the to-be-burnished work **15**. The driving means advantageously includes a source of motive power, preferably an electric motor **21**, connecting through suitable speed-changing means **22** to the drive shaft **23**, said speed-changing means being of familiar pattern, and not a part of this invention. The drive shaft **23** may be connected with the headstock of the machine through a suitable coupling **24**.

For supporting and rotating the work 15, there are provided complementary jaws 31, 41, associated respectively with the headstock and tailstock, and arranged to grip the work to insure its rotation by the driving means. Advantageously, the jaw 31 may be provided with a lug 32 suitable to engage an opening in the work, such for example as the usual pipe-connection opening 16, see Figure 4, in the head of a range boiler or storage tank, of which the work 15 is a representation.

To make a single burnishing machine adaptable to accommodate work of widely varied lengths, the tailstock 40 is slidably mounted on suitable track-forming members 12, 13 of the frame 10, the said headstock being lockable in any desired position by the bolts 14 and cooperating lugs 17. The jaw 41 of the tailstock is arranged to be brought into or out of engagement with the work 15. Referring to Figure 6, the jaw 41 is shown as being removably secured, as by the illustrated screws, to a collar 42*a* securely mounted on an idly rotatable and longitudinally displaceable shaft 42, the said shaft being journalled in suitable bearings 43, 44 within a rack-provided housing 45. Housing 45 is slidably mounted within a suitable guide 46, formed as an integral part of the tailstock. A compression spring 47 serves to urge the jaw 41 to the left of Fig. 6, and the work 15 is thus resiliently clamped between the jaw 41 and headstock jaw 31. Spring 47 may be contained within a telescoping housing 48. A suitable thrust bearing 49 may be provided. In Figure 6, the spring is indicated as being expanded to the full length permitted by a tailstock stop 50 which, as shown, is secured to said shaft 42 and arranged to abut against the end of the housing 45.

As indicated in Fig. 1, jaw 41 should be of diameter suitable to fit snugly within the concave end of the work 15, the work illustrated being typical of a range boiler having one convex and one concave end. Obviously, other suitable forms of jaws 31, 41 may be employed, the selection being dependent upon the form of work being burnished.

After a suitable spacing of tailstock 40 relative to headstock 30, said spacing being established by the overall length of the work 15, the work is positioned on headstock jaw 31, and jaw 41 is brought into resilient contact with the work by suitable lateral displacement of its tubular housing 45. Such displacement may be effected through the agency of a rack 51, preferably cut into a wall of the said tube, and a suitable manually-rotatable pinion 52, the latter being keyed to shaft 53 and suitably housed and secured within the tailstock frame by the locked bearing 54 and shoulder 53*a* of pinion shaft 53. Suitable crank means, as 55, may be employed to rotate the pinion 52. To lock the position of the housing 45 after the positioning thereof, there may be provided a suitable locking lever 56, see Figures 6 and 7, pivoted on a screw 57 and provided with a nose 56*a*, see Fig. 7, which may advantageously have a configuration suitable for engagement with the rack 51. Means such as the manually operable snubber or cam 58 which, as shown in Fig. 5, is arranged to bear against housing 45, may control the reaction movement of tube 45 on the release of the nose 56*a* of lock-lever 56 at the completion of a burnishing operation. The housing 45 may be held against independent rotation by a feather key 59, see Fig. 5.

Referring to Fig. 4 the burnisher 70 may include a suitable wire or other stiff brush 71, preferably directly driven by a motor 72 of suitable power and speed of rotation. A one and one-half horse power motor, rotating a fifteen inch diameter brush at 710 R. P. M., has been used satisfactorily. The base, 73, of the motor 72 is pivotally secured, as shown, to a slidable mount 74, the pivot 75 being of the nature of a hinge pin. A plurality of coil springs 76, suitably arranged within the mounting 74, urge the motor in a direction clockwise of Fig. 4, and thus keep the brush 71 resiliently in contact with the surface of the work 15. Such resilient contact accommodates surface protuberances, such as side seams, etc. A stud bolt 77, or equivalent, may be employed to limit the movement of the motor 72, the illustrated lock-nuts on the bolt 77 limiting movement about the pivot 75.

To permit movement at right angles to the work 15 to accommodate tanks or other objects of diverse diameters, the motor mounting 74 is slidably arranged upon a carriage 78, the latter riding upon the rails 11, 12, and being arranged for positive drive along said rails by lead-screw means, as presently described.

By conventional means, including a worm 81, acting in cooperation with a traveller 82 secured to the mounting 74, the latter may be walked toward or away from the work 15. A suitable crank 83 is provided for the rotation of the screw 81. As is obvious, the pressure of the brush against work 15 may be established by the positioning of the mounting 74 as well as by the yielding pressure afforded by the springs 76.

Hot water storage tanks are made in a variety of diameters, the customary trade practice including sizes ranging from twelve inch diameter to twenty-two inch diameter, in increments of two inches. The "swing" of the burnishing machine, therefore, should accommodate a twenty-four inch tank to permit easy handling of all sizes.

The longitudinal travel of the burnisher carriage 78 is effected, concomitantly with the rotation of the work, and at desired speed, by a lead screw 84, of suitable pitch, journalled in suitable bearings 85, 86, see Fig. 1, and disposed parallel to the longitudinal axis of the work. Screw 84 is in engagement with a cooperatively threaded sleeve in a carriage drive member 87 rigidly secured to the underside of the burnisher carriage 74, see Fig. 4, and the rotation of the screw 84 moves the truck 74 in one or the other direction.

The screw may be rotated by suitable gearing, which as indicated in Figures 1 and 2, may be driven from the main drive shaft 23 by a belt and pulley organization 90. Preferably, the customary organization of speed changing driving and driven pulleys is employed, as shown. The worm drive-gearing, see Figure 3, may be rotatably mounted in a frame or spider 91 provided with suitable shaft-accommodating bearings, as shown. Pulley-driven shaft 92 is arranged to drive its associated bevel gear 93, which in turn meshes with and thereby drives a double bevel gear 94, arranged for idle rotation on a suitable supporting shaft 95. A thrust-bearing 95*a* absorbs vertical thrust. Gear 94 is in continuous mesh with gears 96, 96, the collars of which are respectively keyed, see 97, 97, to drive the associated reversing-clutch members 98, 98 arranged for idle rotation on the shaft 100, said shaft being preferably an extension of the lead screw 84.

The drive connection between members 98

and shaft 100 is effected by the shiftable, spline-provided drive collar 101 slidably keyed into power drive relationship with shaft 100, as on the feather key 102. The collar 101 may, therefore, be brought into operative engagement with either clutch member 98, 98, as presently described. For shifting the collar 101, a shift fork 103 is pivotally supported, on the frame members 11, 12, in the brackets 104, 104; the shift fork is secured to a shaft 105, and a rotation of the shaft 105 rotates shift fork 103. The tines 106 of shift fork 103 have inwardly turned roller bearings 107 arranged to engage a circumferential slot 108 formed centrally of the collar 101.

For shifting the collar 101 by manual operation, an extension of shaft 105 is journalled in a suitable bearing 109 and provided with a suitable shift lever 110.

Collar 101 is guided in its lateral displacement by its extending flange portions 111; these flange portions ride upon the surface of clutch members 98, 98. A plurality of splines 112 formed about the inner periphery of collar 101 are disposed in suitable operative relationship to a suitable plurality of keyways 114 in the members 98, 98. As will be understood, engagement of splines 112 with the keyways 114 will transmit the rotation of gear 93 to the shaft 100, and the said shaft will rotate in one or the other direction.

The direction of rotation of the lead screw 84, and hence the direction of travel of the burnisher 70, may be manually controlled by a suitable throwing of the lever 110.

In operating upon tanks or similar structures fabricated from the alloy disclosed and claimed in my aforesaid United States Patent No. 2,017,025, it has been found that tanks up to and including 16 inches in diameter may be satisfactorily burnished by two passages of the burnisher over the surface of the tank, that is, by starting the burnisher at the extreme right-hand end of the tank as viewed in Fig. 1 and returning to the starting point after a complete passage along the tank. On larger sizes, four passages of the burnisher give most satisfactory results.

It is a feature of the present invention that the direction of travel of the burnisher may be made automatically reversible, so that an operator, after starting the operation of the burnishing machine, may be saved the manual operation of reversing the direction of travel of the burnisher, and thus be free for attending a plurality of burnishing machines.

To accomplish such automatic reversal, I provide an organization including a rod 117, said rod being in parallelism to the axis of rotation of the work 15, and slidable, within the bearings 118, 118 in the direction of travel of the burnisher 70. As indicated in Fig. 4, the carriage drive member 87 which contains the follower nut engageable by the worm 84 is provided with a downwardly projecting forked extension 120, the tines of which extension straddle the rod 117. Stops 121, 121 are arranged for manual adjustment along the rod 117, and the setting of such stops determines the extremes of travel of the burnisher carriage 78 along the tracks 11, 12.

Referring now to Figs. 2 and 8, an extension of the shaft 105 has affixed thereto an upwardly extending lever 122, and it will be apparent that a rotation of said lever is effective to shift the clutch collar 101 onto either of the clutch members 98, 98. The rotation of the lever 122, within the limits established by the engagement of the splines 112 with the keyways 114 is effected by an organization including an overthrow spring 123, secured at one end to a pin formed at the upper extremity of lever 122, and secured at its lower end to an upper arm of a bell crank 124, the latter element being pivotally secured to an extension 125 of one of the supporting brackets 104. The lower arm 126 of the said bell crank is pivotally connected, as by the rigid link 127, to an end of the rod 117.

Referring to Fig. 1, in which figure it is assumed that the burnisher 70 is travelling from right to left, the forked extension 120, near the completion of the run of the burnisher in such direction, engages with the left-hand stop 121, and bodily displaces the rod 117 in a direction to the left of Fig. 1. Such bodily displacement moves the link 127 to the left, thus rotating the bell crank 124 and shifting the axis of the spring 123 to some location on the other side of the center line of the shaft 105. Upon a suitable displacement of the spring axis, the pull of the overthrow spring 123 causes the lever 122 and its therewith associated fork member 103 to be rotated clockwise of Fig. 1, and the accompanying angular displacement of the tines 106 of said fork member effects a throwing of the clutch collar 101 out of engagement with the left hand clutch member 98, through the dead center position, and into engagement with the opposing, or right hand, clutch member 98, thereby effecting a reversal of the direction of rotation of the screw 84 and a consequent reversal in the direction of travel of the burnisher 70.

Similarly, when the burnisher 70 has reached its desired limit of travel to the right, pressure of the element 120 against the right-hand stop 121 causes a displacement of the rod 117 to the right, and swings the bell crank, thereby the axis of the spring 123, into the Fig. 1 position. Such movement of the spring 123 again serves to throw the clutch collar 101 from the right hand clutch element 98 to the other, and causes a reversal of travel of the burnisher.

It will thus be seen that for the small size tanks, the burnisher may be passed twice along the length of the tank without attention from the operator, and, likewise, in the larger size tanks the burnisher can be caused to travel four times along the length of the tank.

Recognizing that in certain instances it may be desirable to maintain the clutch in its neutral, i. e., Fig. 3, position, the manual shift lever 110 is provided with a manually operated latch 130, said latch having a nose 131 which may be brought into engagement with a suitable opening 132 provided in the upper flange of the trackway 11. The latch 130 is subjected only to the strain imposed by the tension spring 123, and thus is readily manually operable.

It will be understood that such automatic reversal means may be dispensed with. Likewise, the link 127 may be directly connected to a downward extension of the lever 110 or equivalent, in which event, the displacement of the lever 127 may serve merely to bring the clutch collar 101 into neutral position, thus halting the travel of the burnisher, and requiring the operator to manually operate the lever 110 to complete the shifting of the collar 101 into engagement with either one or the other of the clutch elements 98.

It will be obvious, that the movement of the carriage 74 may be stopped at any desired point along the length of the work 15 by throwing the

reversing lever 110 into neutral, i. e., Fig. 3, position. Likewise, should any portion of the surface of the work require additional burnishing, the burnisher 70 may be caused to travel back and forth over the portion of work, any number of times.

It will be apparent that were the brush 71 mounted in a plane vertical to the axis of the tank 15, the markings of the brush against the surface of the tank would trace a spiral or helical path. The opposing slopes of the helical path, as the brush makes a complete "round trip" of the tank surface would result in a diamond like marking which may be undesirable. To negative the effects of the helical brush marking, the motor 72, as indicated in Fig. 1, is mounted at a slight slope, thus inclining the plane of the brush 71. The initial marking of the brush on the tank surface, that is, during the travel of the burnisher from right to left, will be helical. On the return trip, however, the sloping of the brush in the direction of travel tends to off-set the normally helical tracing and the resultant brush marks present the appearance of being substantially at right angles to the axis of the tank. Thus, at the completion of the burnishing operation, the brush marks give the appearance of being uniformly vertical, and the final appearance of the burnishing operation is greatly improved.

Whereas I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. In a burnishing machine, a frame, adjustable means associated therewith for mounting the object to be burnished, means for rotating said object, burnisher means including a power driven brush urged resiliently against said object, said brush being shiftable in a direction at right angles to the axis of rotation of said object, means for moving said burnishing means longitudinally of said object during the rotation thereof, and means for halting the longitudinal travel of the burnisher in one direction and causing its travel in an opposite direction, said means including a lead screw arranged to propel said burnisher means, a plurality of power driven idlers, said idlers rotating in opposite directions, shiftable means for transmitting the rotation of one of said idlers to said lead screw, lever means for displacing said shiftable means to engage one of said idlers in power transmitting relationship, spring means for throwing said lever, and means operable at the termination of any desired longitudinal travel of the burnisher and connected to said spring means to shift the position of said spring means in a manner affording the desired throw of said lever to accomplish reversal of the direction of travel of the burnisher.

2. In a burnishing machine, the combination with a frame, burnishing means resiliently mounted on said frame and arranged for movement longitudinally thereof, and laterally slidable and adjustable tail stock means, of a work engaging and supporting jaw independently laterally displaceable with respect to said tail stock means, spring means interposed between said jaw and said tail stock means and arranged to urge the said jaw into resilient engagement with said work, locking means operative upon said tail stock means for maintaining the adjustment thereof against the reaction of said spring means, and snubber means operative upon said tail stock means to restrain the reaction of said spring upon the release of said locking means.

3. In a burnishing machine, the combination with a frame, burnishing means mounted on said frame and arranged for movement longitudinally thereof, and tail stock means, of a work support housing longitudinally movable in said tail stock means, means for displacing said housing and locking the same in desired position, work engaging jaw means operatively associated with said housing means and longitudinally displaceable with respect thereto, compression spring means disposed intermediate said jaw and said housing and operative to hold said jaw in resilient engagement with said work, and snubber means operative upon said longitudinally movable housing to restrain the reaction of the spring thereagainst upon release of said locking means prior to the removal of work from said burnishing machine.

4. A burnishing machine comprising, in combination, a frame, means associated therewith for mounting an object to be burnished, means for rotating said object, means comprising a rotating brush urged into resilient contact with said rotating object to burnish the same, a power-driven lead screw arranged to drive the burnished means longitudinally of said rotating object concomitantly with the rotation of said object, and means for automatically reversing the direction of rotation of said lead screw at the termination of any desired travel of the burnisher means, said means including a pair of oppositely rotating clutch members held in mutual spaced relationship, a shiftable clutch collar feather-keyed to said lead screw means and arranged for power-transmission engagement with one or the other of said collars for rotating the lead screw in the direction of rotation of the thereby engaged clutch member, stop means arranged to be bodily displaced by the travel of said burnisher near the completion of such travel in one direction, link means associated with said stop means and adapted to be displaced thereby, a shift lever operatively associated with said clutch collar to move the same out of engagement with one clutch member and into engagement with a second clutch member, a bell crank mounted for rotation upon displacement of said link means, and overthrow spring means linking said bell crank and said clutch collar shift lever to throw the therewith associated clutch collar through a neutral stage in effecting the transition from one to another of said clutch members.

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