UNITED STATES PATENT OFFICE

2,174,879

APPARATUS FOR CLEANING ELONGATED METAL OBJECTS

Joseph M. Hiblish and John K. McIahan, Pittsburgh, Pa.

Application May 4, 1938, Serial No. 265,936

10 Claims. (Cl. 51—164)

This invention relates to improvements in apparatus for cleaning scale, rust and pitting from the surface of elongated objects, such as steel billets, slabs, bars, rods and other shapes, and treating the same by coating these objects with substances to retard further corrosion.

The apparatus disclosed herein is an improvement of that disclosed in application Serial No. 133,991, filed March 31, 1937, bearing the same title, upon which Letters Patent No. 2,134,587 were issued on October 25, 1938.

The principal object of this invention is the provision of apparatus for removal of scale, rust and other surface impurities and defects from elongated objects by impact and attrition.

Another object is the provision of a rotary drum for receiving elongated metal objects which are rolled and moved laterally therein and with means for tilting the drum on its axis for shifting the objects longitudinally thereof to produce an attrite and an abrasive action between the objects themselves and the drum.

Another object is the provision of means for changing the tilting speed of a rotary drum to control the longitudinal shifting of elongated metal objects therein.

Another object is the provision of a floating rotary drum arranged to receive elongated metal objects and means for tilting said drum causing it to move longitudinally and thereby shift the objects longitudinally therein.

Other objects and advantages appear hereinafter.

In the accompanying drawings a practical embodiment of the principles of this invention is illustrated wherein:

Fig. 1 is a side elevation of a machine for cleaning elongated metal objects illustrating the preferred form of the apparatus.

Fig. 2 is an end elevation of the machine as viewed from the right in Fig. 1.

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 1.

Fig. 4 is a detail view of the wheel mounting for supporting the rotary drum.

Fig. 5 is a side elevation of a modified form of the machine.

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

Fig. 7 is an end elevation of the machine shown in Fig. 5 illustrating the hoisting mechanism.

Referring to Figs. 1 to 4 on the drawings, 10 represents a track base which comprises a pair of fabricated channel members 11 assembled in spaced relation by means of cross braces and arranged to be mounted on a suitable foundation. A rail 12 is carried on the cap plate of each channel member thereby forming a track. At the left end the channel members and the track 12 slope to the foundation as indicated at 13, forming an inclined section of track which terminates at the stops 14. The other end of the track 12 terminates at the stop 15 on the horizontal section of the channels.

The right end of the channel members 11 also slope to the foundation and are arranged to support the inclined fabricated channel members 16 in spaced relation. The vertical planes of the channel members 16 are parallel to the vertical planes of the channel members 11 but are spread farther apart as may be noted in Figs. 2 and 3. A rail 17 is carried on the cap plate of the channel members 16 forming an inclined track which terminates at the stops 18 at the top and the stops 19 at the bottom.

A toothed gear rack 20 is also supported on the top of the channel members 16 adjacent the rails 11, 21 represents an inturned flange member which overlies a portion of the cap plate on the channel member 16 forming a guide rail to prevent a pinion which engages the gear rack from becoming disengaged.

22 represents a carriage which is preferably constructed of two parallel steel beams or channel members 23 having transverse plates 24 and 25 of the same character forming a rectangularly shaped chassis. The ends of the transverse beams are preferably cut to fit the flanges of the longitudinal beams 23 and brackets are supplied at the juncture of these members to strengthen the joints made therebetween. When each of these parts are welded together a satisfactory rigid structure is had.

The carriage is supported at one end by means of the individually mounted wheels 26 each having a grooved periphery 27 arranged to ride on the rails 12. These wheels are journaled on the stationary pins 28 the ends of which are carried by the vertically disposed parallel plates 29. To provide rigidity in this journal supporting structure vertically disposed transverse plates 30 are fitted between the plates 29 and arranged at right angles thereto. Triangular bracing plates 31 are welded to the inner plates 29 to brace the journal supporting structure against severe lateral loads. Each of these vertically disposed plates are welded to the horizontal plate 32 which in turn is secured to the longitudinal beams 23 and the transverse beam 24 as illustrated in detail in Fig. 4. The transverse bracing plates 30 are 50
notched out as indicated at 33 to permit the wheels 26 to engage the stops 14 and 15. The other end of the carriage is provided with similar journal supporting structures 34 centrally thereon owing to the fact that the gauge of the track 17 is wider than the gauge of the track 12. In place of the pin members 28 the journal supporting structures 34 are provided with the bearing sleeves 36 arranged to receive the rotary shaft 37. An additional transverse plate 30 may be welded between the plates 29 directly above the axial center of the sleeves 36, as shown in dotted lines in Fig. 1, to provide additional strength for the assembly.

The grooved wheels 35 are free to rotate on the shaft 37 but are designed to carry the whole of the vertical load of the right end of the carriage. The pinions 38 are mounted on the shaft 37, outwardly adjacent the wheels 35, and are keyed thereto. These pinions are arranged to engage the teeth of their respective racks 29. The ends of the shaft 37 have bolted thereto the keeper plates 35 which retain the rollers 40 adjacent the pinions 38. These rollers are arranged to engage the under side of the guide rail flange 21. Thus the wheels 35 and the pinions 38 are retained against upward movement that might tend to dislodge these members from their proper engagement with the track 17 and the gear racks 29.

A sprocket wheel 41 is keyed to the shaft 37 intermediate its ends and is aligned with a second sprocket wheel 42 keyed to the shaft 37 carried by the speed reducer 44 which is operated by the motor 45. The motor 45 may be reversible and operated remotely through a circuit controller. An electric switch may be placed adjacent each end of the track 17 for opening the circuit of the motor 45 as the wheels 35 approach the stops 18 and 19. These switches may be so constructed to reverse the motor automatically, thereby providing continuous operation of the lift throughout a cleaning run.

As the lift proceeds up the inclined track 17 from the lower end thereof, which position is indicated on dotted lines in Fig. 1, the carriage 22 moves to the left along the horizontal portion of the track 19 until it reaches the horizontal position illustrated in full lines in Fig. 1. Further movement of the lift in the same direction rolls the wheels 26 down the inclined section 13 toward the stop 14 and the wheels 35, on the inclined track 17, approach the stop 15. This position of the carriage is also indicated by dotted lines in Fig. 1. It should be noted that the inclination of the carriage 22 at these extreme positions is approximately the same number of degrees from the horizontal, yet the horizontal distance traveled by the carriage from the horizontal position to the upper limit of travel is materially less than the horizontal distance traveled from the horizontal position to the lower limit of travel. The structure providing this movement is particularly advantageous and forms an important object of this invention.

If the motor 45 is operated at a constant speed and the lift is started at the bottom of the track 17, at which time the carriage 22 is tilted at an angle of 24°, the carriage will be lifted at a constant rate until it reaches its horizontal position. The left end of the carriage then proceeds down the incline 13 but the lift continues up the inclined track 17 at a constant rate. The rate of tilting the transverse beam 28 is governed by the horizontal position since the horizontal travel is less than one-half the distance during the upper period of tilting when the carriage reaches a tilting angle of 24° at its upper limit.

The degree of inclination of the tracks 12 and 17 may be varied to produce the desired rate of tilting of the carriage with a constant operating speed of the motor. However the speed of the motor 45 may be varied through a circuit controller to change the tilting rate curve just described to any desired degree. This is equally advantageous because the lower period of tilting may be obtained with a slower speed than the upper period, thereby accentuating the latter period. A variable speed motor also provides operating characteristics of the character described for a machine having only a horizontal section of track which is within the scope of this invention.

Two cradles 46 and 47 are mounted on the carriage, 22, at the ends of the carriage parallelly disposed on a transverse beam 24 and 25 respectively. Each cradle comprises two sets of transversely disposed square plates 48 held in spaced relation by diagonal brace members 49, mounted on each side directly above the longitudinal beam members 23, and a framed platform 50 connecting the tops of the plates 48, thereby forming a rigid cradle structure. Each set of transverse plates 48 are held in spaced relation to receive therebetween four grooved idler rollers 51 which rotate on the stationary pins 52 held in said plates. The axes of the pins 52 are positioned to intersect diagonal lines drawn from the corners of the square plates 48 and are oppositely disposed to one another in quadrangular relation so as to intersect the circumference of an imaginary circle drawn from the intersection of the diagonal lines as a center. A circular opening 53 having the same center is cut in each plate 48, thereby exposing a portion of the perimetal surface of the idler rollers 51 as shown in Figs. 2 and 3.

53 represents a circular disk or track the perimetal edge of which engages the bottom of the grooves of the rollers 51 assembled between each set of plates. Thus the four sets of plates each of which support a group of four idler rollers are arranged to carry four circular track disks in tandem relation.

These track disks are provided with aligned openings 54 for receiving a cage or drum 55 which may be secured thereto as by welding. The cage or drum 55 may be formed with a series of plates or bars disposed octagonally in symmetrical relation about the openings 54; and the cage or drum is provided with removable heads 56 on the end thereof for retaining an inner or floating drum 57. However as shown on the drawings but smaller in diameter and shorter than the outer drum 55. 58 represents a motor mounted on the platform 50 of the cradle 46 and coupled to the
speed reducer 59 for driving the shaft 60. 61 represents a sprocket pinion fixed to the shaft 60 and arranged to drive the sprocket chain 62 which engages the sprocket 53 secured to the drum 55 for rotating the latter. The operation and speed of the motor 58 may be governed by the same circuit controller for operating the motor 45. In such case that part of the circuit controller operating the motor 58 may be made to maintain the rotation of the drum at a constant speed during a complete cycle of operation of the lift or it may be desirable to stop or vary the speed of the drum 55 during different periods of the operation of the lift. On the other hand a separate controller may be employed but such a control might prove to be too complicated if the operator is expected to vary the speeds of both motors during a complete cycle of operation which could very easily be accomplished by automatic controller equipment.

It may be seen that the elongated objects into the drum 55 when in any one of the positions indicated, and close the drum heads. When the machine is operated the elongated objects will be rolled within the drum and as the lift moves the carriage or the drum is tilted above and below the horizontal, thereby shifting the load longitudinally within the drum while it is being rolled. By varying the speed of the respective motors as described complete control of the shifting of the load may be had at all times. Thus elongated objects have different cross sectional shapes and being made of different materials may be controlled during their cleaning and coating operation to produce the desired result by controlling the sequence of the time of rolling or shifting of the load which may be accurately determined through the aid of the inclined track 12 and the variable speed motors.

By using the small inner drum 57 within the cage or outer drum 55 it has been found that the longitudinal shifting of this floating drum may be made to occur at a smaller angle to the horizontal than that required to shift the load longitudinally without this inner drum. When the floating drum with a load therein shifts longitudinally in the cage or larger drum 55 and strikes the lower end of the latter, the cage created by this abrupt shock will move the load longitudinally within the smaller or floating drum 57. This is a marked advance in this art and is an important object of this invention as it contributes to the control of the cleaning operation.

Another important feature of this inclined track construction lies in the balancing of the carriage structure and the load carried thereby which engages the sprocket 53 secured to the drum 55 for rotating the latter. Through these inclined trackways a mechanical advantage is obtained which also represents an important object of this invention that is an advance in this art.

Referring now to Figs. 5, 6 and 7, which illustrate a modification of this invention, it will be noted that the drum 55 is rotatably supported in the cradle 46 mounted on the short rectangular base 64 which in this instance is pivotally supported intermediate of its ends on the aligned bearings 65 secured to suitable foundations. The other end of the drum 55 is supported by a hanger 66 comprising a yoke 67 which is provided with an eye 68 at its upper end to receive the hook 69 of a hoist or lift 70. The lower or bifurcated ends of the yoke 67 are provided with aligned bearings 71 arranged to receive the gudgeon ends of the shaft 72. The intermediate portion of this shaft is preferably square to permit the assembly of the parallel plates 73 on opposite sides thereof. These plates are similar to the plate 63 in that they are constructed to support the triangularly disposed pins 52 which rotatably carry the three idler rollers 81. The plates are provided with aligned openings arranged to receive the inner portions of the bearings 80 and support the same by means of the circular disk track 53 riding on the idler rollers 51. This structure permits the lift or hoist 70 to tilt the container 85 about the axis of the bearings 85 while the container is being rotated.

Swiveled rollers 74 are provided on the ends of the shaft 72 and on the upper end of the yoke 81. These rollers are arranged to ride on the wide vertically disposed track 75 and prevent the container from being moved laterally as the load is rolled and shifted therein.

The hoist or lift 70 may be hydraulic, pneumatic or an ordinary electrically driven hoist. In either case the valves 76 of the hydraulic or pneumatic hoists must be capable of being cracked so as to enable the operator to change the speed of tilting the drum during the proper cleaning cycle. The same character of control is required of the electrical hoist. The operator is thus enabled to control the rolling and shifting of the load as the objects are being cleaned and coated. Thus a lift having a very quick or fast speed and a slow speed with a series of intermediate steps therebetween is advantageous for use with this apparatus. A short or quick lift or drop adjacent the upper or lower tilting positions of the container 85 creates a shock on the load therein causing it to shift to the lower end thereof.

The method employed by the use of these structures has marked advantages compared to the methods presented by the prior art wherein the axis, upon which the container is rotated, itself travels in an orbital path.

Where the container rotates on an axis which travels in an orbital path, rods and other shapes of considerable length and of relatively small diameter are likely to become bent, distorted and twisted about each other, thus frequently ruining the material or necessitating a straightening operation. It has been found in the common practice of this invention that such deleterious results do not occur due to the fact that the axis of the container does not travel in an orbital path but in a vertical plane. This is a very important improvement of this invention and affects a very material saving both in labor and material.

To assist and expedite the cleaning action we may introduce into the drum 55, or where the inner drum 57 is used, in the latter, some suitable abrasive material such as sand, coke dust, hard metal scale, etc.

When bars, rods or other shapes are to be coated, as after cleaning, with some material such as graphite, having the property of resisting rust and corrosion, such material is placed in the drum 65 with the articles to be coated and the apparatus then put into operation. By this method a uniformly distributed coat of even thickness is quickly applied to the articles.

We claim:

1. In apparatus for the purpose described, the combination of a support, a horizontally disposed cylindrical container rotatably mounted on said support and arranged to receive elongated metal objects, means for rotating said container to shift...
said objects laterally therein, lift means for alternately raising and lowering an end of said container with respect to its horizontal position as it is being rotated to effect a longitudinal shift of the objects therein, and means for accelerating the speed of operation of said lift means as a movement thereof approaches completion.

2. In apparatus for the purpose described, the combination of a support, a horizontally disposed cylindrical container rotatably mounted on said support and arranged to receive elongated metal objects, means for rotating said container to shift said objects laterally therein, lift means for alternately raising and lowering an end of said container above and below the horizontal while it rotates to effect a longitudinal shift of the objects therein, and means for effecting a faster speed of the lift above the horizontal than below.

3. In apparatus for the purposes described, the combination of a support, a track mounted on the support comprising oppositely inclined end portions, a carriage movable on said track, a cylindrical container mounted on the carriage, means for rotating the container on its longitudinal axis, and means for causing the carriage to travel back and forth on the track.

4. In apparatus for the purposes described, the combination of a support, a track mounted on the support having oppositely inclined end portions and a horizontal intermediate portion, a carriage movable on said track, a cylindrical container mounted on the carriage, means for rotating the container on its longitudinal axis, and means for causing the container to travel back and forth on the track.

5. In apparatus for the purposes described, the combination with a support, an elongated cylindrical container rotatably and tiltably mounted on the support, means for rotating the container and means for tilting the same on its longitudinal axis alternately in opposite directions, of a second container within the first named container and of less length than the latter to permit free individual longitudinal movement of the second container within the first container.

6. In apparatus for the purposes described, the combination with a support, an elongated cylindrical container rotatably and tiltably mounted on the support, means for rotating the container and means for tilting the same on its longitudinal axis alternately in opposite directions, of a second container within the first named container and of less diameter than the latter to permit free individual rotary movement of the second container within the first container.

7. In apparatus for the purposes described, the combination with a support, an elongated cylindrical container rotatably and tiltably mounted on the support, means for rotating the container and means for tilting the same on its longitudinal axis alternately in opposite directions, of a second container within the first named container and of less length and diameter than the latter to permit individual longitudinal and rotary movement of the second container within the first container.

8. In apparatus for treating elongated billets and other elongated metal shapes, the combination of a support, a frame arranged for movement relative to the support, an elongated cylindrical container mounted on said frame for rotation on its longitudinal axis, means for rotating the container, means for moving the frame to cause the container to tilt relative to the support so that each end of the container will alternately be higher than the other end thereof to cause the shapes to slide longitudinally back and forth in surface contact with each other, and closure means at the ends of the container to limit the longitudinal movements of the shapes.

9. In apparatus for treating elongated metal billets and other elongated metal shapes, the combination of a cylindrical container, removable heads for closing the ends of said container, a frame, means on said frame arranged to rotateably support the container on its longitudinal axis, means for rotating said container, means for supporting the frame and the container on a horizontal transverse axis adjacent one end thereof, and means for raising and lowering the other end of said container causing each end of the container to be alternately higher than the other end to shift the metal shapes back and forth in the container as they are being rolled.

10. In apparatus for treating metal billets and other elongated metal shapes, the combination of a support, a frame movably mounted on said support, a pair of spaced apart cradles extending upwardly from the frame and provided with axially aligned annular openings, an elongated cylindrical container extending through said openings and journaled in said cradles, the axis of the container being coincident with the axes of the openings, means for rotating the container in said cradles, means for moving the frame relative to the support to impart to the container a tilting movement confined to a vertical plane for sliding the shapes longitudinally back and forth in surface contact with each other, and closure means at the ends of the container to limit the endwise movement of the shapes.

JOSEPH M. HILBISH.
JOHN K. McCAHAN.