Feb. 28, 1950 D. A. WALLACE 2,498,903

METHOD AND APPARATUS FOR SURFACING CYLINDRICAL OBJECTS

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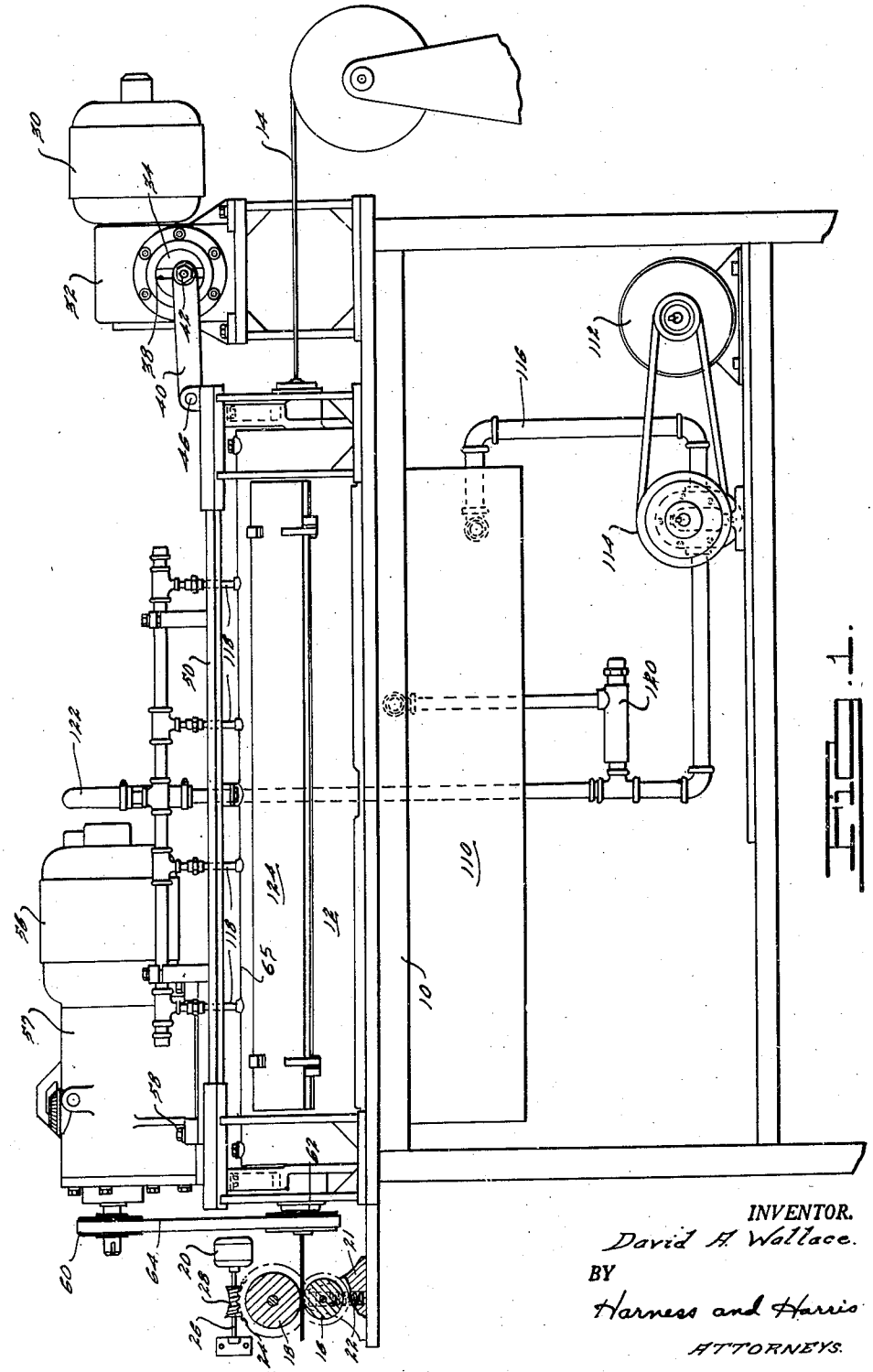


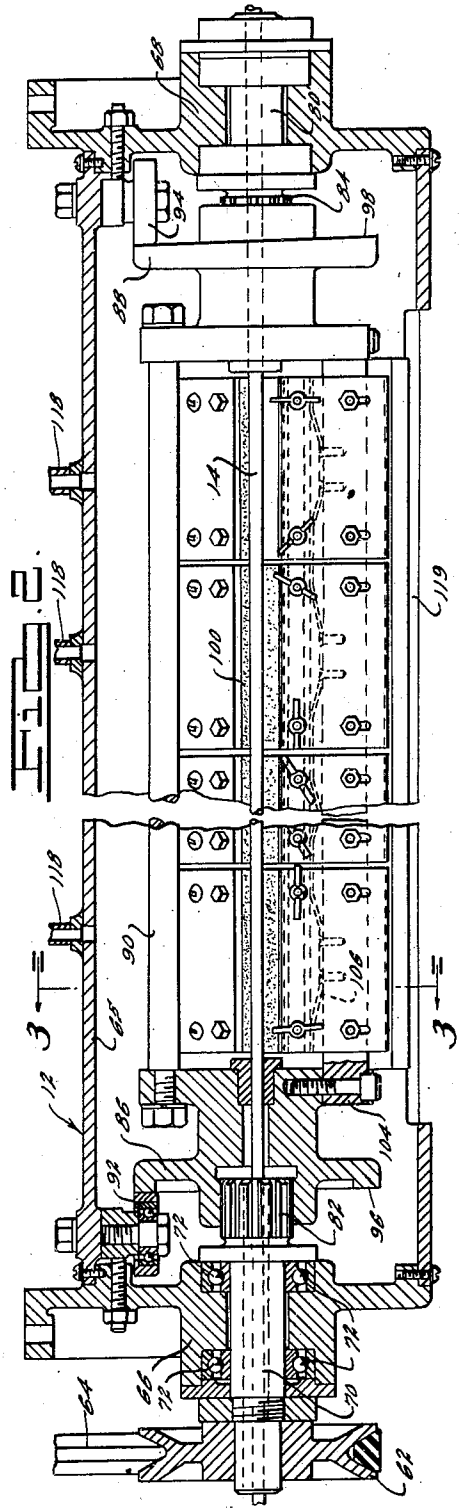
Fig. 1.

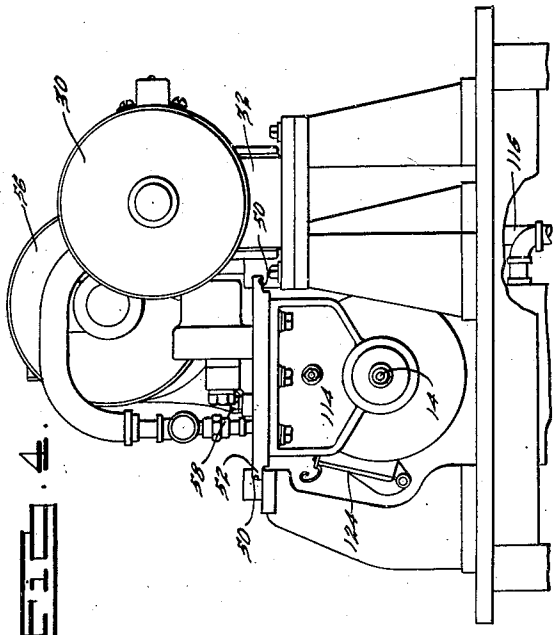
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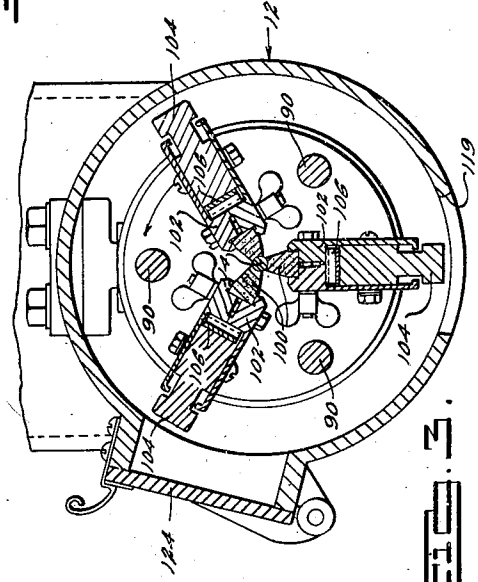
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METHOD AND APPARATUS FOR SURFACING CYLINDRICAL OBJECTS

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2,498,903

METHOD AND APPARATUS FOR SURFACING CYLINDRICAL OBJECTS

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10 Claims. (Cl. 51—34)

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This invention relates to the art of finishing surfaces and comprises means for finishing the surface of a wire or rod as it is fed in a continuous longitudinal movement.

One of the main objects of the invention is to provide a means to compound a plurality of simultaneous movements so that no increment of the work surface is twice traversed in the same direction by the same particle of an abrading element.

It is a further object of the invention to provide means to produce simultaneous movements of different directions, amplitudes and frequencies, whereby a rapid stroke of an abrading element is compounded with a slow stroke of the abrading element so that the element is continuously reciprocated relative to the wire or rod in relatively long slow strokes each of which comprises a plurality of short rapid strokes while the element rotates relative to the wire or rod that is being finished and a continuous longitudinal movement of the wire or rod is maintained.

It is an additional object of the invention to provide a method for finishing the surface of a cylindrical object that compounds reciprocatory movements of different amplitudes and frequencies with linear and rotary movements of abrading elements relative to the surface of the cylindrical object.

The apparatus is adapted to polish either wire or continuous lengths of rod and the term rod will be used herein, although it is to be understood that the invention is not so limited.

In the drawings:

Fig. 1 is an elevation of the apparatus;

Fig. 2 is substantially a vertical section of the carriage portion of the apparatus;

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 2, and

Fig. 4 is an end view of the apparatus.

The apparatus shown in the drawings comprises a frame 10 and a movable carriage 12. The frame carries means to reciprocate the carriage in relatively long strokes and means to continuously feed the rod. The carriage carries abrading elements, means to rotate the elements and means to reciprocate the elements in relatively short strokes.

The rod or wire has been designated by the numeral 14. A pair of rollers 16 and 18 and an electric motor 20 adapted to drive at least one of the rollers through gearing provide a continuous feed of the rod through the carriage. The roller 16 is illustrated as being rotatably mounted on a stationary bracket 21 and urged into engagement with the rod 14 by a spring 22. The driving roller 18 carries a worm gear 24 which is keyed thereto. A shaft 26 of the electric motor 20 carries a worm 28 which drivingly engages the worm gear 24 to effect a drive of roller 18. Rotation of the roller 18 which frictionally engages the rod 14 produces a continuous axial movement of the rod 14.

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Means are provided on the frame 10 for causing the carriage 12 to reciprocate relative to the frame 10 in relatively long strokes. This means comprises an electric motor 30 and a slotted head 34 which is geared through reduction means 32 to the motor 30. The head 34 is provided with a transverse slot 38 which preferably has a dovetailed section (not shown). A pitman 40 is adapted to be secured to the head 34 by a slot engaging element 42. It is evident that any desired degree of eccentricity can be produced between the head 34 and slot engaging element 42 by adjustment of element 42 in the slot 38. Rotation of head 34 thus produces a reciprocation of pitman 40 due to the eccentricity between the head 34 and slot engaging element 42. The outer end of the pitman 40 is pivotally connected to the carriage 12 at 46. The carriage 12 is slidably mounted in a track portion 50 of the frame 10. Suitable track engaging portions 52 are provided on the carriage 12 to guide the carriage in its longitudinal movement. It is therefore evident that reciprocation of the pitman 40 will reciprocate the carriage 12.

An electric motor 56 is secured to the carriage 12 as by bolts 58. A pulley wheel 60 is operatively connected to the shaft of the motor 56 preferably through a variable speed drive mechanism 57. A pulley wheel 62 is adapted to be driven by the motor 56 through a belt 64 which operatively engages pulley wheels 60 and 62. The carriage 12 is provided with a housing 65 having a pair of relatively stationary bearing members 66 and 68. A rotatable shaft 70 is keyed to the pulley 62 and journaled in the bearing member 66. Ball bearings 72 are preferably used to journal the shaft 70 in the member 66. A rotatable shaft 80 is journaled in the bearing member 68. The rotatable shafts 70 and 80 are provided with splined portions 82 and 84 respectively. A collar 86 is splined to the portion 82. A collar 88 is splined to the portion 84. These collars are connected by a plurality of elongated bolts 90. A pair of rollers 92 and 94 are rotatably mounted on the carriage housing 65 and adapted to engage cam surfaces 96 and 98 provided on the collars 86

and 88 respectively. The surfaces 96 and 98 are so shaped that as the collars 86 and 88 rotate these surfaces produce a plurality of relatively short reciprocations of the collar 86, bolts 90 and collar 88 which move as a unit. The irregularities on the surfaces 96 and 98 which produce the relatively short reciprocatory motions are preferably synchronized so that as a high point on the surface 96 engages the roller 92 and moves the unit to the right as illustrated in Fig. 2, a low spot on the surface 98 is aligned with the roller 94 to accommodate this movement. The rotation of the unit and the cam members is of course imparted by the belt 64, pulley wheel 62, rotatable shaft 70 and the splined portion 82 thereof. The shafts 70 and 80 and collars 86 and 88 are each provided with an axial opening adapted to receive the wire or rod 14.

The collars 86 and 88 carry a plurality of abrading elements 100 which are circumferentially spaced about the rod 14 as illustrated in Fig. 3. Each abrading element 100 is carried in a holder 102. Each holder 102 is slidably mounted for lateral movement relative to a longitudinally extending bar 104. A leaf spring 106 reacts against each bar to urge each abrading element to resiliently engage the rod 14. Each bar 104 is secured to the collars 86 and 88. The end portions of each bar are bolted to the collars as illustrated in Fig. 2. Rotation of the collars 86 and 88 thus imparts a rotation to the abrading elements 100 by virtue of the fact that each bar 104 rotates with the collars and carries therewith its associated holder 102 and abrading element 100.

Means have been described herein to produce a plurality of synchronous relative movements between the rod 14 and the abrading elements 100. The rollers 16 and 18 move the rod longitudinally while the motor 30 and slotted head 34 cooperate with the pitman 40 to reciprocate the carriage 12 on the track 50 in relatively long slow movements. The motor 56 rotates the abrading elements 100 relative to the rod 14 and this rotation by means of the cam surface on collars 86 and 88 superimposes a plurality of relatively short rapid strokes of the abrading elements relative to the rod 14.

If desired means to lubricate and cool the work and the abrading elements 100 may be provided. A tank 110 is mounted below the carriage 12. An electric motor 112 is provided and adapted to drive a pump 114. The pump 114 is interposed in a line 116 which has one end connected to the tank 110 and the other end connected to a plurality of inlet nozzles 118 located in the upper portion of the carriage 12. An opening 119 is provided in the base portion of housing 65 so that the lubricant coolant may return by gravity to tank 110. A relief value 120 may be provided between the line 116 and the tank 110 on the downstream side of the pump 114 if desired. The line 116 preferably has a flexible portion 122 therein so that the reciprocatory movements of the carriage 112 will not be hindered.

A door 124 may be provided in the housing 65 of the carriage 12 to facilitate the adjustment or replacement of abrading elements 100 if desired.

Although but one specific embodiment of the invention is herein shown and described, it will be understood that various changes in the sequence of operations, steps and materials employed may be made without departing from the spirit of the invention.

I claim:

1. Apparatus for surface finishing wire comprising a frame structure, a carriage slidably carried by said frame structure for linear movement relative thereto, driving means adapted to impart reciprocatory movement of a first amplitude and frequency to said carriage relative to said frame structure, a holder carried by said carriage and adapted to rotate and reciprocate relative to said carriage, said holder and said carriage having means formed therein which define a passage for said wire, means to create relative longitudinal movement between said wire and said holder, abrading elements carried by said holder and adapted to engage the surface of said wire, power means carried by said carriage and adapted to rotate said holder relative to said carriage and thereby rotate said abrasive elements relative to said wire and cooperating cam means carried by said carriage and said holder and operable as an incident to rotation of said holder to produce a reciprocation of a second amplitude and frequency of said holder and abrading elements relative to said carriage.

2. Apparatus for surface finishing wire comprising a frame structure, a carriage slidably carried by said frame structure for linear movement relative thereto, driving means adapted to impart reciprocatory movement of a first amplitude and frequency to said carriage relative to said frame structure, a hollow shaft rotatably mounted in said carriage, said hollow shaft providing a passage therethrough for said wire, driving means to rotate said shaft, a plurality of abrasive elements adapted to contact said wire, a holder for said elements splined to said shaft and having a cam surface, a cam surface on said carriage adapted to engage said holder and reciprocate said holder at a second amplitude and frequency in response to rotation of said holder relative to said carriage.

3. Apparatus for surface finishing wire comprising a frame structure, a carriage slidably carried by said frame structure for linear movement relative thereto, driving means adapted to impart reciprocatory movement of a first amplitude and frequency to said carriage relative to said frame structure, first and second spaced aligned hollow shafts rotatably mounted in said carriage, a collar splined to said first shaft, a collar splined to said second shaft, each of said collars being provided with a passage therethrough which cooperates with said hollow shafts to define a passage for said wire, a plurality of bars each having the ends thereof secured to said collars and positioned in parallel relationship to said passage, an abrading element carried by each of said bars and mounted for movement radially of said passage, resilient means urging each of said elements into engagement with said wire, power means carried by said carriage and adapted to rotate one of said shafts and thereby rotate said collars and said abrasive elements relative to said wire and cooperating cam means carried by said carriage and said collars and operable as an incident to rotation of said movable apparatus to produce a reciprocation of a second amplitude and frequency of said collars and abrading elements relative to said carriage.

4. The method of surface finishing a cylindrical object comprising the steps of imparting linear movement to said object in the direction of its axis, creating relative rotary movement between abrasive material and the surface of said object during the linear movement and simultaneously

therewith creating a relative reciprocatory movement of a first amplitude and frequency between said object and said material longitudinally of said object and compounding therewith a second reciprocatory movement of a second amplitude and frequency between said object and said material longitudinally of said object.

5. Apparatus for surface finishing wire or rod comprising a frame structure, a carriage slidably carried by said frame structure for linear movement relative thereto, driving means adapted to impart reciprocatory movement of a first amplitude and frequency to said carriage relative to said frame structure, said frame structure having means formed therein which defines a passage for wire, means to continuously feed said wire through said passage, abrading elements carried by said carriage and adapted to engage the surface of wire being fed through said passage, means associated with said carriage and adapted to rotate said elements relative to the wire in said passage and means to impart reciprocatory movement of a second amplitude and frequency to the elements relative to said wire in said passage.

6. A surface finishing machine for finishing the surface of a cylindrical stock comprising a frame, a carriage slidably mounted on said frame, driving means to reciprocate said carriage on said frame, a surface finishing element mounted for rotation and for linear movement relative to said carriage, driving means to rotate said element and to reciprocate said element relative to said carriage and means for imparting longitudinal movement to the stock to feed it through said carriage in contact with said element.

7. A surface finishing machine for finishing the surface of a cylindrical stock comprising a carriage mounted for reciprocation relative to said stock, means to force wire stock longitudinally through said carriage, driving means adapted to impart reciprocatory movement of a first amplitude and frequency to said carriage relative to said stock, abrading elements mounted on said carriage for movement therewith and for rotation and reciprocation relative thereto, said abrading elements being mounted for engagement with said wire stock, driving means connected with said abrading elements and adapted to rotate said elements relative to said carriage and means operable in response to relative rotation of said elements and said carriage to impart reciprocatory movement of a second amplitude and frequency to said elements relative to said stock.

8. Apparatus for surface finishing wire or rod comprising a frame structure, a carriage slidably carried by said frame structure for linear movement relative thereto and including first and second relatively movable parts, means to force wire longitudinally through said carriage, driving

means adapted to impart reciprocatory movement of a first amplitude and frequency to said carriage parts relative to said wire, abrading elements mounted on said first part for movement therewith and adapted to engage the surface of said wire, driving means connected with said first carriage part and adapted to rotate said first part and said elements relative to said wire and said second part and means operable in response to relative rotation of said carriage parts to impart reciprocatory movement of a second amplitude and frequency to said first part and said elements relative to said wire.

9. In a surface finishing machine, a frame structure, a carriage slidably mounted on said frame structure for relatively long strokes of reciprocative movement relative to said frame structure, said carriage including first and second parts mounted for sliding movement one relative to the other and for relative rotation, driving means operable to reciprocate said carriage and said parts, a surface finishing tool carried by and movable with one of said parts, means for rotating said one part during the aforesaid reciprocative movement of said carriage, cooperating cam means carried by said first and said second parts and operable as an incident to rotation of said one part to produce a relatively short stroke of rectilineal reciprocative movement of said one part and said tool relative to said other part.

10. Apparatus for surface finishing wire comprising a frame structure, a plurality of abrading elements, a carriage slidably carried by said frame structure and carrying said elements in radial relationship relative to said wire and in contact with said wire, said elements being mounted in said carriage for reciprocation relative thereto, driving means for imparting to said carriage reciprocatory movements of a first amplitude and frequency and driving means to reciprocate said elements relative to said carriage.

DAVID A. WALLACE.

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