Nov. 22, 1966 R. J. SMITH ET AL 3,286,292

METAL STRIP BRUSHING MACHINE

Filed July 8, 1964 4 Sheets-Sheet 1

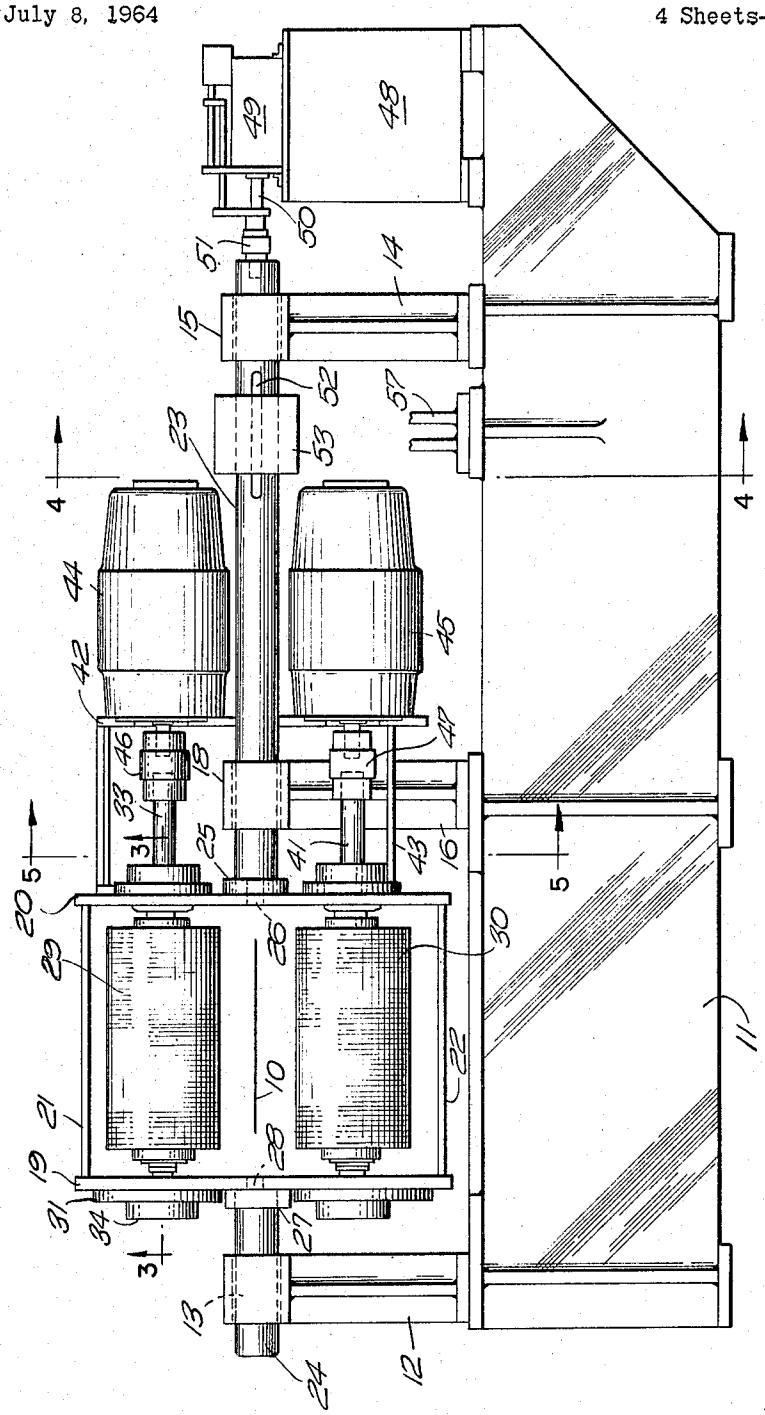


FIG. 1

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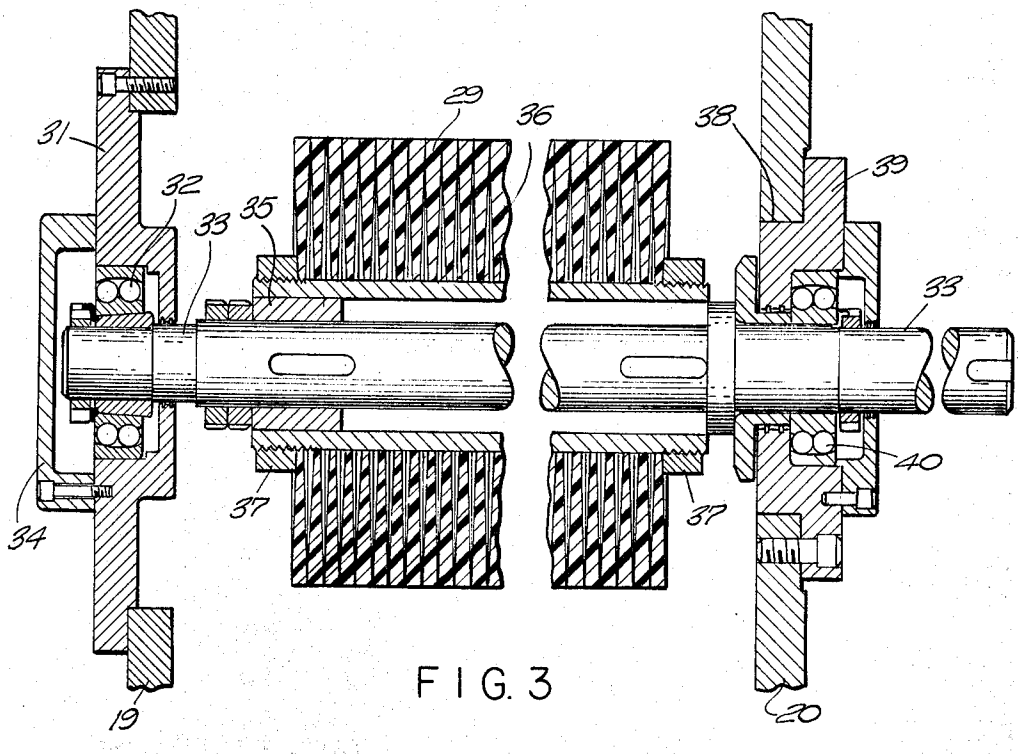


FIG. 3

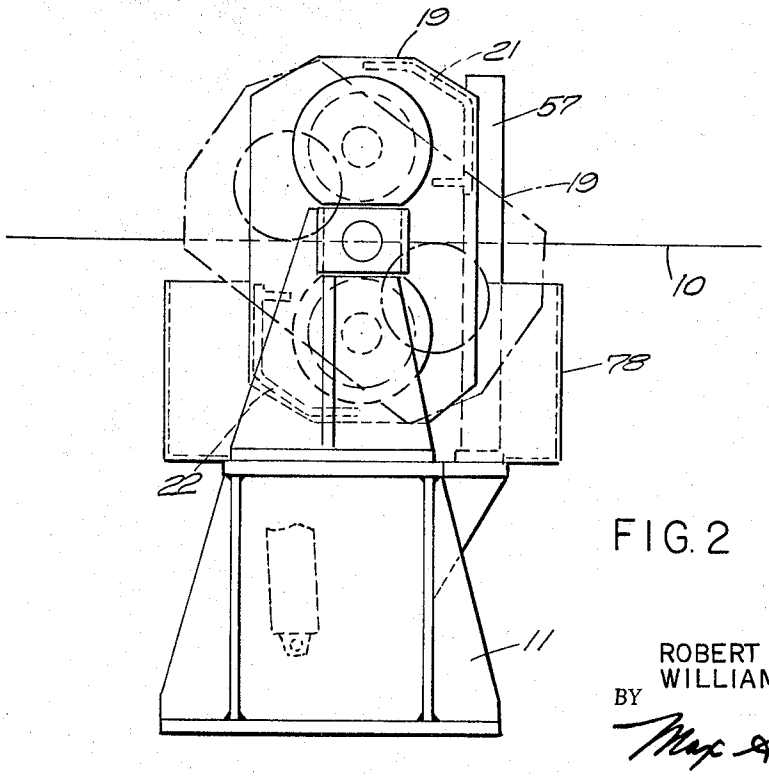


FIG. 2

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METAL STRIP BRUSHING MACHINE

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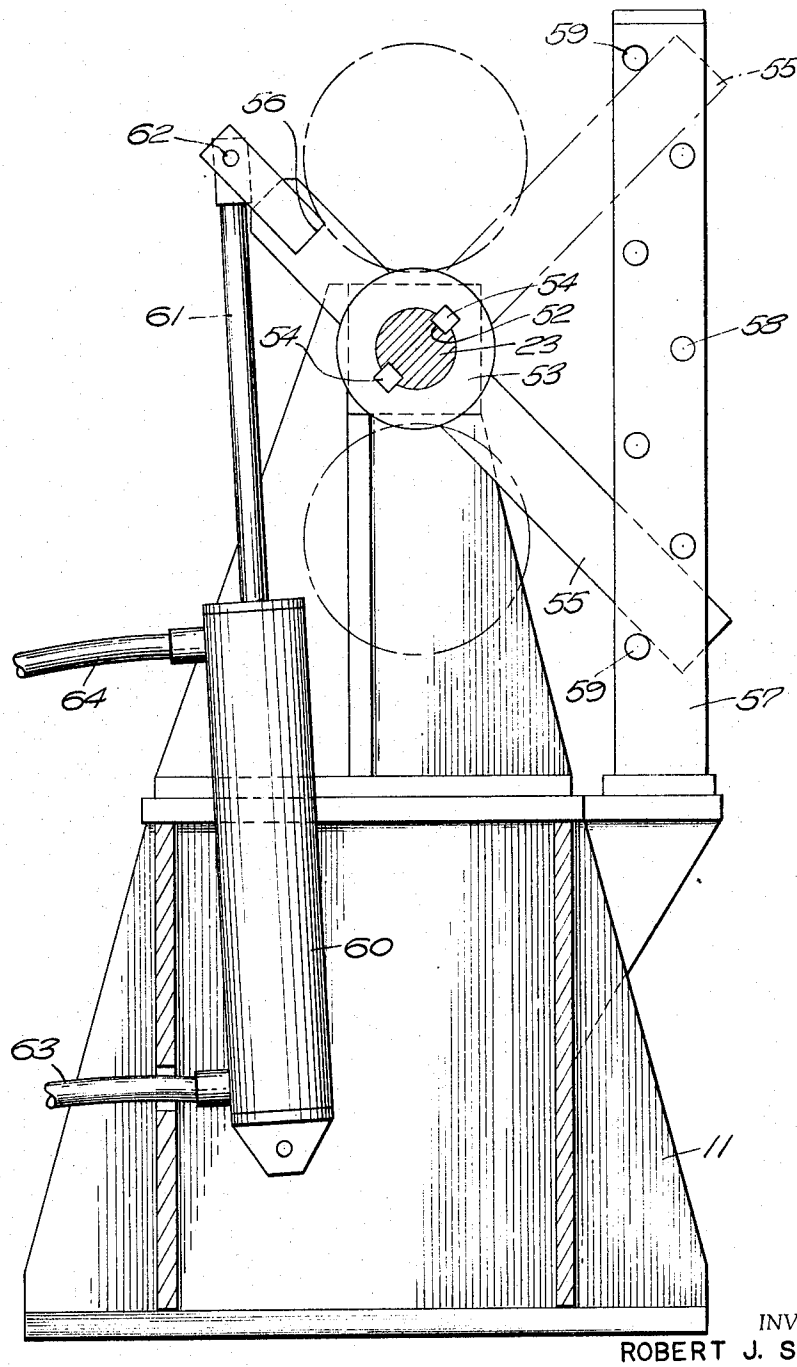


FIG. 4

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METAL STRIP BRUSHING MACHINE

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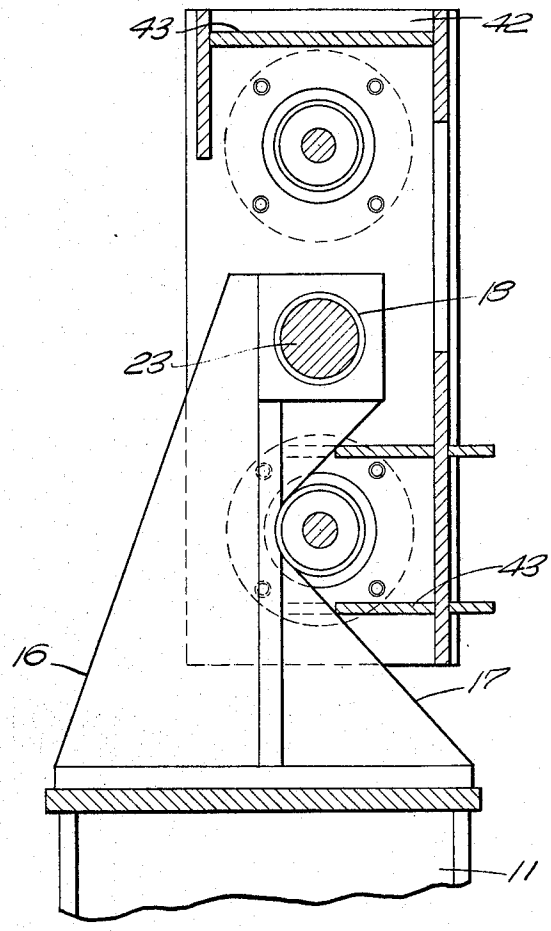


FIG. 5

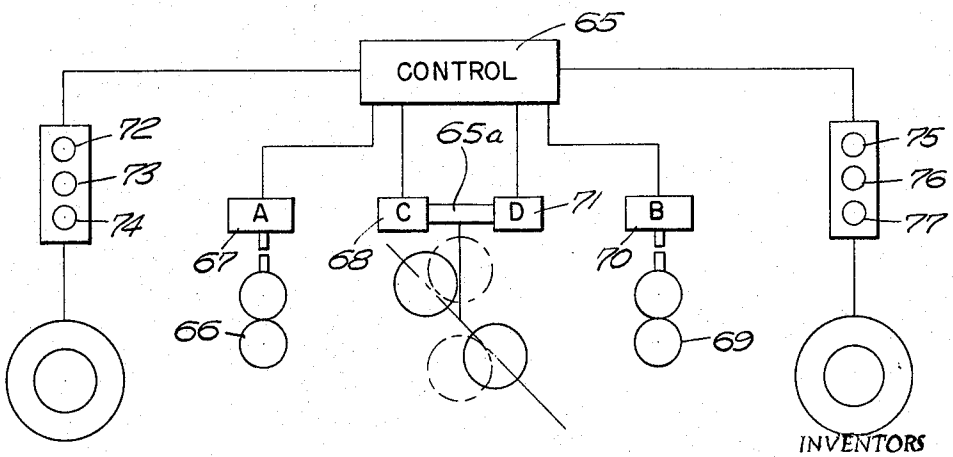


FIG. 6

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3,286,292

METAL STRIP BRUSHING MACHINE

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6 Claims. (Cl. 15—77)

Our present invention relates to the metal forming art and more particularly to a novel machine for brushing metal in strip form.

The principal object of the present invention is to provide a novel machine for applying a brush finish to strip metal.

Another object of the present invention is to provide a machine for brushing strip metal during the final stages of its cleaning and winding.

A further object of the present invention is to provide a brushing machine for strip metal which is also readily adaptable for buffing, brushing, polishing, rougeing or for applying a satin finish to the strip metal.

Another object of the present invention is to provide a brushing machine which is automatically controlled by the movement of the metal being brushed.

Another object of the present invention is to provide a machine for brushing strip metal in transit which is simple in construction and easy and economical to manufacture and assemble.

With the above and other objects and advantageous features in view, our invention consists of a novel arrangement of parts more fully disclosed in the detailed description, following in conjunction with the accompanying drawings, and more particularly defined in the appended claims.

In the drawings,

FIG. 1 is a front elevation of a machine embodying our present invention.

FIG. 2 is an end view thereof taken from the left side viewing FIG. 1.

FIG. 3 is a section taken on line 3—3 on FIG. 1.

FIG. 4 is a section taken on line 4—4 on FIG. 1.

FIG. 5 is a section taken on line 5—5 on FIG. 1.

FIG. 6 is a diagram of the control mechanism.

Metals such as brass, copper, alloys of brass and copper, aluminum, steel, and stainless steel are customarily supplied in strip form suitable for stamping and similar operations. During the final stages of the preparation of the metal in strip form, it is customary to pass the metal through a mild acid bath, remove the acid with a water rinse, brush the metal with suitable brushes for taking off scale and oxide, washing and drying the metal, and then winding it for shipment. The present invention is designed to provide a novel brushing machine, automatically tied to the movement of the metal through the system, and designed to provide a brushing of the strip metal which will result in a smooth and bright finish. By changing the brushes and inserting the machine in different portions of the assembly line, the machine can be used to provide polishing, brushing, and different finishes.

Referring more in detail to the drawings illustrating our invention, FIG. 1 illustrates the machine of the present invention as positioned transversely to the movement of the metal strip. In the manufacture of brass, copper and its alloys, the metal strip at this point is normally quite wide. Slitting of the metal to the customer's specification is performed at a later point in the process, after it has passed through the operations of the present invention. The strip **10** is thus normally moving in the direction at right angles to the machine illustrated in FIG. 1. In the course of the final cleaning

process, the strip is moved from an unwind position to a winder under tension. When the end of one strip is reached and the beginning of another is started, the end of the preceding strip is stitched or spliced to the beginning of the next strip to pull it through the cleaning operation. This splice forms a large bump which is eventually cut off at the winding end by the operator.

The brushing operation described herein is accomplished with a brush formed of compressed nylon discs. The brushes usually are operated at comparatively high speeds. If the bump formed by the splice is allowed to pass through the brushes, the brushes could be chewed up and quickly worn out. Furtherfore, during the splicing operation, or the final cutting operation at the winding end, either the operator may stop completely or greatly slow down the movement of the metal through the cleaning process. The brushes rotating at approximately 1500 r.p.m. would burn the metal strip and probably cut right through it. It is essential therefore that the machine of the present invention operate to protect the brushes and to protect the metal during the brushing operation.

The machine of the present invention is mounted on a suitable base **11**. The base **11** is of a stress relief construction as illustrated. Mounted on the base **11** at the left end viewing FIG. 1, is a supporting bracket **12** of generally triangular shape, broader at the base and narrowing to the top and supporting a bronze bushing **13**. Spaced from the right end of the machine, as shown in FIG. 1, is another similar bracket **14**, supporting a similar bronze bushing **15**. Intermediate the brackets **12** and **14** is another bracket **16**, which is similar to the brackets **12** and **14** but is provided with a V-shaped cut out portion **17**, as shown in FIG. 5, for clearance. The bracket **16** also supports a bronze bushing **18**, the bushings **13**, **15** and **18** being in axial alignment.

We now provide a pair of generally rectangular plates **19** and **20** connected adjacent their upper and lower ends by angular plates **21** and **22** as shown in FIGS. 1 and 2. The plates **19**, **20**, **21** and **22** form a frame which is mounted at the right side, as shown in FIG. 1, on a shaft **23**, and on the left side on a shaft **24**. The shaft **23** is mounted in the bushings **15** and **18** and terminates at the plate **20** with an enlarged collar **25**, and a reduced end **26** which enters a suitable opening in the center of the plate to support the plate **20**. The right end of the shorter shaft **24**, which is supported in the bearing **13**, is also provided with an enlarged collar **27** and a reduced end **28** entering a suitable opening in the plate **19**. The generally rectangular frame formed by the plates **19**, **20**, **21** and **22** is therefore suspended between the ends of the shafts **23** and **24** as shown in FIG. 1.

Mounted in the frame between the plates **19** and **20** are a pair of vertically spaced rotatable brushes **29** and **30**. Both brushes, **29** and **30** are mounted as illustrated in FIGS. 1 and 3. The plate **19** is provided with a large opening which permits removal and replacement of the brush as it is worn. The opening is covered by a plate **31** which is removably bolted in place. The plate **31** carries the bearing **32** which supports the arbor or shaft **33** on which the brush **29** is mounted. The bearing may be covered at **34**. The brush is actually supported on a frame **35**, which is keyed to the arbor or shaft **33**, and comprises a plurality of nylon discs compressed to form a cylindrical brush element mounted on a tubular portion **36** which is locked over the frame at each end by collars **37**. However, other types of brushes or polishers can be substituted to perform brushing, buffing, polishing or rougeing, depending on the desired finish. Also, the brushes may be varied to provide one type of finish on one side of the strip and another type of finish on the other side. At the right end, viewing FIGS. 1 and 3, the plate **20** is provided with a smaller open-

ing 38 in which a bushing 39 is mounted carrying the bearings 40 for supporting the other end of the arbor or shaft 33 which extends through the bearing. The lower complementary brush 30 is mounted in the identical manner on an arbor 41.

Now viewing FIGS. 1 and 5, we provide a rectangular supporting plate or frame 42 spaced from the plate 20 and supported thereon by the transverse strips 43. A pair of upper and lower motors 44 and 45 are bolted to the frame plate 42, as shown in FIGS. 1 and 5, in axial alignment with the arbors 33 and 41 respectively. A flexible coupling 46 connects the motor 44 with the arbor 33, and a flexible coupling 47 connects the motor 45 with the arbor 41. Thus, the brush 29 is driven through the coupling 46 by the motor 44 and the lower brush 30 is driven through the coupling 47 by the motor 45. By utilizing individual drives, complex gearing is eliminated, each motor may be of smaller capacity, and each brush can be separately controlled both as to direction and speed of rotation. It is contemplated that the motors be rheostatically controlled.

Mounted on the extreme right hand end of the base 11 as viewed in FIG. 1, is a cylinder bracket 48 on which is mounted a reciprocating device 49, such as a Schrader "RECIPROPAC." The piston 50 extending from the cylinder 49 is coupled at 51 to the end of the shaft 23. It is contemplated that the brushes 29 and 30 be longer than the width of the stock 10. To promote a better and more even brushing and a more even wear on the brushes, the pneumatic device 49 is designed to axially reciprocate the shaft 23 with a sufficient stroke in each direction to ensure that every inch of surface of each brush will contact the metal at each moment. The reciprocating action of the pneumatic cylinder 49 thus pulls the shaft 23 axially backwards and forwards, which in turn pulls the brush frame mounting and motors and the brushes therein, and finally the short shaft 24 at the opposite end.

Now referring to FIGS. 1, 2 and 4, it is obvious that when the parts are assembled as shown in FIGS. 1 and 4 there is considerable space between the brushes and the stock 10. However, when the shafts 23 and 24 are pivoted into the dot and dash line position shown in FIG. 2, the upper brush 29 will contact the upper surface of the stock 10 and the lower brush 30 will contact the lower surface of the stock 10 so that there is a simultaneous brushing of the upper and lower surfaces of the stock. Thus pivotal movement of the shafts 23 and 24 which in turn cause pivotal movement of frames 19 and 20 and the brushes 29 and 30 cause the brushes to either contact or move away from the stock. This pivotal movement is controlled by the construction illustrated in FIGS. 1 and 4.

Viewing FIG. 1, to the left of the bearing 15, the shaft 23 is provided with a pair of keyways 52 of sufficient length to permit the reciprocable axial movement of the shaft hereinabove described. Mounted on the shaft at this point is a collar 53 which is keyed to the keyways, as at 54. As shown in FIG. 4, a guide arm 55 extends angularly downwardly from the lower portion of the collar 53 and in alignment therewith, another arm 56 extends upwardly therefrom. Mounted on the base 11 in the path of axial movement of the guide arm 55 is a guide post 57 which comprises spaced parallel plates. The arm 55 is adapted to swing from the position shown in FIG. 4 to the upper dot and dash position within the confines of the guide post 57. The spaced plates of the guide post 57 are provided with a plurality of openings 58 to permit the positioning of upper and lower stop pins 59 to control the degree of turning movement of the collar 53. This adjustment permits the turning movement of the collar 53 and of the shafts 23 and 24 to increase or decrease the pressure of the brushes against the stock 10 and to increase or decrease the distance to which the brushes are lifted from the stock 10.

Movement of the collar 53 is controlled by a pneumatic cylinder 60 having a piston rod 61 which is pivotally attached at 62 to the outer end of the arm 56. It is obvious that upward and downward movement of the cylinder rod 61 will cause reciprocating movement of the short arm 56 and of the collar 53. This in turn will cause pivotal movement of the shaft 23 and the brushes 29 and 30. The cylinder 60 is controlled, as by lines 63 and 64 to supply hydraulic or pneumatic pressure for its movement. In some instances, such as for fine finishes, it may be desirable to more accurately control the pressure of the brushes on the strip. For this purpose, the pressure lines 63 and 64 may be provided with reduction valves which can be operated to control the pressure in the cylinder 60. Also pivotal movement of the shaft 23 may be provided by other suitable means such as a gear and rack, or by solenoid powered devices.

Control of the device is accomplished in general by the diagrammatic hookup shown in FIG. 6. An electronic control box 65 controls a four-way air valve 65*a* which controls the passage of the air pressure through the pipes 63 and 64 to the cylinder 60 for pivoting the shafts and brushes. As the metal is passing through the system, and the brushes have been pivoted so that they contact the upper and lower portions of the metal, they first pass between a pair of pinch rollers 66, the upper roller of which is spring biased and operates a micro-switch 67. When the bump in the metal caused by the splice passes between the pinch rollers 66 it energizes the micro-switch 67 which in turn, through the control mechanism 65, operates the solenoid valve 68, causing pivotal movement of the brushes away from contact with the metal. This permits the bump to pass through the brushing device without touching the brushes. After it has passed through, the bump can contact another set of pinch rollers 69, at the other side of the machine, which operates a micro-switch 70, and through the control panel 65, operates a solenoid valve 71 which causes the brushes to tilt or pivot back into contact with the metal.

In addition, as has been previously explained, the metal is originally being unwound at one end and wound at the other end after passing through a series of acid baths and washings. At the unwind end, the operator must stop the metal when the end is reached in order to splice or stitch another length of metal to it. At this point the operator is equipped with a board having a stop button 72 a slow running or jog button 73 and a running button 74. To prevent the metal from being burnt by the brushes and to prevent injury to the brushes, the control panel is designed to tilt the brushes away from contact with the metal whenever the unwind operator presses either button 72 or 73 for stopping or slow running or jogging. On pressing the button 74 for standard high speed running, the control panel will again tilt the brushes into contact with the metal. By the same token at the winding end, this operator must stop the metal when the bump or splice reaches him and cut it out and then start a new wind on a new core. He is also provided with a control panel having a stop button 75 a slow running or jogging button 76 and a full running button 77. Again if he presses buttons 75 or 76 the control will cause the brushes to tilt away from the metal whereas when he presses button 77 they will tilt into contact with the metal. Other safety controls may be added, for example, for stopping all motors if the strip should break.

It is further contemplated that a water spray may be provided with the brushes for cleaning and cooling. If desired, a splash tank 78 can be mounted on a base beneath the brushes as shown in FIG. 2. The cleaning or polishing of the metal especially of brass and copper alloys usually includes an acid bath and a wash. The metal is handled in a continuous running operation from an unwind position through a stitcher to form the splice so that one strip of metal pulls the other strip of metal through the various devices, and a tension bridle is provided for providing the

proper tension to the metal as it passes through. The metal first passes through a mild acid bath, a wringer, and a rinse to remove the acid with a high velocity water spray. Now comes the device of the present invention which includes brushing and a cold water spray while brushing. The metal is now passed through a hot water immersion with boiling water then through a hot box for drying. It can then be wound.

However, if it is desired to form even more expensive finishes such as a satin finish, rouge, buffing or polishing, it is done at this point before the winding, and can be done with the machine of the present invention with different types of brushes and polishing wheels. The brushes of the present invention are automatically controlled to produce the desired results without the need of another separate operator. The device can be installed as part of the usual conventional cleaning and brushing process. It is comparatively simple in construction and easy and economical to manufacture and assemble. Other advantages of the present invention will be readily apparent to a person skilled in the art.

We claim:

1. A device for brushing a metal strip moving under tension from an unwinding to a winding position comprising an elongated base, a plurality of spaced vertical posts mounted on said base, a bearing on the top of each post, said bearings being in axial alignment, a split shaft rotatably and axially slidably mounted in said bearings, a rectangular plate vertically mounted at the split end of one shaft portion, a complementary rectangular plate mounted on the split end of the other shaft portion, said plates being horizontally joined by supporting members to form a rectangular frame supported by said shaft, the metal strip passing through said frame, spaced upper and lower brushing elements mounted in said frame above and below the strip, means for pivoting said shaft and frame to cause said brushing elements to contact the upper and lower surfaces of the strip, and means mounted on said base for reciprocating said shaft and frame transversely to the strip.

2. A device according to claim **1** wherein said brushing elements are each mounted on a separate shaft extending from one side of said frame, an auxiliary frame portion mounted on one side of said main frame, a reversible rheostat-controlled motor mounted on said auxiliary frame in alignment with each of said brushing element shafts, and a flexible coupling connecting each motor to its aligned shaft for individually and selectively driving each of said brushing elements.

3. A device according to claim **1** wherein a collar is keyed to said shaft, an operating arm extends from said collar, and a pneumatically reciprocable piston is pivoted to the end of said operating arm.

4. A device according to claim **3** wherein a vertical guide is mounted on said base, said guide comprising spaced parallel plates having aligned openings, a guide arm extending from said collar between said guide plates and stop pins selectively positioned in said openings to limit the pivotal movement of said arm, collar and frame.

5. A device according to claim **1** wherein said frame is mounted on a shaft, a collar is keyed to said shaft, an operating arm extends from said collar, a pneumatically reciprocable piston is pivoted to the end of said operating arm, and a vertical guide is mounted on said base, said guide comprising spaced parallel plates having aligned openings, a guide arm extending from said collar between said guide plates, and stop pins selectively positioned in said openings to limit the pivotal movement of said arm, collar and frame.

6. A device according to claim **1** wherein there is means for automatically pivoting said shaft to move said brushing elements away from the strip in response to the passage of a bump on the strip.

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