July 17, 1951 C. L. DEWEY 2,561,101

ROTARY PEENER

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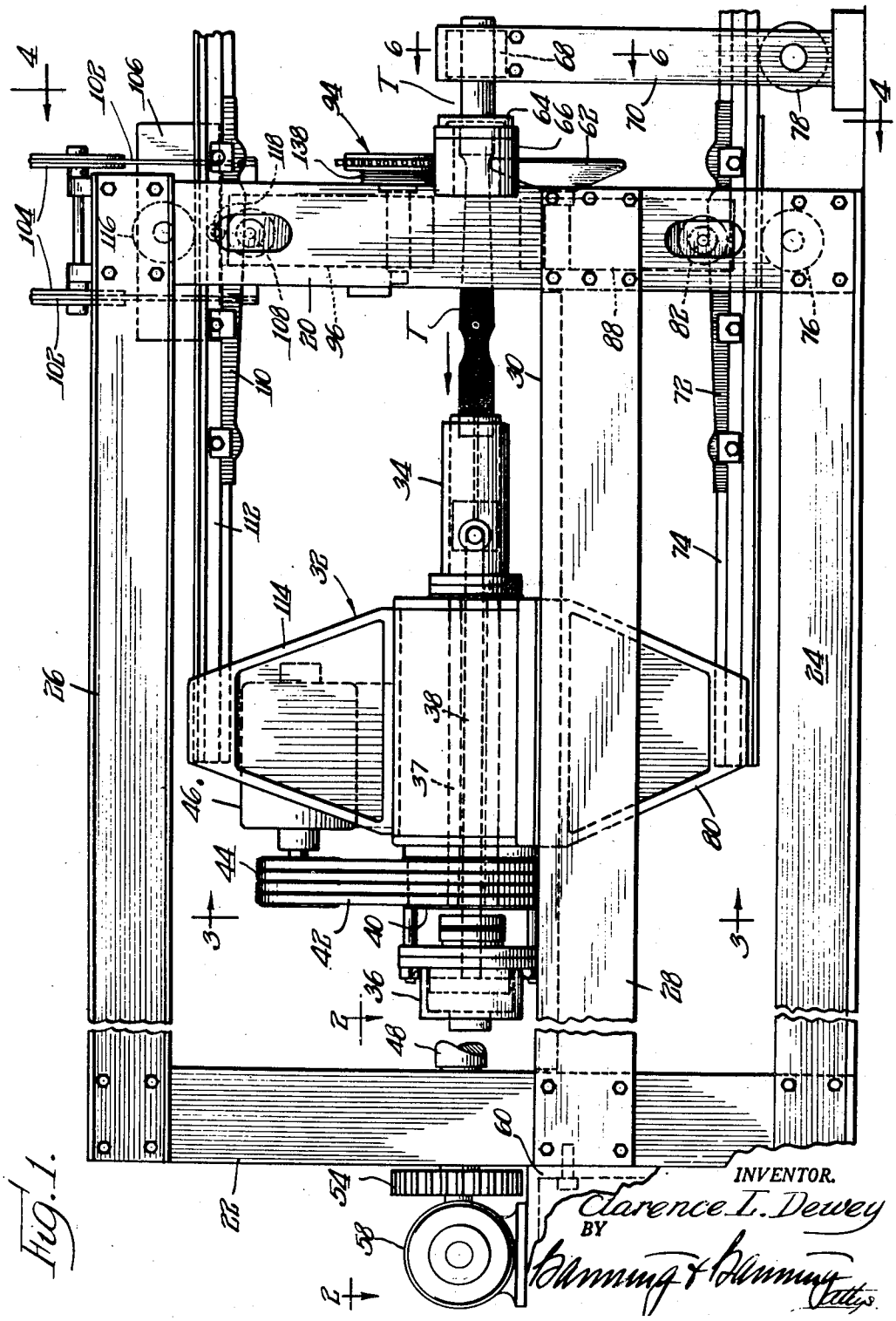


Fig. 1.

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ROTARY PEENER

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Fig. 3.

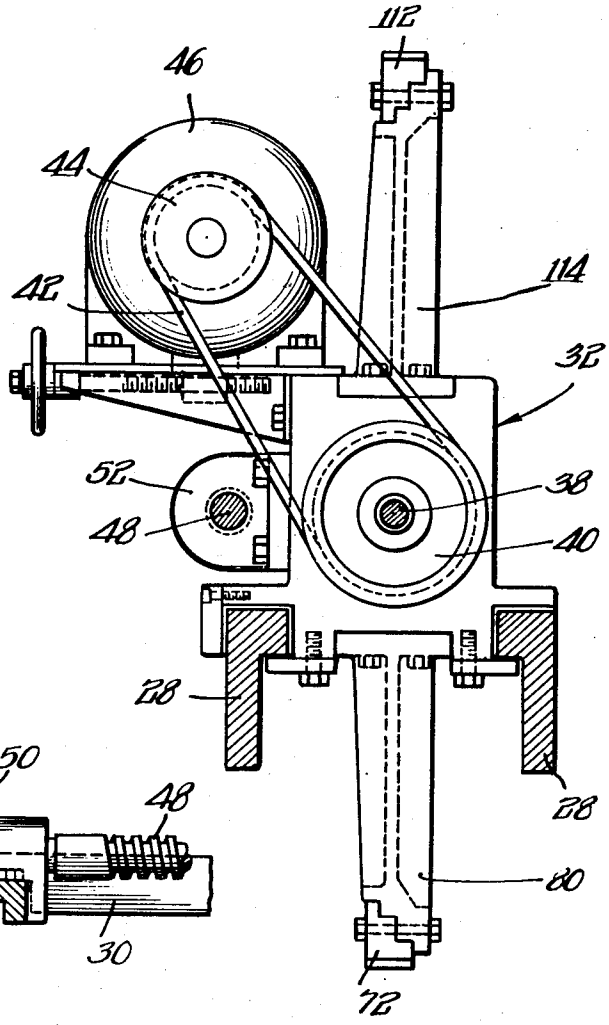
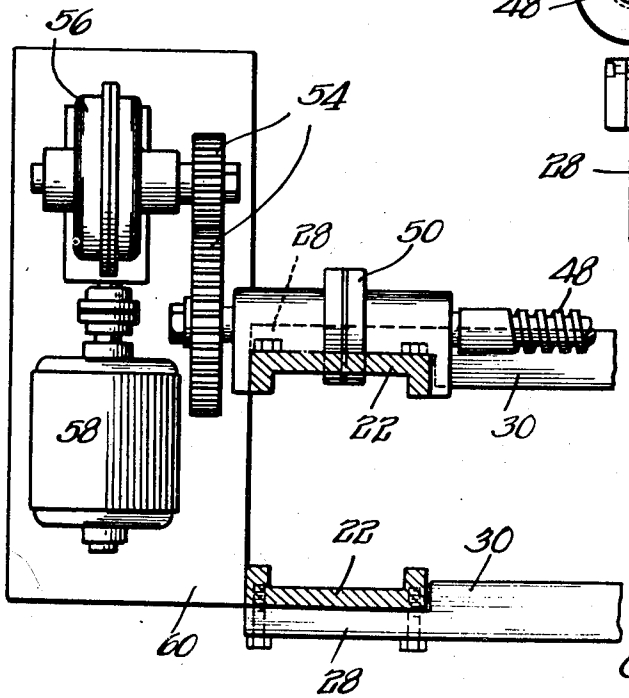


Fig. 2.



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Fig. 4.

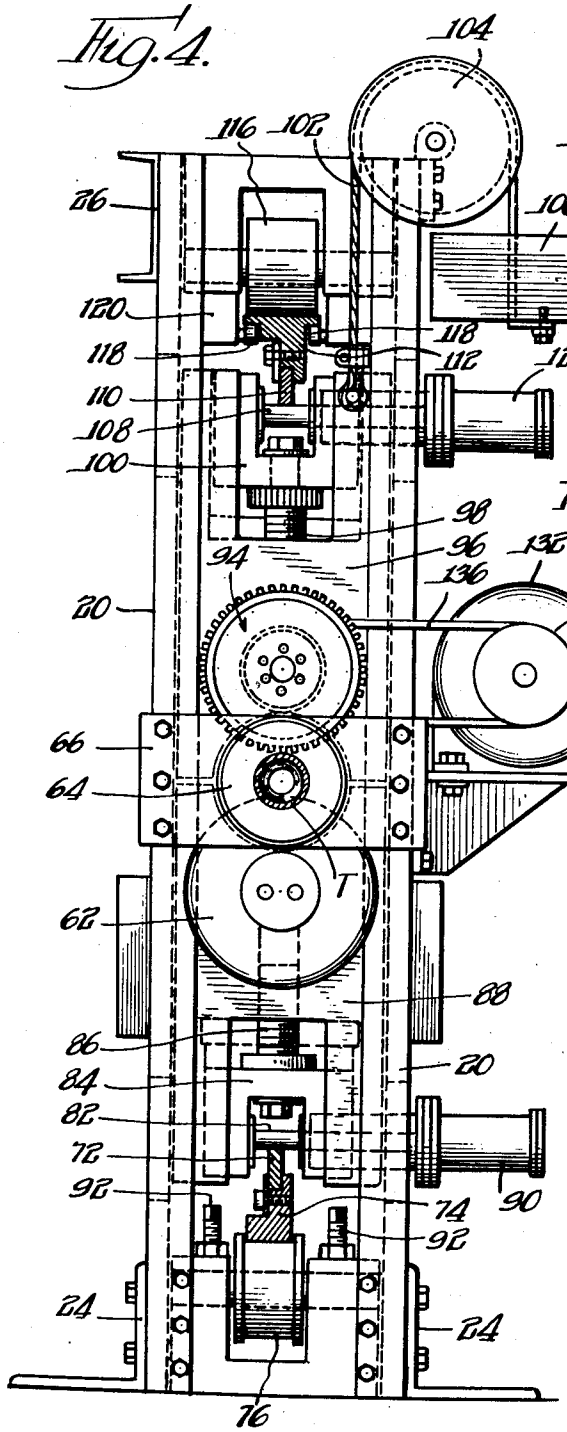


Fig. 5.

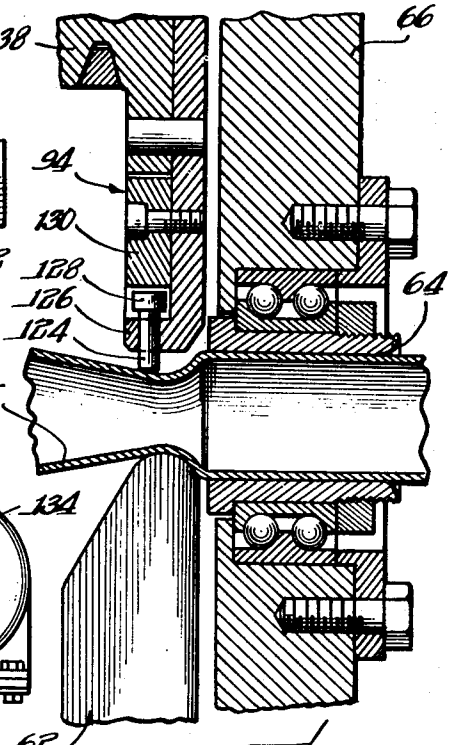
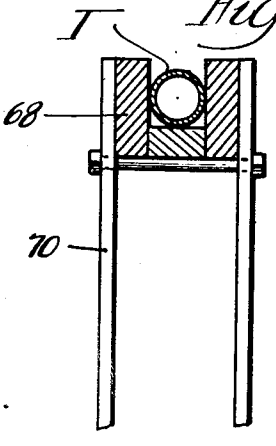


Fig. 6.



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ROTARY PEENER

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Fig. 7.

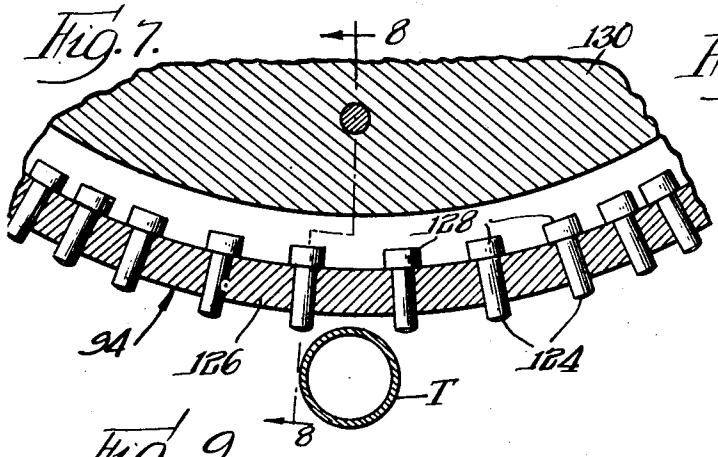


Fig. 8.

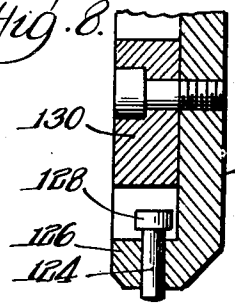
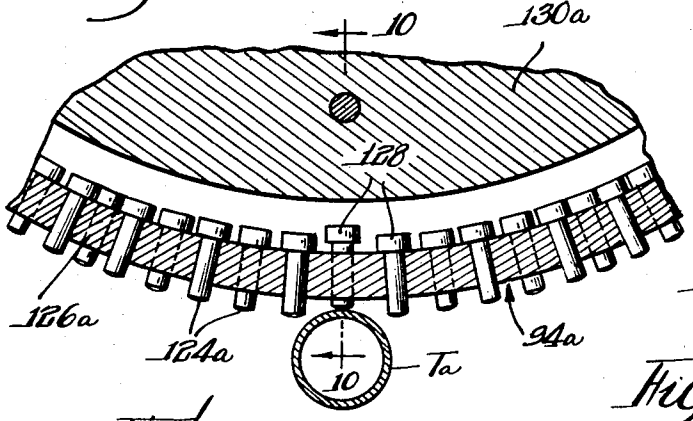


Fig. 9.

Fig. 10.



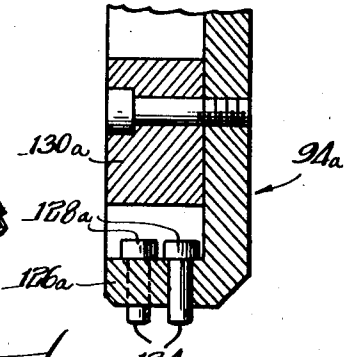
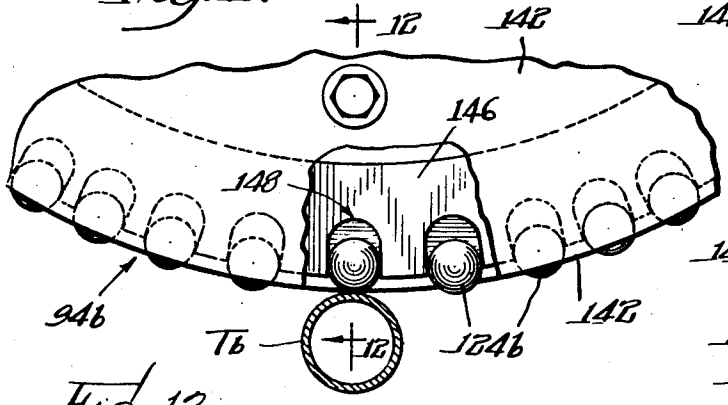


Fig. 11.

Fig. 12.



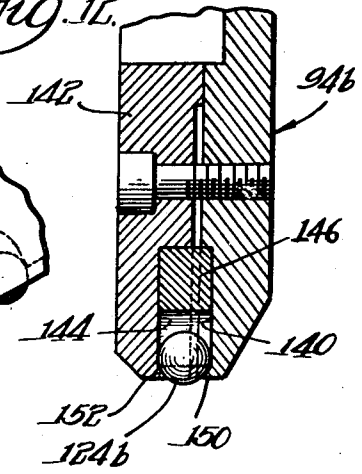
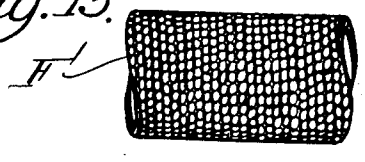


Fig. 13.



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UNITED STATES PATENT OFFICE

2,561,101

ROTARY PEENER

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Application February 3, 1947, Serial No. 726,043

1 Claim. (Cl. 29—90)

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My invention relates to machine tools and has for its general object the provision of an improved hammering or peening machine for finishing metal.

Metal shaping and forming operations tend to leave marks or blemishes in the surface of the metal which detract from the appearance of the finished product. It has been the practice heretofore to eliminate these marks from the metal by resorting to relatively time-consuming and expensive finishing operations, such as buffing. The finish which is imparted to the metal by conventional finishing methods is not necessarily the one best suited for the purpose to which the metal may be put. In the case of furniture constructed of metal tubing, for example, a smooth finish on the metal would readily show any scratches or other marring of the surface which may occur while the furniture is in service.

One of the salient features of the present invention is that it affords a simple and economical method of imparting to the metal a finish which effectively disguises the marks and blemishes left on the metal as a result of the shaping operation, as well as rendering unnoticeable any marring of the surface which is likely to occur while the finished product is in service. This object is achieved by hammering or peening the metal to obtain a "fish-scale" or "snakeskin" finish which greatly improves its appearance. A further advantage is that the surface of the metal is hardened by being cold-worked so that it more effectively resists scratching, nicking and similar disfiguration.

Another object of the invention is to provide a novel rotary peener in which a series of peens is disposed on the periphery of a wheel, each peen normally being urged radially outwardly and being arranged to rebound inwardly upon striking the surface of the metal, leaving a small indentation in the metal. More specifically, my invention has application to a machine for operating upon metal tubing, wherein the tube is rotated while being worked thereby to space the indentations formed therein by the flying peens.

A further object is to so adapt the peener that it may be used in conjunction with a metal tube shaper, whereby the tubing is peened substantially concurrently with the shaping thereof.

Various other objects, advantages and features of the invention will be apparent from the following specification when taken in connection with the accompanying drawings wherein certain preferred embodiments are set forth for purposes of illustration.

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In the drawings, wherein like reference numerals refer to like parts throughout:

Fig. 1 is a front elevation of a tube shaping and peening machine which embodies the principles of the invention;

Fig. 2 is a fragmentary horizontal section taken on the line 2—2 of Fig. 1;

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

Fig. 4 which is a vertical section taken on the line 4—4 in Fig. 1, shows the portion of the machine (mostly in elevation) hereinafter referred to as the work head;

Fig. 5 is a fragmentary longitudinal section showing in detail the tube shaping and peening members of the machine;

Fig. 6 is a section through the metal feed trough taken on the line 6—6 in Fig. 1;

Fig. 7 is a fragmentary section view through a peening wheel transverse to the direction of feed of the metal tubing, showing one form of the peens which may be employed;

Fig. 8 is a section on the line 8—8 in Fig. 7;

Fig. 9 is a sectional view similar to Fig. 7 but showing an alternative arrangement of the peens;

Fig. 10 is a section on the line 10—10 in Fig. 9;

Fig. 11 is a sectional view through a peening wheel equipped with a modified form of the peens;

Fig. 12 is a section on the line 12—12 in Fig. 11; and

Fig. 13 is a view of a section of metal tubing to illustrate the type of finish imparted thereto by my novel peening process.

Referring now to the drawings, and particularly Figs. 1 through 4 thereof, the combination tube shaper and rotary peener therein illustrated is supported by a suitable frame comprising head posts 20, tail posts 22, base beams 24, top beams 26 and rails 28. The rails 28 are machined on the top surfaces thereof to afford smooth ways 30 upon which a head stock 32 is adapted to travel back and forth.

A metal tube T which is to be shaped and peened is gripped at one end thereof by a chuck 34 carried by the head stock 32 and is drawn through a work head comprising the tube shaping and peening elements supported between the head posts 20 of the machine. These operations are performed upon the tube T while it is traveling from right to left as viewed in Fig. 1. The jaws of the chuck 34 preferably are pneumatically operated by the piston of a compressed air cylinder 36 carried by the head stock 32, the piston being connected by a pull shaft 38 to the

chuck jaws. Pulleys 40 mounted on the hollow driving shaft 37 are connected by belts 42 to pulleys 44 on the shaft of a motor 46 mounted on the head stock 32. The motor 46 operates to rotate the shaft 37 and tube T as the head stock 32 travels along the rails 28. The motor speed and the relative sizes of the pulleys 40 and 44 are selected to obtain the desired rotational speed of the tube T. The purpose of rotating the tube T as it is drawn through the work head will appear presently.

For moving the head stock 32 back and forth there is employed a feed screw 48, Figs. 1, 2 and 3, which is journaled in a bearing 50 mounted on one of the tail posts 22 and threaded through a nut 52 secured to the head stock 32. Through changeable reduction gears 54 and a worm gear 56, the feed screw 48 is coupled to a driving motor 58 mounted on a platform 60 attached to the tail posts 22. The motor 58 is reversible to actuate the head stock 32 alternately in opposite directions. The motor speed and gear ratios are selected to obtain the desired rate of feed of the tube T as, for instance, coarse feeds for aluminum, brass and copper tubing, medium feeds for low carbon steel tubing, and fine feeds for high carbon and stainless steel tubing.

The work head includes a shaping roll 62, Figs. 1, 4 and 5, which is capable of vertical movement toward and away from the axis of the tube T as it progresses through the work head. It will be understood that where the machine is being employed to operate only on straight tubing, the shaping roll 62 may be held stationary or dispensed with altogether. To resist the thrust of the shaping roll 62 against the tube T there is provided a bushing 64 mounted in a housing 66 secured to and extending between the head posts 20. Tube T passes through the bushing 64 prior to being operated upon by the shaping roll 62. That portion of the tube T which is being fed into the work head is supported by a trough 68, Figs. 1 and 6, carried by a stand 70. The trough 68 is constructed of or lined with suitable material which will not deface the tube T.

To control the radial movement of the shaping roll 62 relative to the tube T there is employed a templet 72, Figs. 1 and 4, in the form of an elongated bar having a contour corresponding to the shape of the table leg or other article into which the tube T is being formed. The templet 72 is bolted to a horizontally extending templet bar 74 which is supported from beneath by rollers 76 and 78, respectively mounted in the work head and the stand 70. One end of the templet bar 74 is secured to a depending arm 80 of the head stock 32. Hence, as the head stock 32 travels back and forth along the rails 28, the templet bar 74 and templet 72 are moved longitudinally therewith. The roller 76 serves to back up the templet bar 74 against the thrust of a roller 82 which rides on top of the templet 72. The templet roller 82 is carried by a vertically movable block 84 disposed between the head posts 20 in the work head. The block 84 is connected by an adjusting screw 86 to another vertically movable block 88 in which the shaping roll 62 is journaled.

Thus, as the head stock 32 travels forwardly, or to the left as viewed in Fig. 1, the templet 72 causes the shaping roll 62 to move vertically for shaping the tube T as it is drawn through the work head. Inasmuch as the tube T is turned while being drawn forwardly, the pressure of the shaping roll 62 is progressively applied around the periphery of the tube. The roll 62 is free to turn on its own axis.

When the head stock 32 reaches the end of its working stroke, the rotation of the feed screw 48 is reversed to start the return stroke of the head stock. A pneumatic cylinder 90, Fig. 4, mounted on the movable block 84 is provided to effect retraction of the templet roller 82 during the return stroke of the head stock 32, thereby avoiding unnecessary wear of the templet 72 and roller 82. Adjustable stops 92 support the sliding block 88 while the roller 82 is retracted.

The rotary peener which finishes the metal tube T comprises a wheel 94, Figs. 1, 4, 5 and 7, journaled in a slide block 96 disposed between the head posts 20 in the work head. The block 96 is connected by an adjusting screw 98 to a smaller block 100 disposed between legs of the block 96. Ropes or cables 102 secured at one end thereof to the block 96 are passed over sheaves 104 mounted on the top of the work head and are attached at their other ends to a counterweight 106. The block 96 thus is pulled upwardly by the counterweight 106, causing a roller 108 carried by the block 100 to bear against a templet 110 which controls radial movement of the peening wheel 94 relative to the tube T. The templet 110 is bolted to a horizontally extending templet bar 112 which is fastened at one end thereof to an upright arm 114 of the head stock 32. A back-up roll 116 journaled in the top of the work head cooperates with the upper surface of the templet bar 112 to take up the thrust of the templet roller 108. Rollers 118 positioned beneath flanges along the upper edge of the templet bar 112 are journaled in support blocks 120.

During the return stroke of the templet 110 the templet roller 108 is retracted by a pneumatic cylinder 122, and the rollers 118 support the templet bar 112. The blocks 120, which may be provided with adjusting screws (not shown), limit upward movement of the block 96 and the parts carried thereby under the influence of the counterweight 106 when the templet roller 108 is retracted.

The peening wheel 94 is provided with a series of peens 124 spaced about the periphery of the wheel. In the embodiment of the invention illustrated in Figs. 5, 7 and 8, the peens 124 are shaped as pistons or plungers, the shanks of which extend through apertures in a flange 126 of the wheel 94. As the wheel 94 is rotated, in a manner to be explained presently, the centrifugal force tends to urge the peens 124 radially outwardly. Such movement of the peens 124 is limited by heads 128 on these peens. It should be noted that the force of gravity acting on the peens 124 in the lower half of the wheel 94 also urges these peens radially outward, but the effect of gravity is negligible compared to that of the centrifugal force which is developed during operation.

As each peen 124 is carried past the tube T, it strikes the tube a glancing blow and rebounds radially inward. The movement of the peens on rebound is limited by a ring 130 secured to the wheel 94 in spaced relation to the flange 126. Each peen 124 preferably is rounded at its lower end, and as it strikes the tube T, it forms a small, round indentation in the surface of the metal. Inasmuch as the tube T is rotated while being operated upon, the indentations formed therein by the individual peens 124 are closely spaced around the tube. The resultant finish F,

Fig. 13, on the tube T resembles fish-scales or the skin of a reptile, thus effectively disguising any blemishes in the tube T as it is being shaped and also hardening the surface of the metal to more effectively resist marring.

The peening wheel **94**, as shown in Fig. 5, is located slightly to the rear of the shaping roll **62** in the direction of feed of the metal tube T so that the tube is first shaped and then peened. In effect, however, the two actions occur so close together as to be substantially concurrent. The peening wheel **94** may be rotated in either direction relative to the rotation of the tube T, although to avoid undue scuffing of the peens **124**, it will usually be rotated in the opposite direction radially, so that as the peens **124** meet the surface of the tube, they are traveling in substantially the same linear direction, though at considerably different speeds, at the point of contact. For rotating the wheel **94** there is provided a motor **132**, Fig. 4, having a pulley **134** that is connected by a belt **136** to a pulley **138**, Figs. 1 and 5, on the peening wheel **94**. The belt **136** is sufficiently yielding to permit vertical travel of the wheel **94** under the control of the templet **110**, whereby the peening wheel **94** follows the contour of the shaped tube T.

If desired, the finish F, Fig. 13, on the tube T may be so formed that the appearance of an orderly pattern of indentations is avoided. This is achieved in the present instance, first, by so arranging the machine that the tube T is fed relatively slowly through the work head while being rotated at a comparatively high speed. Secondly, the spacing of the peens **124** around the periphery of the wheel **94** is such as to prevent the formation of any readily discernible regular pattern on the surface of the tube T. This may be done in several ways. For example, as shown in Fig. 7, the peens **124**, while being in circumferential alignment, may be spaced irregularly so that the successive marks or identations which they form in the metal are distributed at random around the periphery of the tube T. This has been found to be very effective in preventing the appearance of a recurring pattern in the finish F, Fig. 13.

Another way of effecting random distribution of the marks on the tube T is to stagger the peens axially of the peening wheel as illustrated in Figs. 9 and 10. Thus, a double row of peens **124***a* is disposed around the circumference of the wheel **94***a*, the peens **124***a* in one row being arranged alternately with the peens **124***a* in the other row.

The individual peens may be formed in a variety of shapes, the piston or plunger type being illustrated in Figs. 7 to 10. The peens also may consist of small balls or spheres as illustrated in Figs. 11 and 12. The peening wheel **94***b* is provided with an annular recess **140** in one face thereof extending to the outer edge of the wheel **94***b*. A retaining ring **142** secured to said face of the wheel **94***b* likewise has an annular recess **144** opposed to the recess **140**. A spacer ring or plate **146** is clamped between the wheel **94***b* and the ring **142**, seating in the annular recesses **140** and **144**. Pockets **148** afforded in the outer edge portion of the spacer plate **146** respectively house the ball-shaped peens **124***b*. Annular lips **150** and **152** on the wheel **94***b* and ring **142** at the outer edges of the recesses **140** and **144**, respectively, serve to retain the balls **124***b* in the pockets **148**.

The operation of the embodiment shown in Figs. 11 and 12 is similar to that described above in connection with Figs. 7 and 8. As the ball peens **124***b* approach the tube T*b* they are urged radially outwardly by the effect of centrifugal force acting thereon, projecting slightly beyond the edge of the wheel **94***b*. As each ball strikes the surface of the tube T*b*, it forms a small indentation in the metal and rebounds radially inwardly. The balls **124***b* may be spaced irregularly around the wheel **94***b* as shown in Fig. 11 to insure random distribution of the marks or identations in the finished surface of the metal tube T*b*.

The invention has bee n described thus far as being employed in conjunction with a tube shaper. Obviously, it is applicable also to finishing straight tubing. In this event a simple arrangement may be utilized inasmuch as it is not necessary to provide for movement of the peening wheel radially of the tube. In such an arrangement it may be preferred to employ two peening wheels disposed on opposite sides of the tube.

The invention has been described as being adapted primarily to impart a hammered finish to metal tubing for improving the appearance thereof. It should be observed, however, that the invention is also useful when used to strengthen the tubing by cold-working the surface thereof. It may also be utilized to remove rust or scale from the metal. The peener may be adapted to peening the interior surfaces of tubing, as well as operating upon sheet metal.

The pattern of the peened surface is determined by the rotative speeds of the tube T and the peening wheel **94**, also by the longitudinal rate of feed effected by the screw **48**. The size and shape of the individual peen marks is determined largely by the radius of curvature, shape, diameter or other dimensions of the striking ends of the peens. Variations in patterns of surface finish may be made by various peener end designs such as triangular and square. The depth of impression is determined by the weight and centrifugal force acting on each peen. Random patterns, which usually are preferred, are obtained in several ways, such as by irregular angular spacing of the peens, staggering the peens, or making the weights and shapes of the peens non-uniform.

It should be noted that the blows of the peens upon the tubing tend to counteract the radial stress of the shaping roll thereon, thus relieving the bushing **64** of some of the thrust of the shaping roll. This effect may be increased by employing a plurality of peening wheels or, if desired, by utilizing a pair of diametrically opposed shaping rolls at the work station and disposing the peening wheel at a subsequent point in the travel of the tubing.

As will be apparent to those skilled in the art, various other changes may be made in the specific embodiments set forth for purposes of illustration without departing from the principles of the invention. The invention is accordingly not to be limited to the precise details disclosed herein but includes all modifications thereof within the spirit and scope of the appended claim.

I claim:

A machine of the class described, including a frame having a fixed vertical work head at one end and provided at a point between its top and bottom with horizontal rails, a head stock slidable along the rails and provided with means for engaging metal tubing for drawing the same through the work head, said head stock extending above and below the rails, upper and

lower blocks slidably mounted in the work head, a lower roller mounted on the lower slide block, said upper slide block being provided with spaced upwardly extending legs, an inner block vertically slidable between and guided by said legs, an upper roller mounted on the inner vertically slidable block, upper and lower templets slidably mounted in the frame and connected with and actuated by the head stock and located at the upper and lower portions thereof and arranged to engage said rollers, and means carried by the upper and lower slide blocks for operating on the tubing drawn through the work head.

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