APPARATUS FOR SWAGING METALS

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UNITED STATES PATENT OFFICE

APPARATUS FOR SWAGING METALS

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1. This invention relates to metalworking apparatus of the rotary swaging machine type, and is particularly directed to improved means for introducing lubricating and cooling fluid into the dies of such apparatus.

Rotary swaging machines are characterized by a plurality of dies mounted in a rotary head which are caused to act on the periphery of the work by a plurality of rollers surrounding this head. As each die passes under a roller, it is depressed, striking the work, while between blows the dies are thrown outward by centrifugal force.

In rotary swaging machines of conventional type, the dies alone are rotated about the work, the rollers being mounted in the stationary machine housing. This type of machine is satisfactory for relatively small diameter work pieces, but is not satisfactory for large diameter work such as pipe from five to seven inches in outside diameter.

The relatively large size of the rotary head carrying the dies limits the speed of rotation of such head, consequently limiting the number of blows which can be delivered by the dies to the work, and so limiting the rate at which swaging can proceed. For large work pieces it is more desirable to use the counter-rotating type of swaging machine in which the dies and a ring carrying the rollers are rotated in opposite directions. A machine of this type, constructed to handle pipe of the size previously mentioned, can be operated at reasonable rotational speeds but still produce a large number of impacts upon the work and so maintain a good rate of production. A counter-rotating type of swaging machine is described in Conner and Robinson Patent No. 1,655,535.

It is desirable in the operation of swaging machines continuously to lubricate and cool the dies by a fluid, such as oil or water. It is not a difficult matter to provide for such lubrication in swaging machines of the conventional type wherein the die-carrying head only rotates, as in the stationary part of the machine fluid conduits can be provided leading to the rotating dies. In the counter-rotating type of swaging machine, however, the rotating dies are surrounded by the counter-rotating roller ring and means for rotating this ring. It is an object of my invention, therefore, to provide means for lubricating and cooling the dies and work of the counter-rotating type of swaging machine.

When material which has been hot rolled is subsequently cold worked by swaging or other means, the hot-rolled scale which formed on the surface of the material during the hot working flake off since it is brittle and inelastic. In the case of a large work piece, such as pipe of the size previously mentioned, the amount of this hot-rolled scale which accumulates during swaging is considerable. This scale tends to work in between the dies of the rotating die head and, if not removed, packs tightly, causing premature die breakage. Prior to my invention, to the best of my knowledge, counter-rotating type swaging machines had been provided with means for introducing lubricant at the surface of the work piece only, it being considered that the centrifugal force developed in the rotation of the machine would throw the fluid outward through the dies and roller rings. In practical operation, however, I have found that lubricating means of this type cannot prevent the accumulation of hot-rolled scale between the dies. It is therefore a further object of my invention to provide means for flushing out hot-rolled scale and preventing its accumulation in the dies.

Other objects will appear in the course of the following description of my invention.

My invention is an improvement in swaging machines which provides an annular channel or conduit for lubricant, concentric with the swaging machine axis and formed in two annular parts. One part is carried by the annular end plate attached to the inner rotating head, whereas the other annular part, which cooperates with the first-mentioned part to form a closed channel, is stationary. Lubricating fluid may be introduced through this stationary part. It also provides fluid passages in the annular end plate leading from the annular channel to the dies and rollers, through which lubricating fluid may flow, and other fluid passages through which this fluid may drain to a sump. From this sump it is pumped to the lubricating channel and recirculated.

A present preferred embodiment of my invention is illustrated in the accompanying figures of which:

Figure 1 is cross-sectional view of a counter-rotating type swaging machine provided with the apparatus of my invention taken on the plane 1—1 of Figure 2; and
Figure 2 is an elevation of such a machine illustrating details of my apparatus. Figure 3 is an end elevation of the lubricating apparatus of my invention taken in cross section on the line III, III of Figure 4. Figure 4 is a cross section through a portion of the apparatus of Figure 3 taken on the plane IV, IV of this figure. Figure 5 illustrates in detail an element of my apparatus.

The swaging machine comprises a heavy base structure 1, housing a pair of roller bearings 2, in which rotates a hollow spindle 3. The spindle 3 in turn houses a pair of roller bearings 4, in which rotates a second hollow spindle 5. One end of spindle 3 is enlarged to form a flywheel pulley 6, which is recessed to contain an annular roll carrier 7 provided with a plurality of freely rotating rollers 8. The axis of the roll carrier 7 is concentric with that of the spindles 3 and 5, and the roll carrier 7 is free to revolve about this axis. The end housing 2 loses the recess in the flywheel 6 in which the roll carrier 7 revolves. The corresponding end of spindle 5 is provided with a die carrier 10 having radial slots in which a plurality of dies 11 are mounted in opposing pairs. The dies are free to move radially in the slots of spindle 5. The die carriers are confined in the end plate 12. The opposite end of spindle 5 is provided with a flywheel pulley 13. Pulleys 6 and 13 are caused to rotate in opposite directions by belts 14 actuated by driving means not shown. This apparatus is described in more detail in the Corrigan and Robinson patent previously mentioned.

I provide the annular end plate 12 with an outwardly extending ring 15, which is formed with two parallel flanges 16 and 17 extending radially from the annular channel 18. This ring 15 is encased by the split ring 19, the inner surface of which is provided with a pair of channels 20 and 21. These channels 20 and 21 cooperate with the flanges 16 and 17 respectively of the ring 15 so that the split ring 19 closes the annular channel 18. As has been mentioned, the ring 15, which is a part of the end plate 12, rotates with the inner spindle 5 of the swaging machine. The split ring 19, however, is maintained stationary, its annular channels 20 and 21 forming rotary seals with the annular flanges 16 and 17 of ring 15.

The end plate 12 is provided with a plurality of fluid passages 22 leading from the channel 18 to the inner face of the end plate, preferably at points adjacent the zone of contact between the hammer rolls 8 and the dies 11. The flywheel pulley 6 housing the annular roll carrier 7 is also provided with fluid passages 23 leading from the inside end of the roll carrier recess through the flywheel pulley 6 and the housing 9. A sump 24 is provided below the flywheel pulley 6, discharge into a drain pipe 25. The drain pipe 25 leads to a fluid pump 26 of conventional type, which forms no part of my invention and is therefore represented schematically only. The drive for pump 26 is not shown. This pump 26 forces fluid through the pipe 27 into the branch pipe 28 which is tapped into the split ring 19. A fluid discharge pipe 30 is also provided for directing lubricating and cooling immediately upon the surface of the work.

The operation of the apparatus of my invention is evident from the figures. The cooling and lubricating fluid is forced by the pump through pipes 27, 28 and 29 into the channel 18 formed by the ring 15 and split ring 19. From this channel the fluid is conducted through the passages 22 in the annular end plate 12 and discharged into the working parts of the machine at the zone of contact of the hammer rolls 8 and dies 11. It might be assumed that the rotation of the machine, which develops sufficient centrifugal force to throw the dies outward between contacts with the hammer rolls, would throw the cooling and lubricating fluid radially outward through the hammer rolls only to the discharge passages 23. I find, however, that this is not the case, and that fluid so introduced flushes scale out of the dies very effectively and also lubricates the work surface of the swaged article. The fluid, carrying accumulated scale, discharges only from the fluid passages 23 when they are at the bottom of their circle of rotation and is collected in the sump 24, from which the fluid is conducted by the drain pipe 25 to the pump 26 for recycling. Although not shown in the drawing, a filter at the upper end of the drain pipe 25 is desirable.

The channel 18 from which the lubricating fluid is distributed may take other forms than that of the figures. For example, the stationary split ring 19 could be located inside the ring 15 and form the bottom rather than the top of the channel. Or, the rings 15 and 19 might be constructed to separate in a vertical rather than a horizontal plane. Likewise, the fluid passages 22 in the end plate 12 might be brought out at other points on the inner face of this end plate, although I obtain best results when these passages terminate as shown at the zone of contact of the hammer rolls 8 and the dies 11.

Although I have described and illustrated the present preferred embodiment of my invention, it will be understood that the invention is not limited thereto but may be otherwise embodied or practiced within the scope of my claims.

I claim:

1. Lubricating apparatus for a counter-rotating swaging machine or the like provided with an inner rotating swaging head, a rotating annular hammer roll carrier and an outer rotating head, comprising an annular end plate adapted to be attached to the inner rotating head, an annular fluid conduit concentric with this plate and formed of two annular members rotatable one on the other, one of said members being attached to the annular end plate and the other said member being maintained stationary, a plurality of fluid passages within the end plate each communicating with the annular fluid conduit and opening on the inner face of the end plate, and means for introducing fluid into the annular fluid conduit through the stationary member thereof.

2. Lubricating apparatus for a counter-rotating swaging machine or the like, provided with an inner rotating swaging head, a rotating annular hammer roll carrier and an outer rotating head, comprising an annular end plate adapted to be attached to the inner rotating head, an annular axial extension of the end plate provided with a pair of separated parallel annular flanges projecting radially outward, a stationary ring surrounding these flanges and provided on its inner surface with a pair of annular channels cooperating with the parallel flanges of the end plate extension to form a closed annular fluid conduit, a plurality of fluid passages in the end plate each communicating with the closed annular fluid conduit and opening on the inner...
face of the end plate, and means for introducing fluid into the closed annular fluid conduit through the stationary ring.

3. Lubricating apparatus as in claim 2 in which the fluid passages in the annular end plate open on the inner face thereof at the zone of contact between the hammer rolls and the inner rotating swaging head and the annular end plate is provided at its junction with the outer rotating head with a radially outwardly projecting annular flange cooperating with the outer rotating head.

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