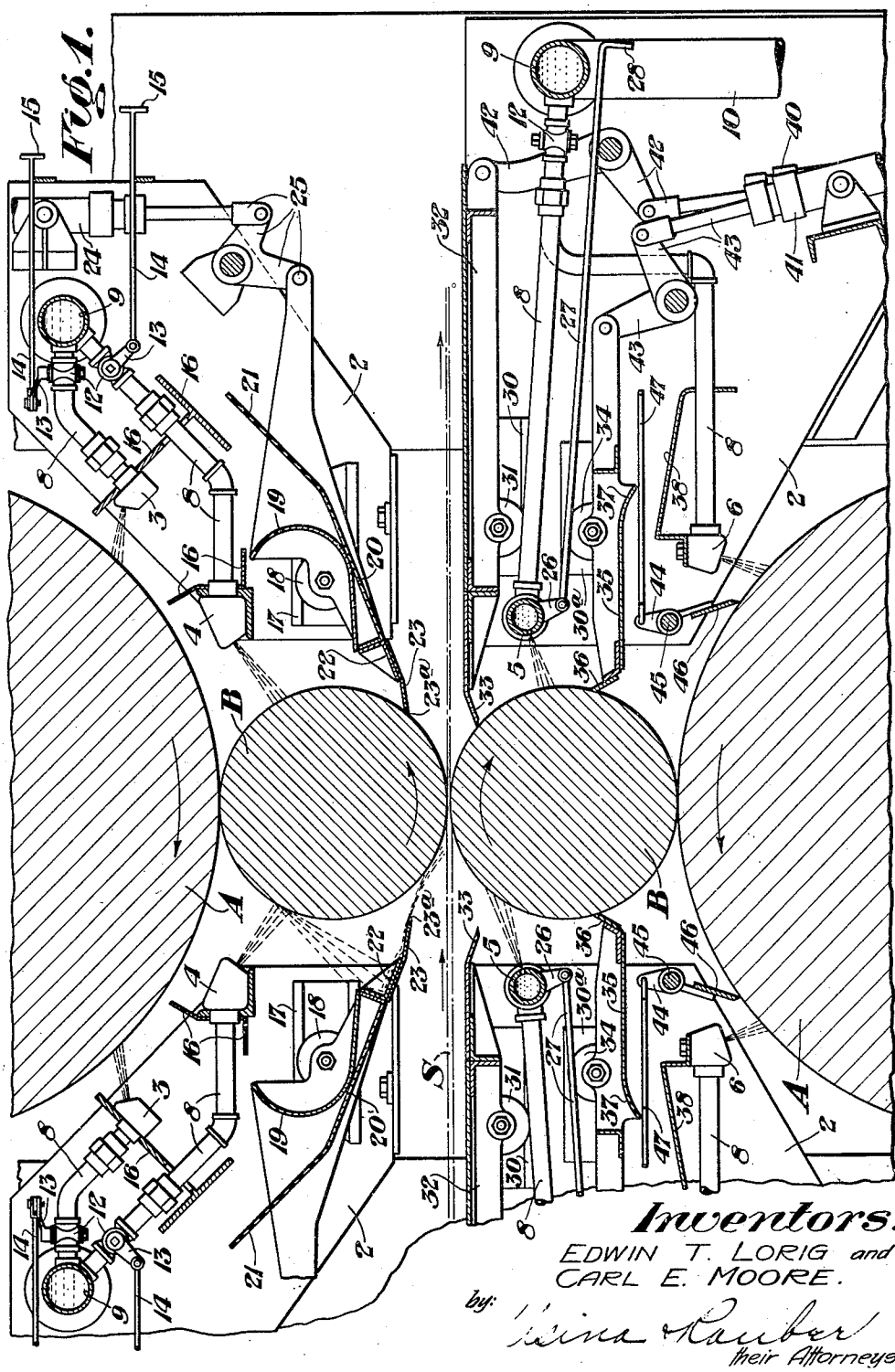
Oct. 15, 1935. E. T. LORIG ET AL 2,017,403

METHOD OF PROCESSING SHEET METAL

Filed Nov. 13, 1933 3 Sheets-Sheet 1

Fig. 1.



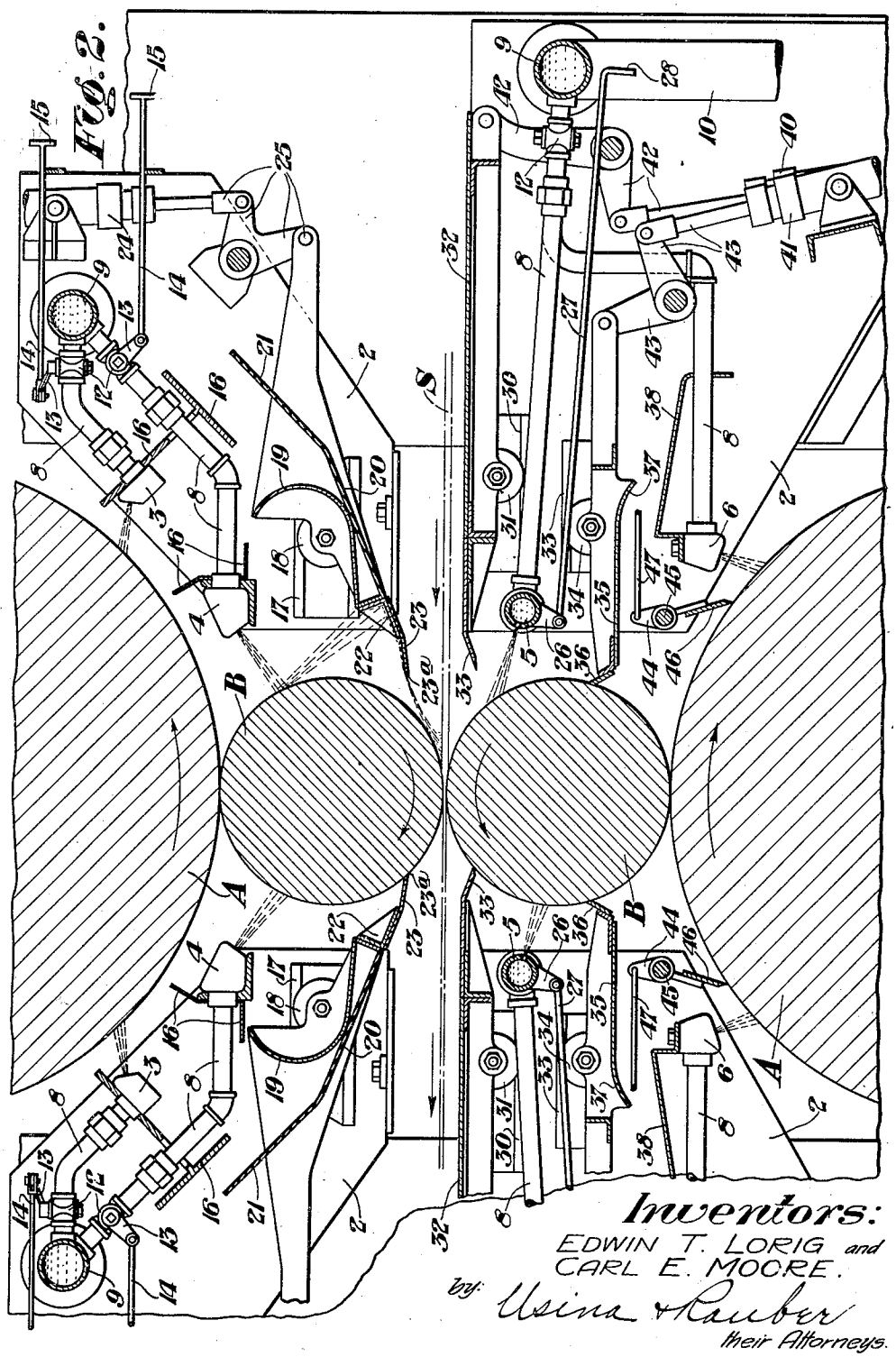
Inventors:
EDWIN T. LORIG and
CARL E. MOORE.
by: Wilkinson & Lauber
their Attorneys.

Oct. 15, 1935. E. T. LORIG ET AL 2,017,403

METHOD OF PROCESSING SHEET METAL

Filed Nov. 13, 1933 3 Sheets-Sheet 2

Fig. 2.



Inventors:
EDWIN T. LORIG and
CARL E. MOORE.
by: Usina & Lauber
their Attorneys.

Oct. 15, 1935. E. T. LORIG ET AL 2,017,403

METHOD OF PROCESSING SHEET METAL

Filed Nov. 13, 1933 3 Sheets-Sheet 3

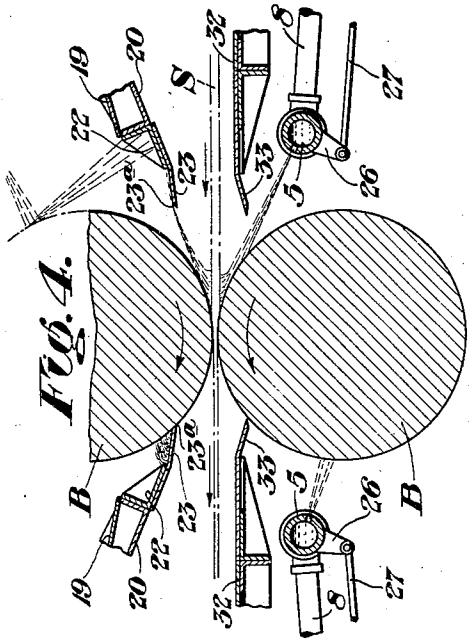


Fig. 4.

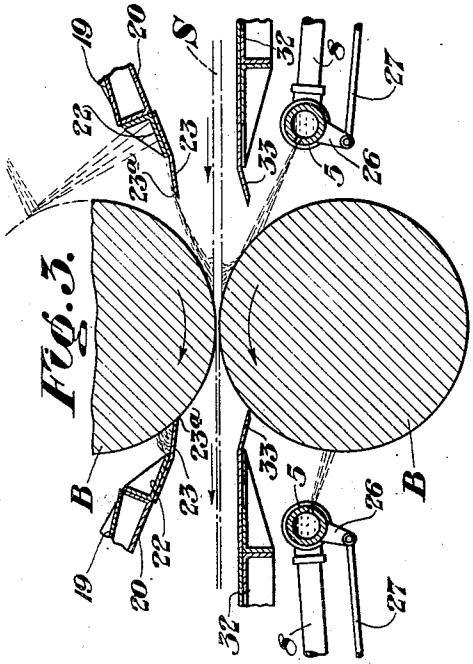


Fig. 3.

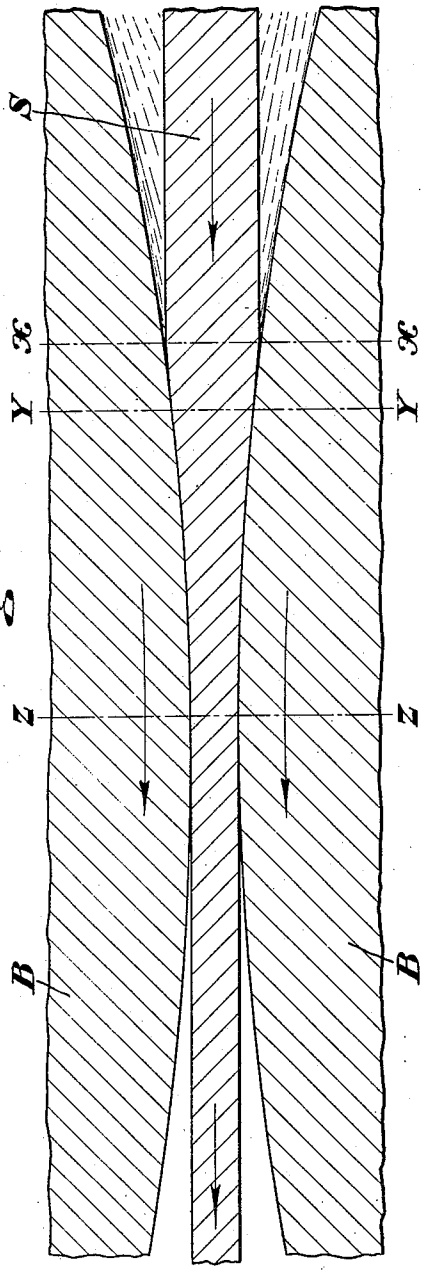


Fig. 5.

Inventors:
EDWIN T. LORIG and
CARL E. MOORE.
by: Ussina & Lauber
their Attorneys.

Patented Oct. 15, 1935 2,017,403

UNITED STATES PATENT OFFICE

2,017,403

METHOD OF PROCESSING SHEET METAL

Edwin T. Lorig and Carl E. Moore, Gary, Ind., assignors to American Sheet and Tin Plate Company, a corporation of New Jersey

Application November 13, 1933, Serial No. 697,864

3 Claims. (Cl. 29—18)

This invention relates to a novel method of processing sheet metal, and more particularly to the cold reduction of continuous metal strip, although not limited thereto.

In the manufacture of continuous metal strip, slabs or billets are first rolled on a hot strip mill to obtain a work-piece of very substantial length, nominal width, and relative thinness. The strip thus obtained is usually pickled, washed, and oiled, after which it is coiled and subsequently cold processed to reduce its thickness, greatly elongate it and provide it with a finally finished surface. The cold reduction operation referred to usually takes place in a continuous type of 4-high mill.

In commercial operations of this sort, the material forms slivers on its surface which contact with the bodies of the metal working rolls, the latter also collecting deposits of carbonized oil and impurities accruing from the prior processing referred to.

These impurities must be removed, or they will result in an imperfectly processed work-piece, in addition to occasioning the frequent removal and regrinding of the surfaces of the various metal working rolls.

In our co-pending applications, entitled Method and apparatus for maintaining constant the temperature of metal working rolls, Serial No. 697,862, filed November 13, 1933, and Serial No. 697,863, filed November 13, 1933, there is disclosed novel means for spraying the surfaces of the various metal working rolls with a coolant, which also serves as a lubricating medium between the material and the rolls. While these devices are very effective in operation, surplus quantities of the cooling medium, or coolant, must be removed from the mill on the side from which the material is emerging, otherwise it will coat the strip in excessive quantities and occasion difficulties in subsequent operations, such as, for example, annealing.

In two co-pending applications, of Lawrence S. Dahl and John L. Peet, entitled Method and apparatus for cleaning metal working rolls, Serial No. 694,315, filed October 19, 1933, and Serial No. 694,316, filed October 19, 1933, means are provided for cleaning the surfaces of the metal working rolls of metal slivers, carbonized oil deposits and other impurities, and removing the combined coolant and lubricating media referred to, from the side of the mill from which the material is emerging.

According to the teaching of the present invention, the novel method of processing sheet metal results in the complete maintenance of a constant temperature of the bodies of the various metal working rolls, and the provision of an antifriction, or "slip", area at what is known as the "nip" of the metal working rolls, or initial area of reduction.

One object of the present invention is the provision of a novel method of processing sheet metal in such manner as to procure the maintenance of a constant temperature for the metal working rolls, and the provision of such coolant, which likewise serves as a lubricating medium to their initial areas of reducton, resulting in a "slip area" at this point, and the consequent production of an article of manufacture characterized by having a finely finished surface otherwise unobtainable.

Another object is to provide a novel method of the class described which will efficiently and completely remove all slivers of metal of the work-piece, carbonized oil deposits and other impurities from the surfaces of the metal working rolls at points adjacent their initial areas of reduction. These and still further objects will be apparent after referring to the drawings, in which:

Figure 1 is an elevation of the device of the invention as used in connection with a "4-high" mill of the cold reduction type, the latter being shown in section.

Figure 2 is a view similar to Figure 1 of the apparatus in another stage of operation.

Figure 3 is a sectional detail of the device as operating in Figure 2.

Figure 4 is a sectional detail of the device in a modified stage of operation.

Figure 5 is an enlarged sectional detail representing the function of the apparatus of the invention.

Referring more particularly to the drawings, the letter A designates a pair of large backing-up rolls between which there is disposed a pair of smaller metal working rolls B, all of which when taken together form a conventional type of "4-high" mill used in cold reduction operations. A supporting frame 2 is attached to either side of the mill, composed of the backing-up and metal working rolls A and B, respectively, and extends both above and below its horizontal center line. The frames 2 support on either side of the mill a single manifold 3 adjacent the lower portion of the upper backing-up roll A, and a series of individual manifolds 4 adjacent the upper portions of the upper metal working roll B. A like series of manifolds 5 is

similarly supported on both sides of the mill adjacent the upper portions of the lower metal working roll B, while a single manifold 6 is disposed adjacent the upper portion of the lower backing-up roll A and on both sides thereof.

Referring to Figures 1 and 2 of the drawings, each of the individual manifolds 3, 4, 5 and 6 comprises a hollow chamber in which there is disposed a plurality of suitable spray nozzles, preferably operating to deliver a flat film of liquid coolant to the surfaces of the various rolls.

Each of the manifolds 3, 4, 5 and 6 is provided with a supply pipe 8. The supply pipes 8 are connected to a common supply chamber 9, one being provided on either side of the mill and both above and below its horizontal center line.

The coolant, which serves also as a lubricating medium, is delivered from a suitable source to the supply chambers 9 by means of a pipe 10. A valve 12 is disposed between each of the chambers 9 and in the pipes 8, and are each provided with an actuating lever 13 to which there is connected an operating rod 14 having a handle 15 remotely situated with respect to the vertical center line of the mill, in order that the valves may be remotely and conveniently controlled.

By adjusting each of the valves 12 through its handle 15, the operation of the various spray nozzles in the various chambers may be individually regulated, and if deemed desirable entirely discontinued, in such manner as to enable the flow of coolant onto selective portions of the bodies of the rolls A and B with the consequent maintenance of constant temperatures.

A number of baffles 16 are shown as being associated with each of the manifolds 3 and 4, and serve to control the flow of liquid after it has fallen off the bodies of the various rolls in order to restrain, so far as is practical, the escape from the mill of the superfluous quantities thereof.

A pair of trackways 17 are secured on either side of the mill to the frames 2 and serve to support a pair of rollers 18, to which there is connected a continuous and curved plate 19. A relatively flat plate 20 is connected to each of the curved plates 19 and provided with a rearward extension, as at 21, in order to augment the function of the baffles 16 for the manifolds 3 and 4.

A continuous trough 22 is connected to each of the curved plates 19 and relatively flat plates 20 and made to extend the length of the metal working rolls, and each has secured thereto a scraper blade 23. These blades are provided with hollow-ground contact edges 23a and are brought into and out of contact with the lower portion of the upper metal working roll B by means of fluid cylinders 24 and connecting linkage generally indicated at 25.

The series of manifolds 5 on either side of the mill and below the line of pass are preferably formed cylindrical and mounted for partial rotation in unison on the frames 2 in any well known manner. A link 26 is connected to the rotatable manifolds 5, and to an operating lever 27 having a handle 28 extending remotely from the mill and somewhat adjacent the handles 15 for controlling the operation of the valves 12. This is for the purpose of permitting the manifolds 5 to spray coolant on the surface of the lower metal working roll B at an angle relatively coinciding with its direction of rotation. That is to say, the manifolds 5 on the left-hand side of the mill will spray coolant upwardly with respect to the horizontal center line of the lower metal working roll B when it is rotating clockwise, and conversely upon reversing the direction of rotation of the various rolls of the mill, as shown in Figure 2, the manifolds on the right-hand side of the mill being rotated in such manner that they will spray upwardly while the corresponding manifolds on the left-hand side of the mill be made to spray downwardly.

Suitable trackways 30 are mounted on each of the frames 2 below the trackways 17 and on both sides of the mill, and serve to support rollers 31, each pair of which have mounted thereon a table 32 having on its end nearest the vertical center line of the mill a scraper blade 33. A pair of still lower trackways 30a on either side of the mill support rollers 34 having mounted thereon plates 35 which carry on their ends nearest the vertical center line of the mill a scraper blade 36, and are curved downwardly at their rearward ends, as shown at 37, in order to permit the flow of superfluous quantities of coolant onto a baffle 38 for the lowermost manifolds 6.

In practice, the scraper blades 36 are maintained against the lower portion of the lower metal working roll B on both sides of the mill regardless of its direction of rotation. Suitable fluid cylinders 40 and 41 control the movement of the various scraper blades 33 and 36, by means of suitable linkages generally indicated at 42 and 43, respectively.

A bell-crank lever 44 is pivoted on each of the frames 2 and on either side of the mill, as at 45, and support on their lowermost ends scraper blades 46 which are ordinarily made to continuously contact with the upper portion of the lower backing-up roll A, and are suitably adjusted by means of actuating rods 47.

If the mill is made to feed in the direction shown in Figure 1, that is, from left to right, the curved plate 19 on the left-hand side of the mill is retracted from the vertical center line thereof in such manner as to bring the scraper blade 23 to a position relatively remote with respect thereto, and the corresponding scraper blade 23 on the right-hand side of the mill is made to contact with the upper metal working roll.

In this position, the spray manifold 4 on the left-hand side of the mill will dispense coolant downwardly onto the surface of the upper metal working roll, from which it will be deflected onto the trough 22, and then flow downwardly across the upper surface of the scraper blade 23 and directly into what is known as the "nip" of the upper metal working roll; or, in other words, the initial area of reduction between the strip being processed and the metal working rolls. This area is represented in Figure 5 between the lines X and Y. At this point the lubricating qualities of the coolant serve to provide a "slip" area before the metal strip is substantially reduced between the lines Y and Z, and due to the "welling-up" of the liquid at this point all particles of foreign matter are washed away. This condition makes for ideal processing in that portion of the mill wherein the most substantial reduction is effected.

While the scraper blade 23 on the side of the mill from which the strip is emerging is in contact with the lower portion of the upper metal working roll B, in order to clean its surface, the spraying of the coolant is continued from the manifolds 4 and the tray 22 serves to retain a backwash at this point, as shown in Figures 3 and 4, which likewise serves to wash away the impurities referred to.

It will be seen that, due to the disposition of the trays 22 with respect to the direction of rolling, the cooling media and lubricant is suitably delivered into the "nip" of the upper metal working roll. The conditions below the horizontal center line of the mill are, of course, different, as the liquid tends to fall away from the upper portion of the lower metal working roll.

For this reason, the levers 28 are adjusted to affect the spraying of the combined coolant and lubricant in such manner as to converge towards the direction of rotation. If the rolls are rotating at relatively high speed, a slight spray angle as shown in Figure 3 will be sufficient, as the high peripheral speed of the rolls will tend to carry the liquid into the "nip" and lubricate the lower initial area of reduction and serve, in addition, to wash away the impurities by gravity. However, if the rate of rotation of the various rolls is retarded, the speed of the lower metal working roll B will be insufficient to carry the desired quantity of coolant and lubricant into the "nip", and the angle at which the liquid is sprayed must therefore be increased, as shown in Figure 4.

By providing the lubricant in sufficient quantities at all times to the areas described, a highly superior yield of product results, with finely finished surfaces heretofore unobtainable in cold reduction practice of the type referred to. In addition, the various rolls may be used for a greater length of time before it is necessary to regrind them. These conditions serve to greatly minimize the necessary number of processing passes.

It is to be understood that the term "superfluous" as used in the claims is intended to define a quantity greater than a mere film, which results in the new functions referred to.

While we have shown and described one specific embodiment of our invention, it will be understood that we do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of our invention, as defined in the following claims.

We claim:

1. The method of cold-working sheet metal which includes passing the work-piece through the rolls of a mill and simultaneously delivering a liquid lubricant into the area of initial reduction of the rolls of the mill, the liquid lubricant being under high pressure and in quantities superfluous to that required to form a mere film, the delivery of the liquid lubricant taking place only on that side of the mill on which the work-piece is entering whereby the exiting work-piece is substantially free therefrom.

2. The method of cold-working sheet metal which includes passing the work-piece through the rolls of a mill, delivering a liquid lubricant into the initial area of reduction of the upper metal-working roll of the mill, and delivering a liquid lubricant onto the lower metal-working roll thereof at an angle relatively coinciding with its peripheral travel, the liquid lubricant being under high pressure and in quantities superfluous to that required to form a mere film, both deliveries of the liquid lubricant taking place only on that side of the mill on which the work-piece is entering whereby the exiting work-piece is substantially free therefrom.

3. The method of cold-working sheet metal which includes passing the work-piece through the rolls of a mill, delivering a liquid lubricant into the initial area of reduction of the upper metal-working roll of the mill, delivering a liquid lubricant onto the lower metal-working roll thereof at an angle relatively coinciding with its peripheral travel and modifying the angle at which the liquid is dispensed in accordance with the rate of rotation of the rolls of the mill, the liquid lubricant being under high pressure and in quantities superfluous to that required to form a mere film, both deliveries of the liquid lubricant taking place only on that side of the mill on which the work-piece is entering whereby the exiting work-piece is substantially free therefrom.

EDWIN T. LORIG.
CARL E. MOORE.