Spray unit for rolling mill.

A rolling mill for rolling metal has at least one spray unit (12, 14) mounted adjacent the roll assemblies (4, 8; 6, 10;) for delivering liquid to one or both of the roll assemblies and/or the work (W). The spray unit (12, 14) comprising a manifold (28) having a chamber (30) extending parallel to the axes of the rolls; means (32) for supplying liquid to the chamber (30); a nozzle bar (34) carried by manifold (28); and a series of spray nozzles or sets of spray nozzles (22, 24, 26) carried in passages in the nozzle bar (34) and spaced along the manifold in the axial direction of the rolls. Each spray nozzle or set of spray nozzles has a pipe (38) in communication with the passage or passages and passing across the manifold chamber (30) transversely to the axes of the rolls, a diaphragm (58) closing an opening in the manifold wall opposite the ends of the pipe (38), and means externally of the chamber (30) for varying the separation of the diaphragm (58) from the end of the pipe (38) to control flow of liquid from the manifold chamber (30) into the pipe (38) and thence to the spray nozzle or nozzles.
This invention relates to a spray unit for supplying cooling and/or lubricating liquid to the rolls of a rolling mill or to the material being rolled therein.

It is known to provide for the purpose of spraying the rolls of a rolling mill, or the rolled material, a so-called spray bar which extends widthwise of a mill stand, the spray bar being fed with liquid under pressure and being provided with suitable nozzles disposed so as to emit the lubricant in the desired direction. Valves are provided within the rolling mill system in order to control the emission of lubricant through the nozzles and these values work on the "on/off" principle, i.e. they are either fully open or fully closed.

Hitherto these valves, which are incorporated in the spray bars, have been complicated and demanded precision machining, and consequently they have proved to be expensive to produce and to maintain. In the present invention a spray bar is provided with a valve arrangement which is simple, comparatively inexpensive and easy to maintain.

The present invention provides in one aspect a spray unit for a rolling mill comprising a spray bar which is adapted to be mounted adjacent the mill rolls and which has a manifold for liquid to be sprayed; a series of spray nozzles or sets of spray nozzles spaced along the bar and communicable with the manifold; and, for each nozzle or set, a diaphragm-type valve arranged to control flow of
liquid from the manifold to the respective nozzle or set of nozzles.

By using a diaphragm valve for the control of each nozzle or set of nozzles, the complexity, cost, and maintenance of the valve is much reduced. In particular a valve construction can be adopted which requires the minimum of precision machining relative to spray bar valves which are normally used.

The diaphragm valves may be actuated by pneumatic means.

Preferably, each spray nozzle or each set of such nozzles has a supply pipe with an open end accessible to the manifold; the valve for that nozzle or set then comprises a flexible diaphragm which is controlled either to engage and obturate the open end or to allow communication between the pipe and the manifold. Thus, the diaphragm may form part of a chamber to which fluid under pressure may be supplied to control its obturating action.

The invention will be more readily understood by way of example from the following description of a rolling mill spray unit in accordance therewith, reference being made to the accompanying drawings, in which:

Figure 1 shows diagrammatically a side elevation of a rolling mill provided with the spray unit,

Figure 2 is a section view through a spray bar of the spray unit and shows details of the valve arrangement, and

Figures 3 and 4 show modifications in which the valves of Figure 2 are controlled electrically.
As seen in Figure 1 a rolling mill 2 has two roll assemblies, exemplified by work roll 4 and back-up roll 8, and work roll 6 and back-up roll 10. A workpiece W is shown as being rolled between the two assemblies. For the purpose of supplying rolling coolant/lubricant in the form of a fluid to the rolls and the workpiece, the mill is provided with spray bars 12, 14 arranged adjacent the mill and parallel to the roll axes. The spray bar 12 has spaced along its length sets of nozzles, each set comprising a jet nozzle 16 for directing fluid to the top back-up roll, a nozzle 18 for directing fluid to the top work roll and a nozzle 20 for directing fluid to the upper side of the workpiece.

Spray bar 14 is similar, having nozzles 22, 24 and 26 for directing fluid to the bottom back-up roll, the bottom work roll and the underside of the workpiece respectively.

Dealing now with details of each spray unit, reference is made to Figure 2 which shows a section through the spray bar 14, it being understood that the bar 12 is similar in most respects.

Thus, spray bar 14 is formed as a manifold 28 having a chamber 30 and an adaptor 32 is threaded into the manifold. A nozzle bar 34 attached to the manifold 28 has, for each set of nozzles, three passages 21, 23 and 25 which open to the exterior of the nozzle bar and which are threaded to receive the jet nozzles 22, 24 and 26. The passages 21, 23, 25 open to a normally plugged blind hole 36 within the nozzle bar 34, communicating with a tapped hole 42 aligned
with an opening 40 through the adjacent wall of the manifold 28. A tubular member 38 passes through the hole 40 in the manifold and is threaded into tapped hole 42 there being one tubular member 38 in respect of each set of nozzles. As shown, member 38 extends across the chamber 30, i.e. transversely of the roll axes and partly into an opening in the opposite wall of the manifold 28.

Each set of jet nozzles 22, 24, 26 has its own control valve for controlling flow of lubricant from manifold chamber 30 to the nozzles. Each valve is similar and comprises an enclosure plate 44 secured to the exterior of manifold 28 by means of nuts 46 threaded on to studs 48, and defining compartment 50 aligned with the open end of tubular member 38. A pipe 52 is connected to a tube 54 which connects with the compartment 50 at 56. A diaphragm 58, conveniently made of a flexible polyurethane material, is securely clamped between the plate 44 and the manifold 28, so that it closes off compartment 50 and the opening in the adjacent wall of the manifold; the diaphragm is spaced slightly from the end of member 38, there being normally a gap between the adjacent face 60 of the tubular member 38 and the face of the diaphragm.

A supply of compressed air is provided and this is fed as desired from each pipe 52 and tube 54 to the respective compartment 50 to deflect the diaphragm 58 into firm contact with the face 60 of the tubular member 38, thereby to close off the nozzle set and prevent the passage of lubricant from the manifold chamber 30 to the nozzles.
Coolant/lubricant fluid under pressure is supplied via the adaptor 32 in the chamber 30 of the manifold 28. When the diaphragm 58 of any valve is not forced into obturating engagement with the tubular member 38, lubricant passes through the bore of that member into hole 36, and thence to the jet nozzles 22, 24, 26 to spray on to the rolls 6, 10 and the workpiece W.

When it is desired to cut off the supply of fluid from any particular nozzle set to the rolls and the workpiece compressed air is allowed to pass through the pipe 52 and the tube 54 into compartment 50 of the respective control valve. The polyurethane diaphragm is urged into engagement with the end face of the tubular member 38, thus preventing the fluid in the manifold 28 passing through the member 38 and hole 36 to the jet nozzles.

The valves constituted by the diaphragms 58 in Figure 2 may alternatively be operated under electrical control, by means of a solenoid for each valve and a control circuit for selectively energising the solenoids to bring the diaphragms 58 into obturating positions in relation to the ends of the member 38.

The electrical operation of the valves is illustrated in Figure 3 and 4, where the spray bar 14 is shown in outline, with the nozzles, represented by the uppermost 26, projecting therefrom. The enclosure 50 of each valve is dispensed with and plate 44 is replaced by a housing 70 containing the solenoid for the respective diaphragm 58.

In Figure 3, a separate line 72 for each valve leads
from a control box 74 to the respective solenoid, which is also connected to a common return line 76. Selective energisation of lines 72 results in selected valve diaphragms 58 being brought to the closed positions.

Figure 4 shows a generally similar arrangement, but using encoded signals on a common control line 72. In this instance, the control box 74 incorporates an encoder which emits on line 72 a coded signal according to the particular valve that is required to be operated. Latched solenoids are employed and each has a decoder which decodes any signal designated for it and passes it to the solenoid to change over the condition of the latter. Control of individual valves may be effected manually or patterns of valves may be selected automatically under computer control.
1. A spray unit for a rolling mill comprising a spray bar (12, 14) which is adapted to be mounted adjacent the mill rolls and which has a manifold (28) for liquid to be sprayed; a series of spray nozzles or sets of spray nozzles (22, 24, 26) spaced along the bar and communicable with the manifold; and, for each nozzle or set, a diaphragm-type valve (58) arranged to control flow of liquid from the manifold (28) to the respective nozzle or set of nozzles (22, 24, 26).

2. A rolling mill for rolling metal including a pair of roll assemblies (4, 8; 6, 10) between which the work (W) to be rolled is passed; at least one spray unit mounted adjacent the roll assemblies for delivering liquid against one or both the roll assemblies and/or the work; the spray unit or at least one of the spray units comprising a spray bar (12, 14) which is adapted to be mounted adjacent the mill rolls and which has a manifold (28) for liquid to be sprayed; a series of spray nozzles or sets of spray nozzles (22, 24, 26) spaced along the bar and communicable with the manifold; and, for each nozzle or set, a diaphragm-type valve (58) arranged to control flow of liquid from the manifold (28) to the respective nozzle or set of nozzles (22, 24, 26).
3. A spray unit for a rolling mill comprising a spray bar (12, 14) which is adapted to be mounted adjacent the mill rolls and which has a manifold (28) for liquid to be sprayed; a series of spray nozzles or sets of spray nozzles (22, 24, 26) carried by, and spaced along the bar and connected to a conduit (38) having an end opening to the chamber (30) of the manifold (28), and for each nozzle or set of nozzles, a flexible diaphragm (58) mounted adjacent the conduit end, and means (44, 52) for controlling the diaphragm (58) between an obturation position in which it closes the conduit end and an open position in which it allows passage of liquid from the manifold to the conduit and thence to the spray nozzle or set of nozzles.

4. A spray unit according to claim 3, in which the diaphragm (58) closes an opening in the wall of the manifold (28), and the controlling means (44, 52) are disposed outside the chamber (30).

5. A spray unit according to claim 4, in which each controlling means comprises an enclosure (44) on the exterior of the manifold (28), forming a compartment (50) bounded on one side by the diaphragm (58), and means (52, 54, 56) for supplying fluid under pressure to the compartment.
6. A spray unit according to claim 4 or claim 5, in which the conduit is or includes a pipe (38) passing into and across the manifold, but terminating adjacent the diaphragm (58).

7. A rolling mill for rolling metal including a pair of roll assemblies (4, 8; 6, 10) between which the work (W) to be rolled is passed, and at least one spray unit (12, 14) mounted adjacent the roll assemblies for delivering liquid to one or both of the roll assemblies and/or the work; the spray unit or at least one of the spray units (12, 14) comprising a manifold (28) having a chamber (30) extending parallel to the axes of the rolls; means (32) for supplying liquid to the chamber (30); a nozzle bar (34) carried by manifold (28); a series of spray nozzles or sets of spray nozzles (22, 24, 26) carried in passages in the nozzle bar (34) and spaced along the manifold in the axial direction of the rolls; and, for each spray nozzle or set of spray nozzles, a pipe (38) in communication with the passage or passages and passing across the manifold chamber (30) transversely to the axes of the rolls, a diaphragm (58) closing an opening in the manifold wall opposite the ends of the pipe (38), and means externally of the chamber (30) for varying the separation of the diaphragm (58) from the end of the pipe (38) to control flow of liquid from the manifold chamber (30) into the pipe (38) and thence to the spray nozzle or nozzles.