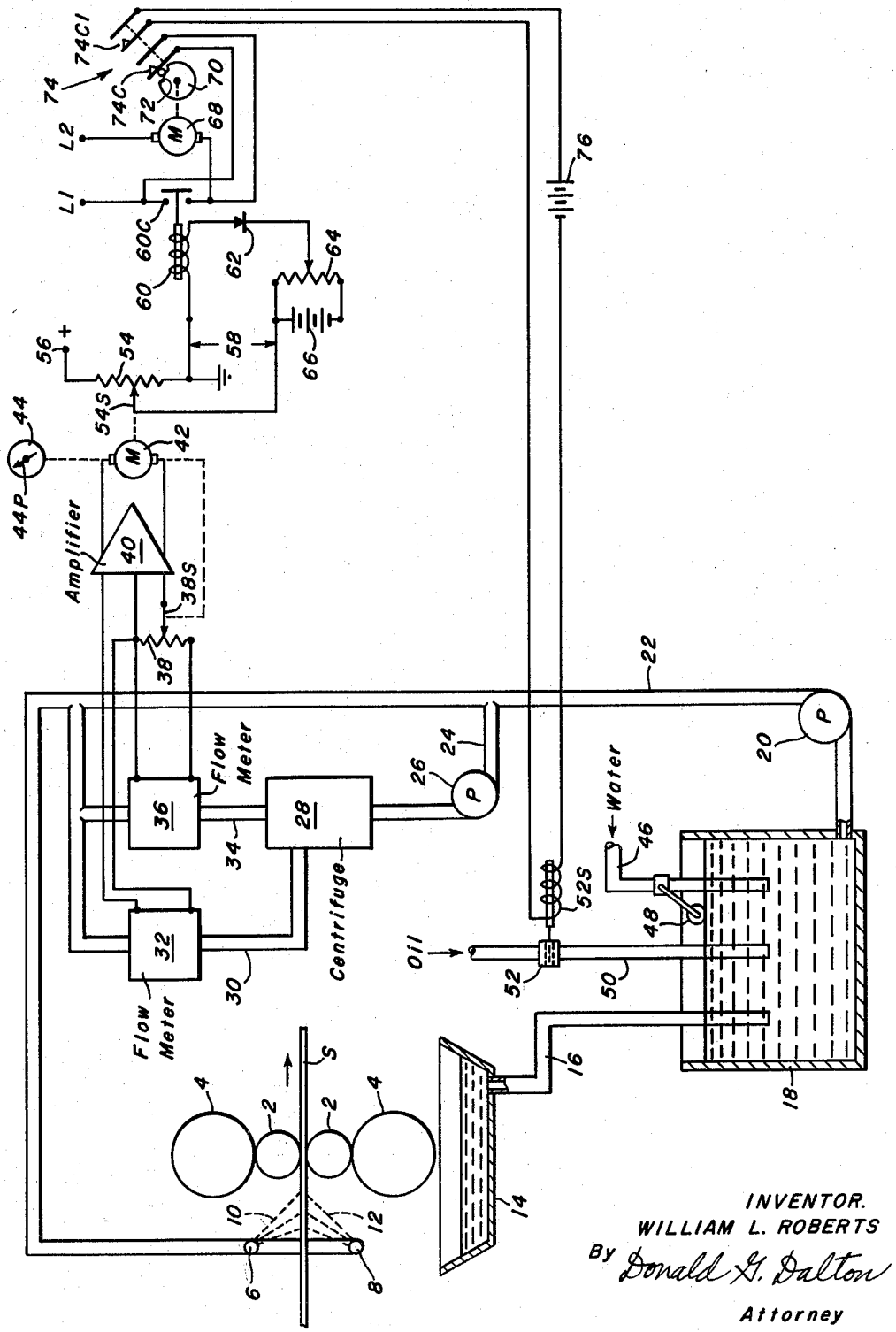
Oct. 20, 1964 W. L. ROBERTS 3,153,420

APPARATUS FOR DETERMINING THE CONCENTRATION OF AN OIL-WATER MIXTURE

Filed Oct. 23, 1962



INVENTOR.
WILLIAM L. ROBERTS
By Donald G. Dalton
Attorney

United States Patent Office 3,153,420 Patented Oct. 20, 1964

3,153,420

APPARATUS FOR DETERMINING THE CONCENTRATION OF AN OIL-WATER MIXTURE

William L. Roberts, Murrysville, Pa., assignor to United States Steel Corporation, a corporation of New Jersey

Filed Oct. 23, 1962, Ser. No. 232,373
4 Claims. (Cl. 137—89)

This invention relates to apparatus for determining the concentration of an oil-water mixture and more particularly to determining the oil-water ratio of lubricants used in the operation of a cold rolling mill and maintaining a predetermined oil-water ratio. In the operation of a cold rolling mill, particularly a strip mill, an oil-water mixture is sprayed on the strip. The oil-water mixture is recirculated and since varying amounts of oil and water are depleted by evaporation and drag-out it is impossible to determine the proper addition of each that must be made to maintain the desired predetermined concentration. For satisfactory operation it is necessary to maintain such a predetermined concentration. At present a sample of the lubricant is periodically withdrawn and allowed to stand for a period sufficient to allow the water and oil to separate. The respective amounts of the water and oil are then determined and the proper amount of either oil or water is added to the lubricating system. This is time consuming and unsatisfactory because the operator may forget or delay in making the determination. Thus, the mill may operate for some period of time without a proper lubricant.

It is therefore an object of my invention to provide a system that automatically determines the oil-water ratio of the lubricant in a cold rolling mill.

Another object is to provide such apparatus that also automatically maintains a desired concentration of oil in the oil-water mixture.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

The single figure is a schematic view of a rolling mill lubricating system incorporating my invention therein.

Referring more particularly to the drawing reference numeral 2 indicates the work rolls of a cold rolling mill. The usual back-up rolls 4 are provided for the work rolls 2. The strip S passes through the work rolls 2 in the direction of the arrow. Manifolds 6 and 8 are provided above and below the strip pass line so as to deliver sprays 10 and 12 of lubricant to the surface of the strip. The lubricant not carried away by the strip or evaporated into the atmosphere falls into a sump 14. A recycle line including conduit 16, reservoir 18, pump 20 and conduit 22 returns the lubricant to the manifolds 6 and 8. The apparatus so far described is conventional.

According to my invention I provide a branch line 24 connected to the conduit 22 and provided with a pump 26. The branch line 24 leads to a centrifuge 28 which may be of any standard type. The AS–16 Super Centrifuge manufactured by The Sharples Corporation, 2300 Westmoreland Street, Philadelphia 40, Pennsylvania is preferred. The oil passes from the centrifuge 28 through a branch conduit 30 back to the main conduit 22. A flow meter 32 is provided in the branch conduit 30. The separated water passes through a branch conduit 34 back to the main conduit 22. A flow meter 36 is provided in the conduit 34. The flow meters 32 and 36 are identical and are preferably of the type manufactured by The Foxboro Company, Foxboro, Massachusetts and shown and described by Figure 10672 on page 23 of their Bulletin 427–1. The flow meters 32 and 36 provide a D.C. potential proportional to the flow rate therethrough. The voltage from flow meter 36 is applied across a potentiometer 38 and the slider 38S of the potentiometer selects a

percentage of the voltage 36 and applies it to an amplifier 40 which compares this voltage with the voltage applied by the flow meter 32. If a difference is detected it is amplified and applied to a balancing motor 42 in such a direction as to move the slider 38S until the voltages are equal. The position of the slider 38S represents the ratio of the two voltages and hence the ratio of the oil and water. A scale 44 calibrated to indicate oil concentration is provided with a pointer 44P which is mechanically connected to motor 42. Other types of ratio indicating devices may be used in place of that shown.

In operation, a sample of lubricant is continuously withdrawn from the conduit 22 by means of the pump 26 and caused to flow through centrifuge 28 and the meters 32 and 36 will operate to provide signals proportional to oil and water flow respectively. These signals are compared and the ratio indicated by pointer 44P on scale 44. When this ratio departs from that desired the operator will add the required amount of oil or water to the system.

Addition of the oil and water may be done automatically instead of manually. Water may be delivered through a conduit 46 having a float controlled valve 48 therein so as to maintain a predetermined level of liquid in the reservoir 18. Oil may be delivered into the reservoir 18 through a conduit 50 having a solenoid operated valve 52 therein. The motor 42 is connected to slider arm 54S of a linear potentiometer 54 and a positive potential 56 is applied across the potentiometer 54. Potential 58 between slider 54S and ground will be proportional to the oil-water ratio and this voltage is applied to a relay coil 60 through a rectifier 62 and potentiometer 64. A battery 66 is mounted in parallel with potentiometer 64. Relay 60 has a normally open contact 60C which is connected in series with a motor 68 to an A.C. power source L1, L2. The motor 68 rotates a cam 70 having a low point 72 therein. The cam 70 operates a switch 74 having normally open contacts 74C and 74C1. Contacts 74C are mounted in parallel with contact 60C so as to provide a holding circuit for motor 68. Contact 74C1 is connected in series with solenoid 52S and battery 76.

In automatic operation, the float valve 48 will maintain the desired level of liquid in the reservoir 18 by permitting flow of water to the reservoir through conduit 46 when the liquid falls below a predetermined level. Under these circumstances the oil concentration will gradually reduce and when it reaches a level below that desired the voltage 58 between slider arm 54S and ground will fall below a certain value corresponding to that set up on potentiometer 64 and the relay 60 will be actuated through conduction of rectifier 62. This causes contact 60C to close, thus starting motor 68 in operation. As motor 68 starts rotating the cam 70 will rotate from the position shown to close contacts 74C and 74C1. Closing of contact 74C completes the holding circuit to motor 68 and causes it to complete one revolution. In the meantime relay 60 will be deenergized. When the motor 68 completes one revolution the cam 70 will have returned to its original position so that the contacts of switch 74 will be open. Closing of contact 74C1 energizes solenoid 52S, thus holding valve 52 open while the motor 68 completes one revolution. This will permit a predetermined amount of oil to flow at a slow rate into the reservoir 18. If the voltage 58 remains below that set up on potentiometer 64 after the oil addition, the relay 60 will again be energized and another slug of oil will pass into the reservoir 18.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims. For example, other

timing mechanism may be substituted for motor 68 and associated mechanism.

I claim:

1. In a rolling mill having means for spraying an oil-water mixture to a workpiece passing through the mill, a recycle line including a reservoir for receiving oil-water mixture from said spray means, and a main conduit for conveying oil-water mixture from said reservoir to said spray means, the combination comprising a branch line from said recycle line for obtaining a sample of said oil-water mixture, a centrifuge in said branch line for separating said mixture into oil and water components, a first branch conduit for receiving said separated oil and returning it to said main conduit, a first flow meter in said first branch conduit, a second branch conduit for receiving said separated water and returning it to said main conduit, a second flow meter in said second branch conduit, and means for comparing the flow through said first and second flow meters to obtain a signal proportional to the concentration of the oil in said oil-water mixture.

2. In the combination of claim 1 means operable by said signal to control flow of oil to said reservoir to obtain the desired concentration of oil in said oil-water mixture.

3. In a rolling mill having means for spraying an oil-water mixture to a workpiece passing through the mill, a recycle line including a reservoir for receiving oil-water mixture from said spray means, and a main conduit for conveying oil-water mixture from said reservoir to said spray means, the combination comprising a branch line from said recycle line for obtaining a sample of said oil-water mixture, a centrifuge in said branch line for separating said mixture into oil and water components, a first branch conduit for receiving said separated oil and returning it to said main conduit, a first flow meter in said first branch conduit, a second branch conduit for receiving said separated water and returning it to said main conduit, a second flow meter in said second branch conduit, means for comparing the flow through said first and second flow meters to obtain a signal proportional to the concentration of the oil in said oil-water mixture, means for delivering water to said reservoir to maintain a desired liquid level therein, means for delivering oil to said reservoir, and means operable by said signal to permit flow of oil to said reservoir to obtain the desired concentration of oil in said oil-water mixture.

4. In a rolling mill having means for spraying an oil-water mixture on a workpiece passing through the mill, a recycle line including a reservoir for receiving oil-water mixture from said spray means, and a main conduit for conveying oil-water mixture from said reservoir to said spray means, the combination comprising a branch line from said recycle line for obtaining a sample of said oil-water mixture, means for separating said mixture sample into oil and water components, a first branch conduit for receiving said separated oil, a first flow meter in said first branch conduit, a second branch conduit for receiving said separated water, a second flow meter in said second branch conduit, means for comparing the flow through said first and second flow meters to obtain a signal proportional to the concentration of the oil in said oil-water mixture, and means operable by said signal to control flow of oil to said reservoir to obtain the desired concentration of oil in said oil-water mixture.

References Cited in the file of this patent

UNITED STATES PATENTS

2,154,132	Mallory	Apr. 11, 1939
2,246,934	Denney	June 24, 1941