United States Patent [19]

Bauch

[11] **3,794,118**

[45] **Feb. 26, 1974**

[54] **HEATED ROLLER AND METHOD OF HEATING THE SAME**

[75] Inventor: **Ernst Bauch**, Bordesholm, Germany

[73] Assignee: **Neumunstersche Maschinen-Und Apparatebau Gesellschaft m.b.H.**, Neumunster, Germany

[22] Filed: **Nov. 16, 1971**

[21] Appl. No.: **199,124**

[30] **Foreign Application Priority Data**

Nov. 21, 1970 Germany 2057391
Dec. 8, 1970 Germany 7045194

[52] **U.S. Cl.** **165/90**, 34/124
[51] **Int. Cl.** **F28d 11/02**
[58] **Field of Search** 165/86–90; 34/124

[56] **References Cited**

UNITED STATES PATENTS

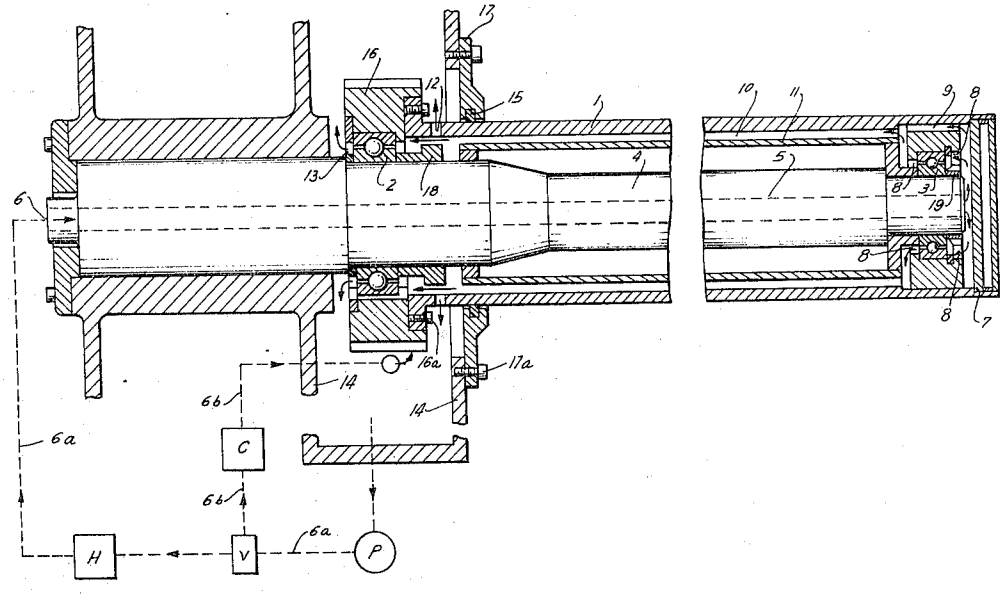
2,933,760	4/1960	Heide	165/89 X
3,302,698	2/1967	Edwards	165/89
3,477,499	11/1969	Ctoetz	165/86
3,583,687	6/1971	Nukahara	165/90

Primary Examiner—Charles J. Myhre
Assistant Examiner—Theophil W. Streule, Jr.
Attorney, Agent, or Firm—Michael S. Striker

[57] **ABSTRACT**

A hollow roll is mounted on a shaft by journal means. The shaft has an axial passage through which a heated lubricant fluid is supplied, part of which is circulated to the journal means to lubricate the same and the remainder of which is circulated—bypassing the journal means—directly into the interior of the roll for heating the latter.

10 Claims, 2 Drawing Figures



PATENTED FEB 26 1974

3,794,118

SHEET 1 OF 2

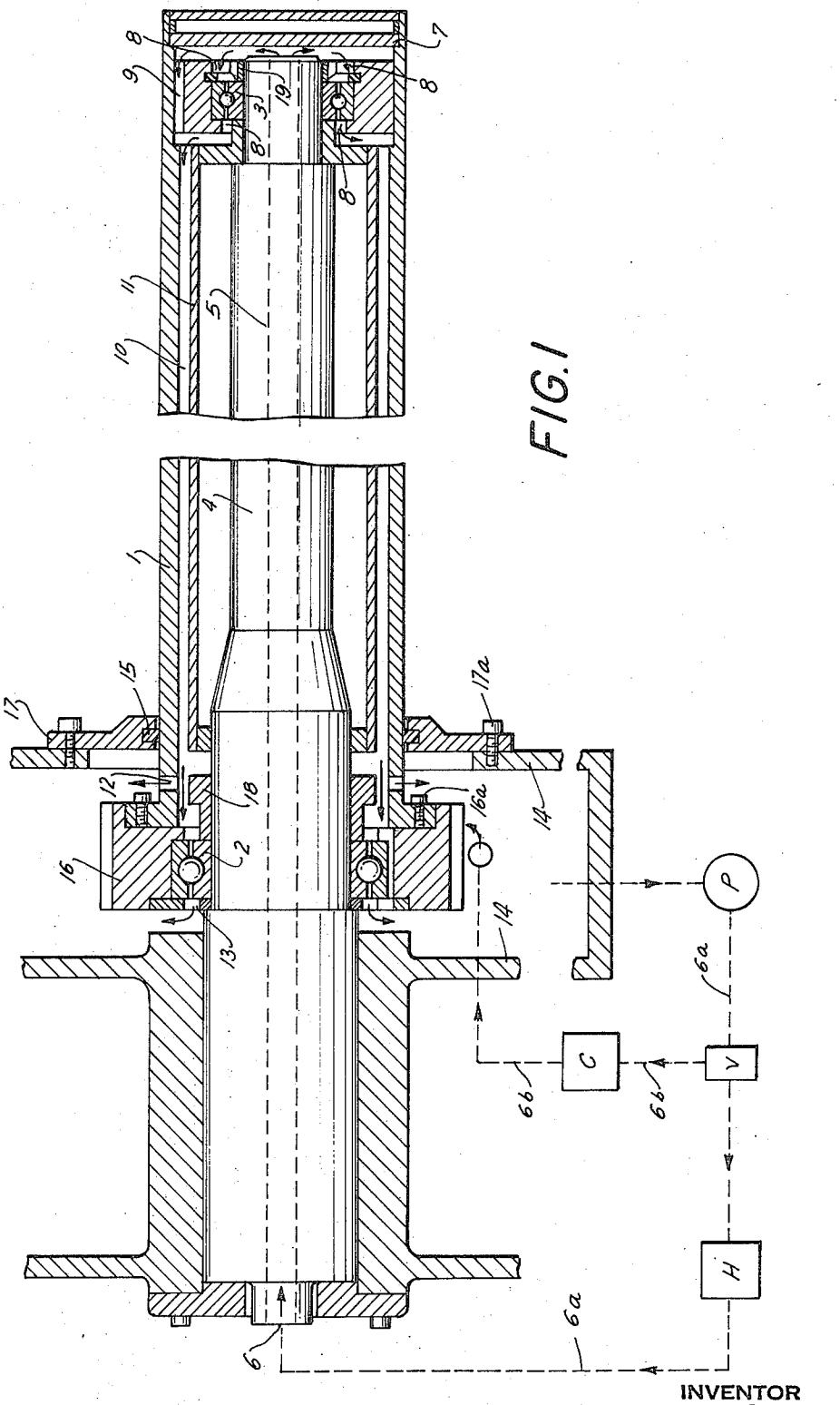


FIG. 1

INVENTOR
ERNST BAUCH
BY
ATTORNEY

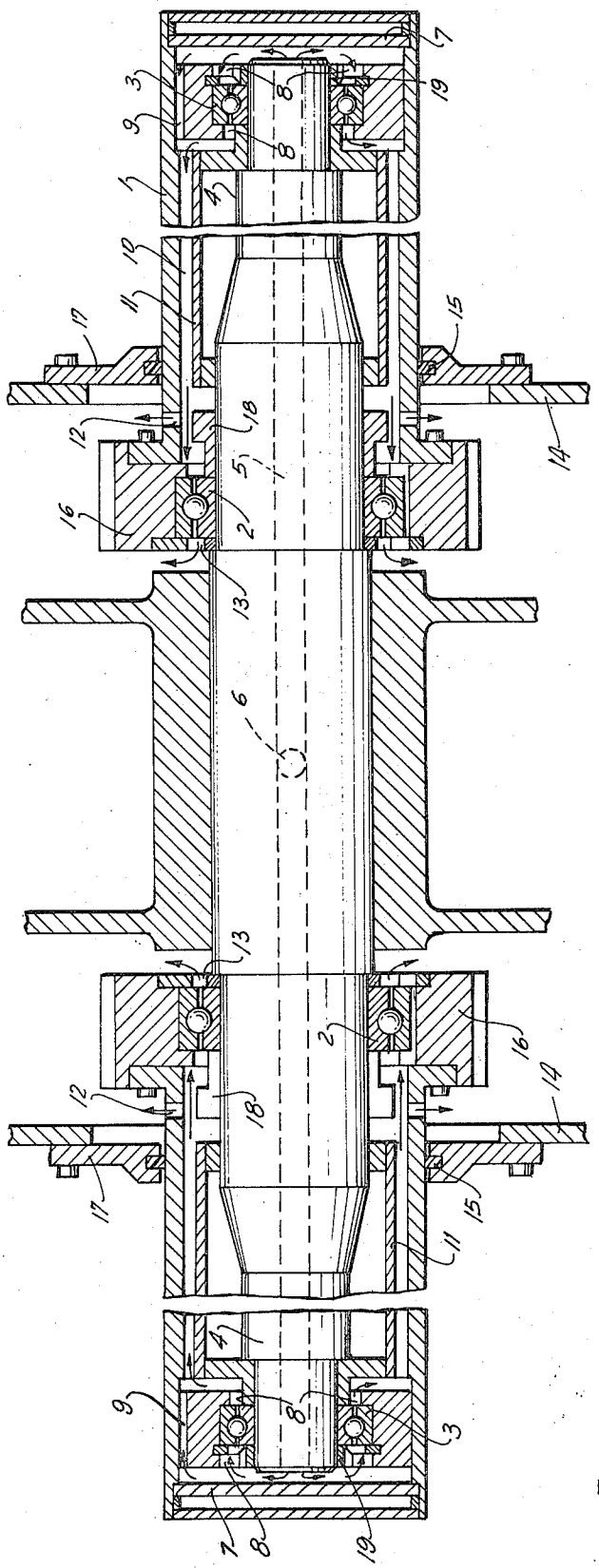


FIG. 2

INVENTOR
CONST BAUCH
BY
ATTORNEY

HEATED ROLLER AND METHOD OF HEATING THE SAME

BACKGROUND OF THE INVENTION

The present invention relates generally to heated rolls, and more particularly to rolls of the type which are used to heat and, sometimes, to advance textile filaments, ribbons composed of such filaments, textiles in general and the like. The invention also relates to a method of heating and lubricating such a roll.

It is already known that textiles made of filaments, particularly synthetic plastic material, ribbons or tapes made of such filaments, or the filaments or yarns themselves, must quite often be heated preparatory to further processing. A variety of different approaches is known for effecting such heating, and this includes the use of rolls which are heated to the requisite temperature by passing a heating fluid through them, with the filaments or textiles passing over the rolls and being heated by contact therewith.

The rolls of this type which are known from the prior art are usually mounted on a shaft which is journalled on a housing and either rotates with the roll or is itself driven and fixed with the roll. Special guidance devices having a sealing function are utilized to supply the heating fluid to the rotating shaft, where it passes through a bore in the center of the shaft to a distributing point in order to pass from there into the hollow jacket or circumferential wall of the roll. After passing through this hollow wall, the heating fluid is returned back to the rotating shaft and is centrally evacuated from the shaft in axial direction of the latter, usually through a second passage which generally concentrically surrounds the first passage through which the fluid is originally supplied. Experience has shown that these prior-art constructions have certain significant disadvantages. Among these is the fact that to obtain the necessary circulation of the heating fluid at least two rotary seals must be provided, namely where the heating fluid is admitted into the rotary shaft and where it is evacuated from the latter. Furthermore, the necessity to have the incoming and outgoing (that is the fresh and the spent) heating fluid pass through one and the same shaft, a temperature equalization between incoming and outgoing heating fluid takes place so that it is necessary for the incoming heating fluid to be heated to a significantly higher temperature than is actually necessary to heat the roll to the requisite degree. In other words, this higher temperature is necessary in order to compensate for the heat losses resulting from heat exchange of the incoming heating fluid with the cooler outgoing heating fluid. It goes without saying that a corollary of this is the fact that it is difficult to maintain the temperature constant. In addition, many of the prior-art constructions require a second circulatory arrangement through which lubricating fluid for the journals of the roll and often also for the drive of the roll is supplied, again requiring additional seals.

SUMMARY OF THE INVENTION

It is a general object of the invention to provide an improved roll of the type here under discussion which avoids the disadvantages of the prior art.

An additional object of the invention is to provide such an improved roll in which the structural measures

required for effecting the necessary circulation of heating and lubricating fluid are very simple.

A concomitant object of the invention is to provide such a roll which can be readily assembled and disassembled with the remaining associated components without having to fear the possibility of damage or the like.

A concomitant object of the invention is to provide a method of heating and lubricating such a roll.

In pursuance of these objects, and of others which will become apparent hereafter, one feature of the invention resides in an arrangement of the character here under discussion, which comprises a shaft and a hollow roll surrounding at least a portion of this shaft. Journal means journals the roll for rotation and supply means supplies a flow of heated lubricant fluid. First guide means guides some of this heated lubricant fluid to the journal means for effecting lubrication of the same, and second guide means guides the remainder of the heated lubricant fluid directly into the interior of the hollow roll, bypassing the journal means, for effecting heating of the roll.

It will be immediately evident that a significant advantage of the construction according to the present invention is the fact that one and the same fluid is used both for heating purposes and for lubricating purposes, and this may be an oil which at the requisite temperatures is capable of affording the necessary lubricating action. Such an oil may be on mineral oil basis or it may be a synthetic flowable lubricant. Inasmuch as only a single fluid circulatory system is required with the construction according to the present invention, the number of seals —which always are subject to deterioration and malfunction—is reduced to an absolute minimum.

Furthermore, by guiding only a smaller portion of the incoming heated lubricant fluid to the journals for lubricating purposes, and having the larger remainder of the heated lubricating fluid bypass the journal means and enter directly into the roll for heating it, the pressure at which the fluid must be supplied in order to assure its proper circulation through the roll can be substantially lower than would otherwise be possible. Among the obvious advantages of this feature is the fact that there is less danger of leakage at those seals which must still be provided despite the significantly simplified construction.

The type of arrangement here in question is usually provided with a stationary housing in which the drive means for the roll is located. In order to eliminate the complicated return of the spent heating fluid through the shaft, and also to eliminate the heat losses resulting from such an expedient, the invention also proposes that the spent heating fluid be directed into the stationary housing from where it can be recirculated to the supply means. This results in a further reduction in the number of sealing arrangements which must be provided in the construction according to the present invention as opposed to those known in the prior art, and permits a still further simplified construction.

In the prior-art construction it has been found particularly disadvantageous that the seal at the inlet of the heating fluid into the rotary shaft was subject to frequent malfunction, not the least because the heating fluid at this point must be under high pressure in order to assure a rapid flowing through the various passages. As a result, such seals are subject to high stresses and

invariably had to be of complicated and expensive construction in order to provide even a reasonably reliable sealing effect. This difficulty is overcome by the present invention which proposes to utilize a stationary shaft with the hollow roll rotating with reference to the stationary shaft. With this construction according to the present invention the most heavily stresses rotary seal required in the prior-art constructions is avoided, because the heated lubricating fluid can now be supplied through the stationary shaft into the roller, for instance through a bore provided in the center of the shaft. This means that it is sufficient to provide a single rotary seal, namely between the stationary housing and the roll, and this seal is not subject to any particular stresses because it is located in the outlet region where the heating and lubricant fluid issues from the shaft and is under less pressure than in the inlet region. Even if the roll is positively driven, it is merely necessary to provide an additional seal at the entry point of the drive shaft, and this seal also is not subject to any particular pressures.

The fluid flow through the hollow roll can be further improved in accordance with the present invention by surrounding the shaft within the roll with a tubular member which defines with the inner circumferential surface of the roll an axially extending annular clearance through which the lubricant fluid passes. This clearance may be either smooth or may be provided with guide ribs for guiding the fluid passing therethrough.

If the roll is positively driven, then it is connected with a drive gear. While it is possible to make the drive gear fixed with the roll, it is preferred to connect the drive gear releasably with the roll in order to facilitate disassembly of the arrangement and the removal of the roll from the shaft. In particular, experience has shown that there is much more frequently a need for repair to be effected on the roll than on the drive itself, and by releasably connecting the drive gear with the roll the latter can be removed by itself whereas the drive gear can remain in position.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary longitudinal section, with parts illustrated diagrammatically, of one embodiment of the invention; and

FIG. 2 is a view similar to FIG. 1 but illustrating a further embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail, it will be seen that in FIG. 1 I have illustrated an embodiment in which the roll to be heated is identified with reference numeral 1 and is mounted by means of journals 2 and 3 (here antifriction bearings) on a stationary shaft 4. The latter is provided with an axial passage or bore 5 provided with an inlet 6 with which it can be connected with a supply of heated lubricant fluid, so that such fluid is supplied via inlet 6 into the passage 5. The latter extends over the entire length of the illustrated shaft and communicates at the end portion of the roll 1 which is closed with the transverse end cap 7 (that is the right-hand end portion in FIG. 1) with the interior of the roll.

At this end portion the first guide means in form of one or more passages 8 is provided which guides some (a smaller part) of the incoming heated lubricating fluid into and through the journal 3 which is thus lubricated. The remainder (the larger part) of the incoming heated lubricating fluid is guided by second guide means in form of one or more grooves 9 directly into an axially extending annular gap 10 which exists between the inner circumferential surface of the roll 1 and a tubular member 11 which surrounds the shaft 4 within the roll 1 with radial clearance from the circumferential wall of the latter.

The lubricant and heating fluid passes through the gap 10 and a smaller quantity of it passes through the journal 2, lubricating the same, before it enters into the passage 13 and from there into the stationary housing 14 which is diagrammatically illustrated. The major portion of the lubricant and heating fluid from the gap 10 passes through the guide passage 12 and also into the housing 14 but bypassing the journal 2.

If the roll 1 is not positively driven (contrary to the embodiment of FIG. 1) then the only rotary seal required for the arrangement is the seal 15 between roll 1 and stationary housing 14. If, however, the roll 1 is positively driven, for instance by the illustrated gear 16 which is shown in FIG. 1, then an additional seal is required for the shaft of the non-illustrated second gear in the stationary housing 14, which second gear cams with the gear 16 to transmit motion to the same and thereby to the roll 1.

The gear 16 can be fixedly connected with the roll 1 so that the two cannot be separated. However, it is advantageous as shown in FIG. 1 to connect the gear 16 with the roll 1 by means of screws or bolts 16a so that they can be separated from one another. These screws or bolts 16a can be released after the annular carrier 17 carrying the seal 15 and mounted by means of screws or bolts 17a to the housing 14, is removed. After the end cap 7 is removed and the mount 19 for the journal 3, the roll 1 can be readily withdrawn and repaired, inspected or exchanged, whereas the gear 16 remains in position. Subsequently, the just-described steps are reversed in order to connect the roll 1 again with the gear 16.

If it should be necessary to remove the gear 16 itself, then the mount 18 for the journal 2 must be removed—in some circumstances also the tubular member 11—whereupon the gear 16 can also be withdrawn axially of the shaft 4 for repair, inspection or replacement.

The seal 15 is entirely sufficient for sealing the stationary housing 14 with respect to the rotating roll 1.

The heating and lubricating fluid which accumulates in the stationary housing 14 is withdrawn therefrom by means of the diagrammatically illustrated pump P and supplied via a conduit 6a to a suitable heater H where it is reheated to the necessary temperature and then supplied to the inlet 6. It is also possible to provide a device for subjecting the fluid to cleaning or filtration

if and when this should be necessary. Such devices are well known, as are the heaters H.

The highest requirements in this arrangement are made of that portion of the fluid which serves to lubricate the gear 16, unless special expensive broad gears are to be used in which the pressures which occur are lower than in conventional gears. To overcome the attendant problems the invention proposes that some of the fluid withdrawn by the pump P be branched off from the conduit 6*a* at a distributing valve V, to be supplied by a branch conduit 6*b* first to a cooling device C (known per se to those skilled in the art) and then to the diagrammatically illustrated inlet port in the stationary housing 14 so that following the curved arrow it can be supplied to the gear 16. This means that the gear 16 is lubricated not only by the ambient fluid which is still in heated condition, but also receives lubrication from the additionally supplied cooled fluid whose admixture with the heated fluid surrounding the gear 16 reduces the temperature at this highest-stressed location and increases the lubricating effectiveness of the fluid. Because the gear 16 and the second non-illustrated gear camming therewith are both located in the stationary housing 14, no rotating seal is required for its supply either.

The embodiment in FIG. 2 is largely the same as that in FIG. 1, and like reference numerals identify like components. Here, however, two of the rollers 1 are mounted on axially adjacent portions of the shaft 4 which is again stationary, and all of the components associated in FIG. 1 with the single roll 1 are also associated in duplicate form with the second roll 1 illustrated in FIG. 2. In this embodiment the passage 5 extends throughout the entire axial length of the shaft 4 and a radial inlet port in the shaft 4 communicates with the passage 5 to supply lubricant and heating fluid thereto.

However, it should be noted that it is also possible (although not illustrated) for the shaft 4 to be provided with two separate bores 5 which do not communicate with one another, that is each end portion of the shaft is provided with its own bore 5. In this case each of the bores 5 may have a radial inlet port so that heating and lubricating fluid can be supplied to each channel 5 individually, establishing in this manner two separate fluid circuits so that the two rolls 1 can be heated to different temperatures if desired.

It will be appreciated that the present invention provides for an arrangement and a method of operating this arrangement in which the difficulties of the prior art are overcome and the objects of the present invention achieved.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of applications differing from the types described above.

While the invention has been illustrated and described as embodied in an arrangement having a roll heated and lubricated with a single fluid, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is set forth in the appended

1. An arrangement of the character described, comprising a shaft; a hollow roll surrounding at least a portion of said shaft; journal means journalling said roll for rotation; supply means for supplying a flow of heated lubricant fluid; first directing means for directing a major part of said heated lubricant fluid directly into the interior of said hollow roll for effecting heating of the same; and second directing means for directing a minor part of said heated lubricant fluid to flow initially through said journal means so as to effect lubrication of the same, and to thereupon become united with said major part downstream of said journal means so as to participate in heating of said roll.

2. An arrangement as defined in claim 1, wherein said shaft is stationary and said journal means journals said roll for rotation about said shaft.

3. An arrangement as defined in claim 2, wherein said supply means comprises at least one channel provided in said shaft and having an inlet end adapted to communicate with a source of said heated lubricant fluid, and an outlet end communicating with said guide means.

4. An arrangement as defined in claim 1; further comprising a tubular member surrounding said shaft within said roll and defining with an interior surface of the latter an axially extending annular clearance which communicates with at least said first directing means.

5. An arrangement as defined in claim 1, said shaft having two axially spaced portions and said roll surrounding one of said portions; and further comprising an additional roll similar to the first-mentioned roll surrounding the other of said portions, additional journal means journalling said additional roll, and additional first and second directing means similar to the first-mentioned directing means but operatively associated with said additional roll and said additional journal means.

6. An arrangement as defined in claim 1; and further comprising drive gear means journalled for rotation about said shaft, and connected with said roll for driving the same in rotation.

7. An arrangement as defined in claim 6; further comprising releasable connecting means for releasably connecting said drive gear means with said roll in releasable relationship.

8. An arrangement as defined in claim 6; and further comprising conduit means for returning lubricant fluid from said roll to said supply means.

9. An arrangement as defined in claim 8; further comprising branch conduit means communicating with said conduit means and the region of said drive gear means for branching off some of the lubricant fluid from the former and supplying it to the latter, and cooling means interposed in said branch conduit means for cooling the branched-off lubricant fluid upstream of said drive gear means.

10. A method of heating and lubricating a hollow roll journalled on a shaft via journal means, comprising the steps of supplying to said hollow roll via said shaft a

heated lubricating fluid; directing a first part of said lubricant fluid to flow through through said journal means for lubricating the same; directing the remaining second part of said lubricating fluid directly into the interior of said roll, bypassing said journal means, for heating said roll; and reuniting said first part with said second part downstream of said journal means so as to participate in heating of said roll.

* * * * *