

Fig. 1

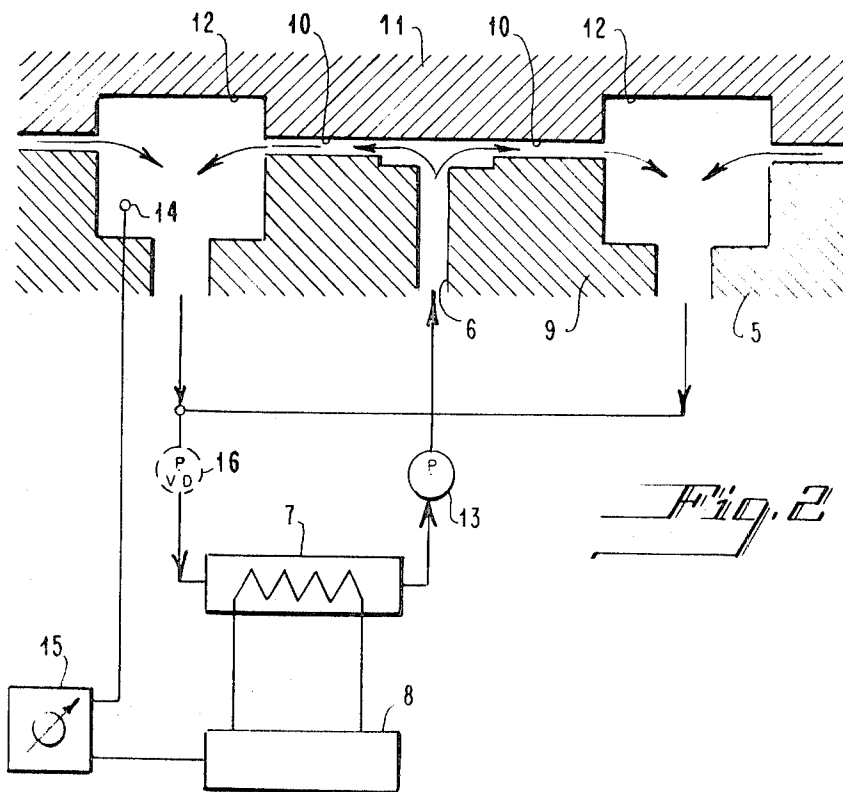


Fig. 2

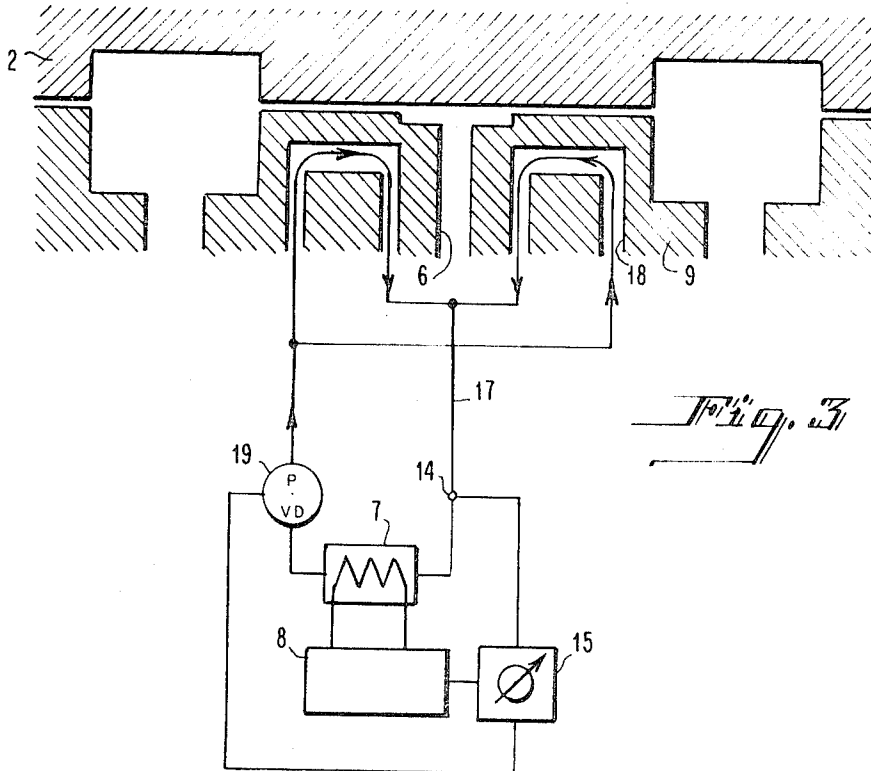


Fig. 3

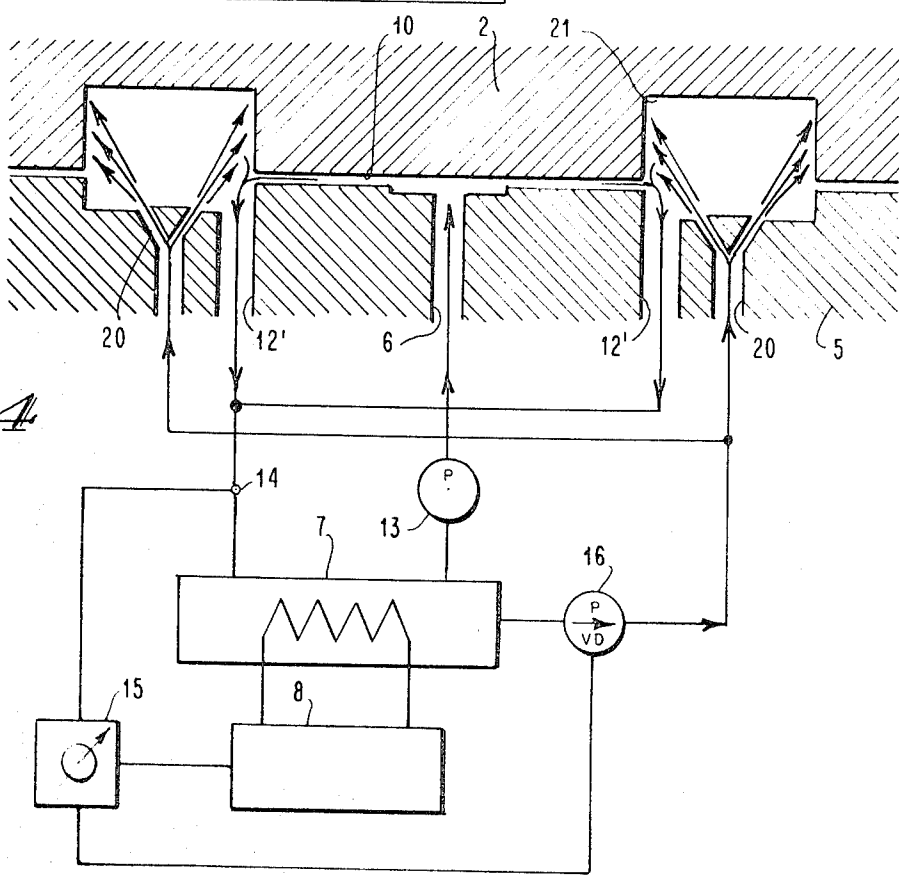


Fig. 4

METHOD AND APPARATUS FOR REGULATING THE TEMPERATURE OF A FORM BED RUNNING ON GUIDEWAYS IN A FLAT BED LETTER PRESS PRINTING MACHINE

My invention relates to method and apparatus for regulating the temperature of a form bed running on guideways in a flat bed letter-press printing machine.

To reduce the inertial forces which are produced by the reciprocating movement of the form bed in a flat bed letter-press printing machine, it is known to make the form bed as light as possible either by providing it with a suitable shape employing a minimum of structural material or by using a structural material in the production thereof which has a low specific weight.

It is also known to guide the form beds accurately in the longitudinal direction thereof and in a horizontal plane on guide rails, guide runners or skids or similar members. These guide members must thereby, at least in part, absorb very great forces, especially during the printing operation proper, and also due to the added dynamic forces arising from the drive mechanisms and determined by the type of drive.

The very frequently employed system of guiding the type foundation or bed on roller members for absorbing the forces applied vertically downwards demands a high degree of precision in manufacture due to the static indefiniteness or uncertainty of those forces. The roller members themselves often do not carry out a purely rolling motion, but rather, experience added movements, determined by their own inertia, which are manifested in a sliding motion that is superimposed on the rolling motion. The consequences thereof are the formation of ripples in the guideway, wear and tear and the development of a loud noise.

The conventional guideways first mentioned hereinabove have the disadvantage that the frictional forces occurring due only to sliding are considerably higher than the rolling friction forces of the roller guides, especially since the formation of hydrodynamic lubricant films is impossible or is possible only to a very moderate extent because of the reversal in the direction of movement of the form bed. The increased frictional output necessarily leads to the development of heat, which is transmitted to the machine component being guided, namely the form bed. Also, in spite of the much smaller frictional output when a so-called hydrostatic lubricant is used, heat is produced due to the choke or throttling losses of the lubricant which is supplied under pressure through very narrow gaps. This heat also is transmitted in part to the form bed. As a consequence of these heat formations, the form bed experiences dimensional changes depending respectively upon the shape and material of the form bed. These changes also effect the type form on the bed and ultimately impede or render impossible maintenance of positional accuracy from one printing pass to another.

The fact that the light metals have more than double the thermal coefficients of expansion than the otherwise commonly used cast iron alloys must then be considered in light of the foregoing, since the intended employment thereof for reducing the inertial forces of the form bed is thus rendered difficult due to the aforementioned disadvantage deriving from the very high coefficients of expansion thereof.

It is accordingly an object of my invention to provide method and apparatus for regulating the temperature of a form bed running on guideways in a flat bed letter-press printing machine which avoid the aforementioned disadvantages of the heretofore known form beds and flat bed letter-press printing machines. More particularly, it is an object of my invention above all to prevent temperature changes in the form bed irrespective of the particular material thereof.

With the foregoing and other objects in view, I provide method of regulating the temperature of a form bed running on guideways in a flat bed letter-press printing machine which comprises measuring the temperature of the form bed, com-

paring the measured form bed temperature to a given nominal value, and selectively precooling and preheating lubricant supplied under pressure and from below to the guideways for the form bed so that the temperature of the form bed corresponds substantially to the given nominal value during operation of the printing machine.

Frictional heat produced in the guideways or the temperature drops occurring in the working space of the flat bed letter-press printing machine cannot therefore have a disadvantageous effect on the maintenance of accurate registry between sequential printing passes, since no change occurs in the shape of the form bed and thereby in the form or type face proper due to thermal effects.

The apparatus of my invention carries out the foregoing method and comprises means for measuring the temperature of the form bed, means for comparing the form bed temperature to a given nominal value, and means for selectively precooling and preheating lubricant supplied under pressure and from below to the guideways so that the temperature of the form bed corresponds substantially to the given nominal value during operation of the printing machine.

In accordance with additional features of the apparatus of my invention, I provide a cooling device and/or a heat exchanger device connected in a circuit in which the lubricant is supplied to the guideways. The lubricant which forms a supporting film for the form bed running on the guideways is regulated to a substantially constant temperature by one or the other or both of the aforementioned devices, the regulating deviation necessary for maintaining the stability of the regulating circuit being only a few degrees centigrade. A regulating deviation of for example 5° C. effects no change in the type form which might introduce difficulties in setting the form in proper registry.

In accordance with another feature of my invention, a temperature sensing member is provided at a location of the lubricant circulating system downstream of the guiding or sliding surfaces of the guideway and form bed for determining the temperature of the lubricant at that location. Also provided is a comparator device in which the measured temperature value is compared with a given nominal temperature value and, in response to a difference therebetween, the comparator effects a change, through the cooling and heat-exchanging devices, in the temperature of the lubricant issuing from the heat exchanging device so that the temperature of the discharging lubricant remains independent of the load within the limits of permissible control deviation. Normally, the discharging lubricant is to be cooled and then returned at a lower temperature to the guiding or sliding surfaces. At the beginning of operation as well as for large temperature deviations in the working space and under conditions depending upon the respective choice of the once established temperature level, an occasional temporary heating of the lubricant may also be advantageous or necessary.

In accordance with a further feature of my invention I provide a circulating system wherein a temperature controlled or quantity-controlled coolant flow circulates, the coolant taking no part in the formation on the guideways of a form bed-supporting lubricant film. The coolant flows through closed channels adjacent the guiding or sliding surfaces of the guideway and thereby maintains the guideway at substantially the same temperature. The temperature of this coolant flow is then independent of the load and facilitates maintenance of the temperature level at a constant value. The coolant paper can in this case be a different medium than that necessary for maintaining a supporting lubricant film.

When using the same medium for cooling as for lubricating, the closed channels can be dispensed with, and the vicinity of the sliding or guiding surfaces can be kept at a constant temperature directly as by spraying with the lubricant for example. The quantity or the temperature of the additionally supplied lubricant is thereby able to be varied in accordance with requirements.

The aforescribed manner of controlling the temperature of the lubricating medium proper can be utilized by itself alone or also together with the method described in the next preceding paragraph. Control of the temperature according to the latter method alone is also conceivable.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in the method and apparatus for regulating the temperature of a form bed running on guideways in a flat bed letter-press printing machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, 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 drawings, in which:

FIG. 1 is a diagrammatic elevational view of a flat bed letter-press printing machine;

FIG. 2 is a sectional view taken along the line A—B in FIG. 1 and shows schematically a circulating system wherein the flow of lubricant is simultaneously employed for cooling the flat form bed;

FIG. 3 is the same sectional view as in FIG. 2 of another embodiment of the invention and shows schematically a circulating system wherein a separate coolant flow is provided; and

FIG. 4 is the same sectional view as in FIGS. 2 and 3 of yet another embodiment of the invention and shows schematically a circulating system wherein there is branching of the flow of lubricant, one of the branches being employed exclusively for cooling the form bed.

Referring now to the drawings and first particularly to FIG. 1 thereof, there is shown in elevational view a flat bed letter-press printing machine having a base frame 1 on which a flat form bed 2, a printing mechanism 3 and an impression cylinder 4 are mounted. The just-mentioned components 2 to 4 of the flat bed letter-press are of conventional construction and are conventionally mounted on the base frame 1. Their specific structure and manner of mounting form no part of the invention herein and are therefore not further described. The form bed 2 is reciprocable by a conventional nonillustrated drive mechanism on guideways 5 of the base frame 1, two different positions of the form bed 2 being indicated by solid and phantom lines in FIG. 1. As the form bed 2 is reciprocated on the guideway 5 it passes the inking rollers of the inking mechanism 3 and the impression cylinder 4. The guideways 5 of the base frame 1 are provided with ducts 6 below the impression cylinder 4. Pressurized oil is supplied through the ducts 6 to the guideways 5 and serves both for lubricating the guideways as well as for cooling the bed 2. A cooling system 7 and a heat exchanger 8 belonging to a circulating system for the lubricant oil are mounted within the base frame 1. A more detailed description of different embodiments of the lubricant and coolant circulating system of the invention are described hereinafter in conjunction with FIGS. 2 to 4 of the drawings.

FIG. 2 shows only a portion of the entire cross section of the guideways 5 and of the form bed 2 sliding thereon. In each guide rail 9 of the guideway 5 there is provided a pressurized oil duct 6 through which the lubricant is conveyed under pressure into the gap 10 located between the form bed rails 11 and the guide rails 9. The lubricant flows through the gap 10 into a discharge chamber 12 and from the latter to the heat exchanger 7 which is suitably coupled to a conventional cooling apparatus 8. After the lubricant has flowed through the cooling apparatus 8, it is forced by the pump 13 again into the duct 6.

A temperature sensing member 14 is mounted in the discharge chamber 12 and determines the temperature of the discharging lubricant therein, the measured temperature value being transmitted to a conventional comparator 15 wherein it

is compared with a given nominal temperature value. Control of the cooling apparatus is effected by the nominal value comparator 15.

If, for example, the lubricant is heated as it flows through the ducts 6, the gap 10 and the discharge chambers 12, so that the temperature thereof in the discharge chambers 12 exceeds a given nominal value, the nominal value comparator 15 accordingly actuates the cooling apparatus 8 to cool the discharging lubricant in the heat exchanger 7. Thus, for example, the comparator 15 may suitably transmit a signal which trips a switch that energizes a pump in the cooling apparatus 8 which will then cause a suitable coolant to circulate through the heat exchanger 7. On the other hand, if the temperature of the lubricant passing from the gaps 10 into the discharge chambers 12 is lower than the given nominal value, the comparator 15 will signal the cooling system to reduce the cooling of the lubricant passing through the heat exchanger 7, or in fact, actually heat the passing lubricant. To effect an accelerated return flow of the lubricant discharging from the gaps 10, an additional pump 16 may be provided in the lubricant circuit. The dimensions of the discharge ducts must be kept at such values that a relatively rapid return flow of the heated or cooled lubricant is possible.

In the embodiment of FIG. 3, it may be assumed that the lubricant passes through the ducts 6, the gap 10 and the discharge chambers 12 in a similar manner as in the embodiment of FIG. 2 except that it does not pass through a heat exchanger. Instead, a separate coolant circulating system is provided for cooling the lubricant. Thus, coolant is passed through suitably formed ducts 18 in the guideways 5, the ducts 18 extending adjacent the ducts 6 for the lubricant in the guide rails 9 of the base frame 1. A temperature sensing member 14 determines the temperature of the coolant in the circulatory loop 17 upstream of a heat exchanger 7, transmits the measured value to a comparator 15 wherein the measured temperature is compared to a given nominal temperature, a signal being transmitted therefrom to suitably control the cooling apparatus 8 and/or the variable pump 19. The pump 19 forces the coolant through the ducts 18. The embodiment of FIG. 3 has the advantage that a coolant can be selected which need not have any of the properties or characteristics of lubricants. If necessary, the additional coolant circulating system of FIG. 3 can be connected parallel to the cooled lubricant circulating system of FIG. 2.

In FIG. 4 there is shown the lubricant circulating system shown in FIG. 2, including the pump 13 connected downstream of the heat exchanger 7 in which the lubricant is cooled by the cooling system 8. The lubricant in the embodiment of FIG. 4 is forced by the pump 13 through the ducts 6 into the gaps 10 and thence into return flow or discharge chambers 12' located upstream of the heat exchanger 7, the temperature of the lubricant in the chambers 12' being determined by the temperature sensing member 14 which transmits the measured value for comparison with a given nominal value in the comparator 15 which accordingly controls the cooling action of the cooling system 8. The embodiment of FIG. 4 differs from that of FIG. 2 in that the lubricant flow in the FIG. 4 embodiment divides downstream of the heat exchanger 7, and an additional and variable pump 16 forces the thus branching lubricant flow into nozzles 20 that are provided adjacent the discharge chambers 12 in the guideway 5 of the base frame 1. Cooling chambers 21 that are formed in the form bed 2 are located opposite the nozzles 20. The lubricant in the branching flow thereof is thus sprayed out of the nozzles 20 into the cooling chambers 21 and flows back through the discharge chambers 12' to the heat exchanger 7. By intensively spraying large parts of the form bed 2, an especially effective temperature regulation is made possible.

The temperature of the lubricant discharging from the chambers 12' of FIG. 4 or of the coolant according to the embodiment of FIG. 3 need only correspond approximately to the given nominal temperature value. A control deviation of about 5° C. promotes the stability of the control circuit. To

facilitate the control process, the output or delivery of the pump 13 can be variable so that by merely controlling the delivered quantity, a specific temperature constancy is assured.

I claim:

1. Method of regulating the temperature of a form bed running on guideways in a flat bed letter-press printing machine, which comprises measuring the temperature of the form bed, comparing the measured form bed temperature to a given nominal value, and selectively precooling and preheating lubricant supplied under pressure and from below to the form bed and the guideways for the form bed so that the temperature of the form bed corresponds substantially to the given nominal value during operation of the printing machine.

2. Apparatus for regulating the temperature of a form bed running on guideways in a flat bed letter-press printing machine comprising means for measuring the temperature of the form bed, means for comparing the form bed temperature to a given nominal value, and means for selectively precooling and preheating lubricant supplied under pressure and from below to the guideways and to the form bed so that the temperature of the form bed corresponds substantially to the given nominal value during operation of the printing machine.

3. Apparatus according to claim 2 comprising a circulating system for the lubricant including a cooling assembly, said circulating system having means for conveying the lubricant to the guideways and for forming a supporting lubricant film thereon, said means for selectively precooling and preheating the lubricant being operatively connected to said cooling assembly for regulating the temperature of the lubricant at an approximately constant temperature whereby the regulating deviation necessary for maintaining stability of the system is only a few degrees centigrade.

4. Apparatus according to claim 2, wherein said cooling assembly includes a heat exchanger.

5. Apparatus according to claim 3 including a temperature sensing member provided at a location in said lubricant circulating system downstream from the surfaces of the guideway on which said lubricant film is formed for determining the temperature of the lubricant at said location, comparator means operatively connected between said temperature sensing member and said cooling assembly for comparing the

temperature sensed by said sensing member with a given nominal temperature and, in response thereto, actuating said cooling assembly to vary the temperature of the lubricant downstream therefrom so that the measured temperature remains independent of the load within the limits of permissible control deviation.

6. Apparatus according to claim 2 comprising a circulating system for the lubricant having means for conveying the lubricant to the guideways and for forming a supporting lubricant film thereon, and a circulatory cooling system including closed channels for circulating a lubricant coolant into and out of proximity of the guide surfaces of said guideways, said circulatory cooling system including a cooling assembly, said means for selectively precooling and preheating the lubricant being operatively connected to said cooling assembly for regulating the temperature of the lubricant in said lubricant circulating system at an approximately constant value.

7. Apparatus according to claim 6 wherein the flow of coolant in said circulatory cooling system is temperature regulated.

8. Apparatus according to claim 6 wherein the flow of coolant in said circulatory cooling system is quantity regulated.

9. Apparatus according to claim 3 comprising a circulating system for the lubricant having means for conveying the lubricant under pressure to the guideways and for forming a supporting lubricant film thereon, and a cooling system for directly applying to the guide surfaces of said guideways a temperature-regulated coolant in the form of the lubricant in said lubricant circulating system.

10. Apparatus according to claim 9 wherein said cooling system includes means for spraying said lubricant coolant into said lubricant circulating system.

11. Apparatus according to claim 3 comprising a circulating system for the lubricant having means for conveying the lubricant under pressure to the guideways and for forming a supporting lubricant film thereon, and a cooling system for directly applying to the guide surfaces of the guideways a quantity-regulated coolant in the form of the lubricant in said lubricant circulating system.

12. Apparatus according to claim 11 wherein said cooling system includes means for spraying said lubricant coolant into said lubricant circulating system.

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