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INSTALLATION FOR HEATING DRYING DRUMS OF DRYING MACHINES

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FIG. 1

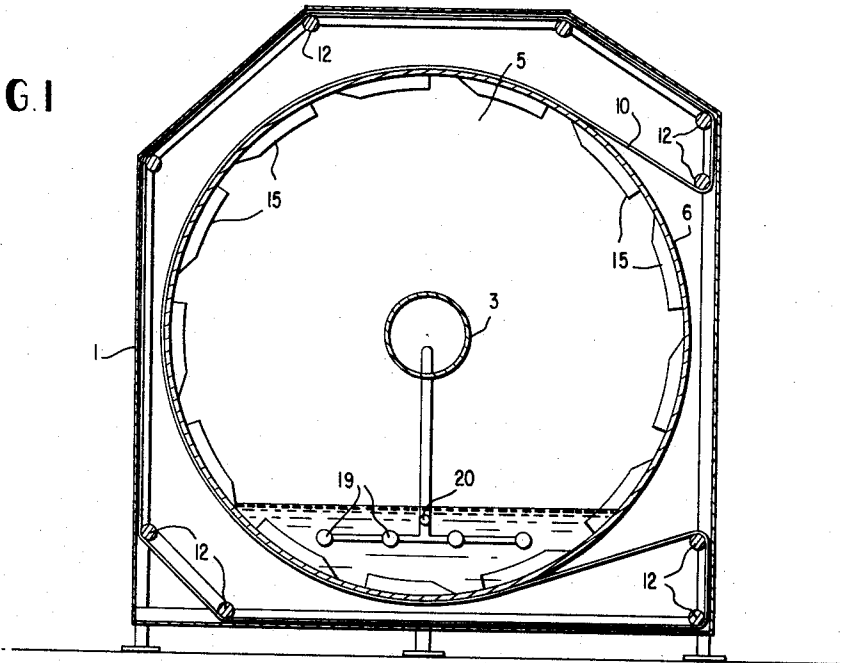
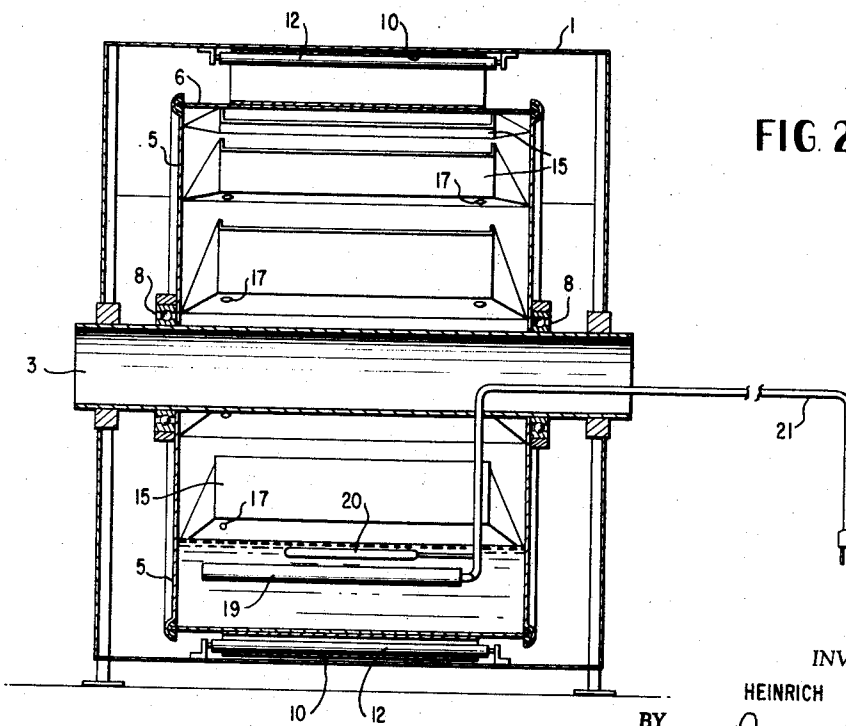


FIG. 2



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INSTALLATION FOR HEATING DRYING DRUMS OF DRYING MACHINES

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1 Claim. (Cl. 34—123)

The present invention relates to an installation for heating the drying drum of a drying apparatus for drying photographic prints which is rotatably supported on a horizontal shaft and against which abuts, over a section of the periphery thereof, a drying cloth in the form of an endless band which is adapted to move in the same direction as the drum.

The drying drums of the known prior art drying apparatus for photographic prints are heated, for the most part, by the supply of warm or heated air to the drum inside. By reason of the relatively slight heat capacity of the air, the sections of the drum consisting of relatively thin steel sheet metal members which serve for purposes of drying are cooled off very rapidly and are not brought back sufficiently rapidly to the temperature required for drying. The warm air serving for purposes of heating must not exceed a predetermined temperature as the use of excessively high temperatures entails the danger of uneven heating with the consequence of uneven drying and local overheating of the drum. Consequently, the heating of the drying drum with warm air leads to frequent occurrences of defective operation as regards photographic prints produced thereby and therewith involves additional expenses.

It has already been attempted to achieve a better heat conduction and heat distribution by the application, along the inside of the drum, of a good heat conducting material, for example, by plating the same with copper. This measure, however, does not entail the expected advantages and, under certain circumstances, causes a contrary effect, for example, in case of a plating which is not completely satisfactory. This is so as in those places in which the applied material does not abut thereagainst closely to form a good intimate contact with the base material, heat-insulating air gaps result therefrom by means of which the heat exchange is additionally deteriorated.

Drum heating systems are also known in the art in which the annular space of a double-walled drum is filled with liquid which is electrically heated. The realization of such a construction, however, is very complicated and involves high manufacturing costs. Additionally, the circulation of the fluid can be achieved only with difficulties and leads often times to failures and breakdowns.

The present invention is concerned with the aim to produce an arrangement in which the sections of the drying drum which are intended for purposes of drying the photographs are heated sufficiently and evenly during rotation of the drying drum without large expenditures. This aim and problems connected therewith are solved according to the present invention by constructing the drum in a fluid-tight manner and by arranging along the inside of the drum casing pockets, constituted by strips extending essentially parallelly to the drum axis, for the accommodation or reception therein of a liquid heat-carrier or heating medium, such as water, which is maintained at a predetermined temperature and is disposed in a sump located within the lower part of the drum.

By a thorough covering of the inside of the cylinder casing with such pockets, there is achieved an even heating of the section of the cylinder casing serving for purposes of drying. The pockets discharge, during rotation thereof, the heat-carrier or heating-medium, preferably

water, as soon as they reach or pass beyond the top point or apex of the path of the drum. The section of the cylinder casing having the respectively discharged pockets cools off slightly which is desirable during operation of the drying drum. Water, by reason of its good heat transmitting and high heat capacity characteristics is recommendable in particular as heat carrier. In order to enable heating of the heat carrier, an electric heating member is arranged within the lower section of the drum within the area of the sump occupied by the heat carrier. Appropriately, the drum shaft is thereby constructed as stationary hollow shaft and is provided with externally arranged roller bearings for the drum. The heating body is then secured at the hollow shaft of the drum and the input and output lines are extended through the hollow shaft.

It may be of advantage for certain operating conditions not to maintain the rising section of the drum casing at an essentially constant temperature but, instead, to permit the temperature to drop during the rise thereof. For that purpose, the pockets may be provided at the lower normally closed edge thereof adjoining the drum casing with apertures of slight size, the size being so dimensioned that the pockets are discharged only partially during the rotation of the drum through about 180°. As a result thereof, the quantity of heat-carrier or heating-medium taken along in each pocket decreases constantly during the rise of the drum, and the heat given off to the surroundings of the pocket thereby decreases with an increasing rise of the corresponding area of the drum casing.

Accordingly, it is an object of the present invention to provide a heating system for the drying drum of a drying apparatus, especially for drying photographic prints, which effectively eliminates the shortcomings and inadequacies of the prior art constructions in a simple manner.

Another object of the present invention resides in the provisions of a simple heating means utilizing a heat carrier of high heat capacity and heat transmission characteristics, such as water, which permits, in a simple manner, the realization of predetermined heating over the section of the drum normally used for purposes of drying the photographic prints.

A still further object of the present invention resides in the provision of heating means utilizing a high thermal capacity liquid which permits the establishment of a predetermined heat gradient over the section of the drying drum used for drying purposes.

These and other objects, features, and advantages of the present invention will become more obvious from the following description, when taken in connection with the accompanying drawing which shows, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein

FIGURE 1 is a schematic cross sectional view of a drying drum provided with a heating installation according to the present invention, and

FIGURE 2 is a schematic longitudinal cross sectional view through the drying drum of FIGURE 1.

Referring now to the drawing wherein like reference numerals are used throughout the two views to designate corresponding parts, reference numeral 1 designates therein a frame of any suitable construction. A hollow shaft 3, which is secured at the frame 1 in any suitable manner, rotatably supports thereon, with the aid of roller bearings 8, a drying drum formed of two end walls 5 and the cylinder casing 6 having a highly polished and surface-protected outer surface. A drying cloth 10 abuts against the cylinder casing 6 over a relatively large section of the circumference thereof, which drying cloth is constructed as an endless band and is guided or returned

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back upon itself, with the aid of rollers 12 supported in the frame 1, over the section thereof that is in contact or abuts against the cylinder casing 6. The drum 5, 6 is supported in a freely rotatable manner by means of bearings 8, while the drying cloth 10 is adapted to be driven with the aid of any suitable motor (not illustrated) thereby imparting a rotary movement to the drying drum by the operative engagement therewith of a portion of the endless drying cloth 10.

The two rim portions of the cylinder casing 6 are inserted into the gap open toward the inside of a sealing ring of essentially U-shaped cross section which is disposed in an annular trough or stiffening corrugation along the outer periphery of the end walls 5. The mutually opposite end walls 5 are kept together in the assembled, fluid-tight condition by tensioning or tie rods of any suitable construction (not illustrated).

Relatively flat pockets 15 are arranged along the inner walls of the cylinder casing 6 which are each constituted by a sheet metal strip, a strip of synthetic material, of the like. The strips forming the pockets 15 are disposed essentially parallelly to the drum axis and extend from one to the other end wall 5 of the drum. The pockets 15 are spaced along one entire longitudinal edge thereof, over the full width thereof, by a predetermined distance from the inner drum wall, whereas the other longitudinal edge of each pocket abuts directly against the inner drum wall. The strips forming the pockets 15 are secured, in any known and appropriate manner, along the rim portions thereof at the cylinder casing 6, the manner of securing depending on the material used, for example, by bonding, cementing, gluing or the like.

Apertures 17 may be provided in the longitudinal edge of each pocket disposed opposite the open side of each pocket, which apertures 17 are so dimensioned that during one half of one drum rotation, not the entire liquid contained in the respective pocket 15 but only a predetermined portion thereof is discharged therefrom.

A heating member 19 of any suitable type is secured on the stationary hollow shaft 3, which heating member 19 is disposed within the water sump slightly above the lowest point of the drum. The supply of current to the electric heating member 19 is extended through the hollow shaft 3 and is realized by any suitable means, such as an electric wire, cable or the like.

The drum 5, 6 is filled up to a predetermined height with a heat carrier, preferably water. The heat carrier is maintained at a predetermined temperature by the heating body 19 of any suitable construction which is adapted to be electrically controlled by a thermostat 20 effectively extending with the sensing element into the heat carrier or heating medium.

Upon rotation of the drum 5, 6 in the clockwise direction as viewed in FIGURE 1, the pockets 15 disposed along the inside of the cylinder casing 6 are submerged in the water sump, are filled with water as the heat carrier, and then take along the water over the path up to the apex or top point of the drum. A predetermined quantity of water is discharged through the respective apertures 17 of each pocket 15 during the drum rotation and flows back along the drum wall into the sump. Within the area of the apex or top point of the drum rotation, the pockets 15 discharge the remaining amount of water through the open side thereof and the water thereby falls back into the sump. By reason of taking along the water as heat

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carrier, the rising cylinder casing section is maintained approximately at the same temperature and is not cooled off significantly from the outside since the water gives off heat continuously.

Operation

The operation of the drying drum according to the present invention is as follows:

During operation of the drying drum, the watered photographic prints are placed on the portion of the drying cloth 10 entering the drum with the emulsion of the film facing upwardly and are thereupon taken along between the driven drying cloth 10 and the drum 5, 6, itself taken along by the movement of the drying cloth 10. As a result of the heat of the drying drum, the prints are dried and leave the conveyer path at the upper reversing place of the drying cloth 10 where they either fall off by themselves or may be taken off by means of a suitable deflector member or the like.

While I have shown and described one embodiment in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of many changes and modifications within the spirit and scope of the present invention, and I, therefore, do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claim.

I claim:

An arrangement for heating the drying drum of a drying apparatus, especially for drying photographic prints, comprising a relatively stationary, approximately horizontal hollow shaft, drum means having a drum casing, means including bearing means on said shaft for rotatably supporting said drum means about said hollow shaft, drying cloth means adapted to be moved in the same direction as said drum means and abutting against a section of the circumference of said drum means, said drying cloth means being in the form of an endless band, said drum means being of liquid-tight construction, and pocket means arranged along the inner side of the casing of said drum means for receiving therein a liquid heat-carrier maintained at a predetermined temperature, said pocket means being formed by strips extending essentially parallelly to the drum axis and being filled from a sump of liquid heat-carrier located in the lower portion of said drum means upon rotation of said drum means, electric heating means disposed within the lower area of said drum means in which is located said sump for heating said liquid medium, said electric heating means including wire means adapted to be connected to the electric circuit and extending through said hollow shaft, and means for supporting said electric heating means on said hollow shaft.

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