April 24, 1945. W. F. GRUPE 2,374,194

PRESSURE ROLLER

Filed Aug. 30, 1941

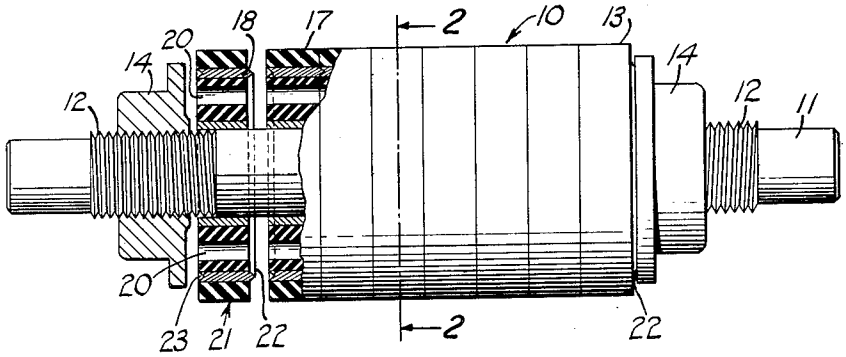


Fig. 1

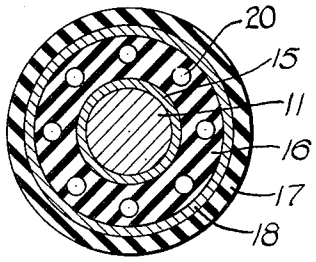


Fig. 2

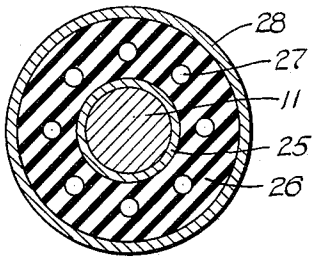


Fig. 3

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Patented Apr. 24, 1945

2,374,194

UNITED STATES PATENT OFFICE

2,374,194

PRESSURE ROLLER

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Application August 30, 1941, Serial No. 408,955

2 Claims. (Cl. 101—407)

This invention relates to pressure rollers for use in printing machines, paper making machines and the like, and aims to provide a durable resilient roller having structural features which increase its life under extreme conditions of use.

There are many occasions where it is desired to apply pressure in relatively great amounts to a web of material passing between a pair of cooperating rollers. For example, in "rotogravure" printing, the ink is transferred from the cells of the engraved printing cylinder to the web by pressure applied through a cooperating resilient pressure roller. Depending upon the speed of operation, the type of ink and the type of paper employed, the force applied to the impression cylinder or the shaft thereof should be such as to create sufficient pressure to bring all depressions in the material being printed into proper surface contact with the engraving and thus effect a proper transfer of ink from the cells of the engraving to the material. Where the stock or material being printed has a very smooth surface, such as with "Cellophane" or metal foil, the pressure required for proper printing may be as low as 5 pounds per lineal inch of impression roller, whereas, if the material is coarse and hard, a pressure as high as 500 pounds per lineal inch of impression roller may be required.

When the usual impression cylinder is rotated under the higher pressures that are required for the harder and more uneven stocks, there is a continuous flexing and unflexing of all of the resilient material (usually rubber or some rubber substitute) in the cylinder and this generates a considerable amount of heat which has a detrimental action on the resilient material. If the impression roller is made of rubber, the heat may be sufficient to cause a further vulcanization of the rubber and eventually render it unfit for use. This is true even where the roller is made of several layers of rubber of different hardness.

It is also desirable in the usual impression cylinder for printing on the harder stocks to have a relatively soft and resilient outside surface so that said surface will produce a suitable printing contact even though there are slight irregularities in the density and thickness of the stock. This tends to create an additional difficulty in operation since an increase in the force applied to the impression cylinder increases the area of contact between the impression cylinder, the paper and the printing cylinder. This not only reduces the effective printing pressure and thus reduces the sharpness of the print, but the distortion of the cylinder surface may be such as to create a difference in surface speeds throughout the area of contact which both affects the structure of the material being printed and the register of the printed impression.

I have discovered that the above and other disadvantages encountered in prior known constructions of impression rollers may be eliminated, and have invented an impression roller with which sharper impressions may be obtained regardless of the width of the press or the characteristics of the material being printed and from which the heat generated due to rotation will be readily dissipated.

In accordance with my invention, these desirable results are accomplished by providing an inner metal cylindrical shell in the resilient material between the outside surface thereof and shaft and concentric with the shaft. More specifically, my improved impression roller comprises a conventional steel shaft, mandrel or core having a relatively soft rubber base layer secured thereto, an outer surface layer of considerably harder rubber, and a pressure distributing layer of metal or other firm resilient material between said base layer and said outer surface layer, all of said layers being firmly bonded together. Actually, the base layer constitutes a soft resilient body for the cylinder and may be provided with longitudinal holes extending throughout the length thereof for expelling heat as the cylinder rotates. I have found that my improved construction provides an impression cylinder which has a greater useful life, which produces a substantially constant area of contact between the impression and printing cylinders, and which permits the use of materially lower pressures with a resultant lowering of the power requirements for running the press.

The above and other features and objects of the invention will become apparent upon consideration of the following detailed description and the accompanying drawing, in which:

Fig. 1 is a front elevational view, partly disassembled and partly in section, of a pressure roller embodying the features of my invention;

Fig. 2 is a transverse vertical sectional view of the roller shown in Fig. 1, taken substantially along the line 2—2 of Fig. 1; and

Fig. 3 is a transverse vertical sectional view, similar to Fig. 2, showing a modified form of construction embodying the features of my invention.

Referring now to the drawing, it will be observed that an impression cylinder 10, embodying the essential features of my invention, comprises a shaft 11 having threaded portions 12 adjacent

each end thereof and a cylindrical roller 13 mounted thereon and held in proper position by means of clamping members 14. The cylindrical roller 13 includes a steel or other suitable metal core 15 having an internal diameter slightly larger than the diameter of the central portion of the shaft 11. A base layer 16 of relatively soft rubber or other suitable resilient material is secured to the outside surface of the core 15 which may be brass-plated or otherwise treated so that the base layer 16 will adhere thereto after vulcanization. The cylindrical member 13 also includes an outer surface layer 17 of considerably harder rubber than the base layer 16 and an intermediate pressure distributing layer 18 of metal or other firm resilient material. This intermediate pressure distributing member 18 is in the form of a cylindrical shell having its inside surface secured to the base layer 15 and its outside surface secured to the outer surface layer 17. It is the function of the pressure distributing member 18 to distribute the pressure applied to the roller through a considerable portion of the relatively soft base layer 16.

In this manner, the contact area between the pressure roller and the other roller with which it is cooperating, such as the printing cylinder in a rotogravure printing press, is maintained at a minimum and, even though the pressure applied is increased, there will be no substantial increase in the area of contact. Due to this and the surface characteristics of the outside layer 17, a maximum pressure of 170 pounds per lineal inch of impression roller is required for proper printing of a material that requires 300 pounds pressure with an impression cylinder of the usual construction.

Where it is desired to have an impression cylinder of approximately five inches in diameter, I have found that the outside surface layer 17 of the roller portion 13 may be about $\frac{3}{16}$ of an inch thick and have a Shore hardness of from 80 to 85, this being substantially the same hardness as in normal tire rubber. The pressure distributing member 18 may be made of steel tubing approximately $\frac{3}{32}$ of an inch thick having an inside diameter of about 4½ inches. The steel tubing is preferably brass-plated on the outside and inside surfaces thereof so as to permit proper rubber adhesion during the vulcanization process; and its thickness and resilience are always such that it will not distort permanently under the maximum load to be applied to the cylinder. The base layer 16 is about 1 inch thick and has a Shore hardness of from 35 to 40. This hardness may range from 30 to 50, depending on the applied load. The core member 15 may consist of steel tubing about $\frac{3}{32}$ of an inch thick having an internal diameter of 2½ inches.

When prior known pressure cylinders are operated in a rotogravure printing press, for example, the contact area between the surface of the pressure cylinder and its cooperating roller is about 1 inch in width; and during operation there is considerable flexing of the rubber between the outside surface and the core which causes the cylinder to become heated to a point that may even cause deterioration of the rubber. However, by including the pressure distributing member 18 in my improved construction, both the area of contact and the flexing of the rubber between the outside surface and the core are reduced to a minimum with a resulting reduction in the amount of heat generated. Any heat that is generated is quickly removed from the cylinder by its travel through the metal pressure distributing member 18 and the core member 15 which, it will be understood, are far better conductors of heat than rubber. In order to aid further in the removal of the generated heat from the base layer 16, a plurality of longitudinal holes 20 extending throughout the length of the cylinder may be provided in said base layer. During operation of the cylinder, these openings will be slightly compressed and thus cause any heated air therein to be expelled.

From the foregoing description, it will be understood that the entire cylindrical section 13 may be constructed as a single section of the desired width in accordance with the principles of my invention. However, my improved construction lends itself well to the formation of a cylindrical member 13 from a plurality of sections or disks 21 as shown in Fig. 1. When this is done, the metal shell 18 may be provided with a V-shaped projection 22 on one exposed edge thereof and a correspondingly shaped groove 23 on the other exposed edge thereof so that when the disks 21 are moved into assembled position said individual disks will be suitably interlocked. In this manner, a cylinder made up of a plurality of disks 21 will function properly as a unit. With such a construction, an impression cylinder is provided which may be used with webs of different widths. If desired, instead of forming the entire cylinder of a plurality of disks as shown in Fig. 1, the central section thereof may be made of a width corresponding to that of the minimum web width with which the cylinder is to be used. Then disks 21 of any desired increment of width may be added to the central section for accommodating webs of different widths.

In Fig. 1, it will be noted that the V-shaped projection 22 at the right hand end of the cylinder contacts the inside face of the adjacent clamping member 14 and thus provides a means for conducting heat into the cylinder shaft 11 so that it may be dissipated in the press frames. It is to be understood that this means and the longitudinal holes 20 each constitute means for removing heat from the central portion of the cylinder. To aid further in the cooling of the cylinder, the clamping members 14 or the projecting ends of the pressure distributing member 18 may be constructed or provided with fan blades or any other suitable means for forcing air through the holes 20; or a hood may be placed over one end of the cylinder and compressed air forced through said holes.

Referring now to Fig. 3, I have shown a modified construction embodying the principles of my invention which is particularly well suited for use with heavy, relatively soft paper stock, such as cardboard, paper board, carton stock and the like. As shown, the cylindrical member mounted on the shaft 11 comprises an inner core member 25 having an internal diameter slightly larger than the diameter of the central shaft. A base layer 26 of relatively soft rubber or other suitable resilient material is secured to the outside surface of the core 25 in a manner similar to the base layer 16 described above. This base layer 26 may also be provided with longitudinal openings 27 for expelling the heat generated during the operation of the cylinder. The modified cylinder also includes an outer metal shell 28 which provides the actual impression surface for the cylinder and also acts as a pressure distributing member similar to the member 18 described

above. The modified cylinder thus differs from that described above in the elimination of the outside harder rubber layer 17. However, when the cylinder is used as an impression cylinder in printing heavy paper board, for example, it provides an excellent impression surface.

While I have described certain preferred embodiments of the features of my invention, it will be understood by those skilled in the art that various changes may be made in the construction and certain features thereof may be employed without others, without departing from my invention or sacrificing any of its advantages.

What I claim is:

1. A pressure roller comprising a shaft, a metal core mounted on said shaft, a relatively soft resilient base layer secured to said metal core, a metal pressure distributing member firmly bonded to the outside surface of said base layer, and means for conducting heat generated in said roller from said metal pressure distributing member to said shaft.

2. A pressure roller comprising a shaft, a metal core mounted on said shaft, a relatively soft resilient base layer secured to said metal core, a metal pressure distributing member firmly bonded to the outside surface of said base layer, and means for removing heat from said roller including a plurality of longitudinal openings in said base layer and means for conducting heat from said pressure distributing member to said shaft.

WILLIAM F. GRUPE.