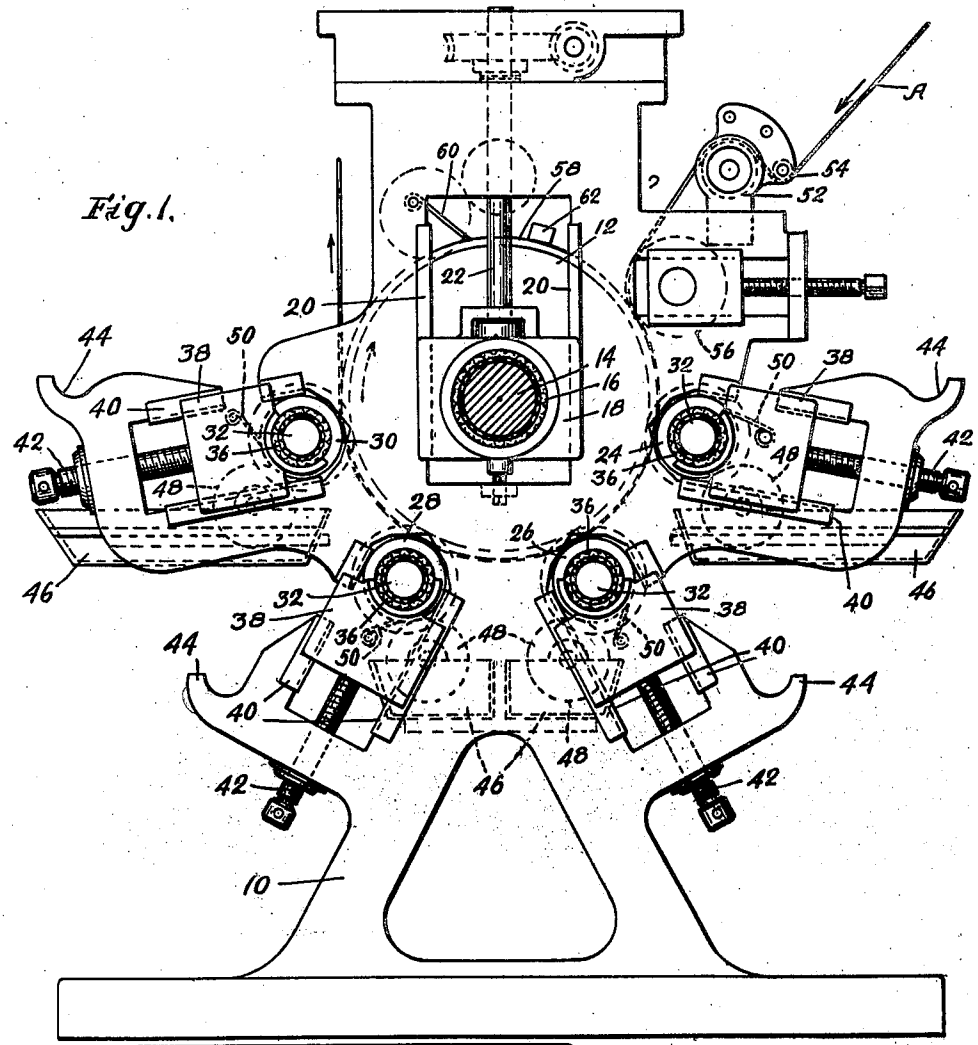
Dec. 2, 1941. H. D. LEARNARD 2,264,475

MULTIPLE-COLOR TEXTILE PRINTING MACHINE

Filed May 11, 1940

Fig. 1.



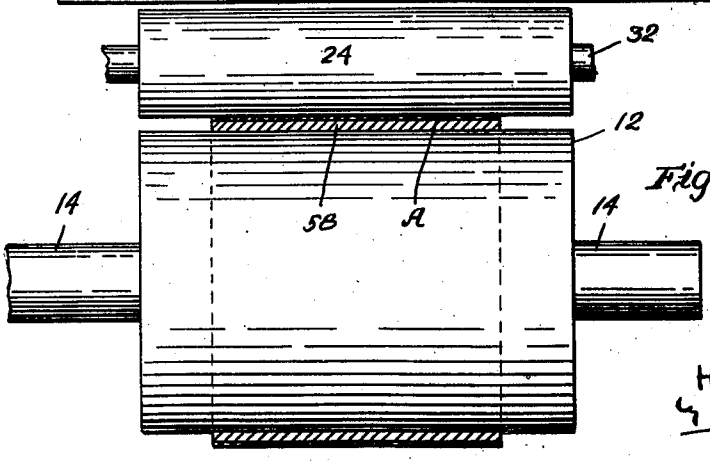


Fig. 2.

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MULTIPLE-COLOR TEXTILE PRINTING MACHINE

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Application May 11, 1940, Serial No. 334,564

9 Claims. (Cl. 101—178)

This invention relates to the printing of woven fabrics with designs in various colors and to a textile printing machine, and particularly to the impression roll of such machine.

The usual multi-color textile printing machine includes a large diameter impression roll and a plurality of engraved printing rolls co-acting therewith, the fabric to be printed passing onto the periphery of the impression roll and successively engaging the printing rolls, which rolls apply successive colors to the fabric, the printing rolls being engraved with different parts of the same design and rotating in unison so that the colors are applied in registration with each other to provide the desired design.

In the usual textile printing machine the fabric to be printed is not pressed directly against the hard cylindrical face of the drum by the printing rolls but instead, against cushions interposed between the fabric and the drum. The usual drum is provided with a peripheral facing consisting of a plurality of layers of fabric tightly wound upon the drum and cemented or otherwise attached together or to the drum to form a thick facing of material yieldability. A relatively thick endless blanket passes around the drum and rotates therewith. Between the blanket and the fabric to be printed is a fabric of so-called back-grey, which usually is approximately co-extensive in length with the length of the fabric to be printed and as wide or wider than the printing rolls and is passed into the machine along with the fabric. Thus the fabric undergoing printing is supported against the pressure of the printing roll by the underlying back-grey, the blanket and the lapping on the impression drum. The back-grey functions primarily as a blotter to absorb ink or dye that passes through the fabric and also receives ink from that part of the printing rolls that extends beyond the sides of the fibre being printed, thereby to protect the blanket. The blanket and lapping provide the resiliency which is necessary to cause the fabric to enter the under-cut ink retaining portions of the printing rolls to abstract the ink therefrom. The back-grey can sometimes be used for the printing of successive lengths of fabric but when it is sufficiently filled with color it must either be washed and dried on tenter frames or else discarded. The endless blanket must be renewed frequently.

An object of the present invention is the provision of a multiple-color textile printing machine, and particularly an impression drum therefor, which renders unnecessary the use of the endless blanket and the back-grey sheet and thereby results in an important economy of operation.

A further object of the invention is the provision of an improved form of impression drum for multiple-color textile printing machines that permits the elimination of the endless blanket and the back-grey and also permits sharper impressions to be made by the much decreased space between the engraved printing rolls and the metal of the impression drum and the much better resilient facing on the impression drum, and the substantial elimination of the lateral drift of the fabric on the drum and by presenting more nearly line contact between the fabric and the printing rolls.

Another object of the invention is the provision of a multiple-color textile printing press having an impression drum provided with a facing on which the fabric to be printed can be directly supported, the facing being of such characteristics that it is bonded permanently to the metal surface of the drum, has high tensile strength, elasticity and durability, no deleterious tendency to creep and break away from the metal surface of the drum under the heavy printing pressure, has high resistance to deterioration under the action of the various printing media employed and practically no surface absorption and thus can be scraped clean of inks each revolution or between successive printing rolls, thereby permitting elimination of the blanket and the back-grey and the printing of sharp, clear-cut, multiple-color designs.

A yet further object of the invention is the provision of an impression roll for multiple-color textile printing machines, and a printing machine having an impression roll, provided with a facing of "neoprene."

With a multiple-color printing machine embodying my improved form of impression drum the engraved printing rolls need only be as long as the fabric is wide, and not longer as has been necessary heretofore, because the fabric is substantially without tendency toward lateral drift and hence a substantial saving in printing material is effected over prior constructions where the printing rolls had to be longer than the fabric is wide and hence the projecting end parts of the printing rolls would deposit ink wastefully upon the back-grey. Instead of making the printing rolls only as long as the fabric is wide the same result can be secured by providing my printing roll with the fabric engaging periphery of an axial length approximately co-

extensive with the width of the fabric. A printing machine having these advantages constitutes a further object of the invention.

A yet further object of the invention is generally to improve the construction and operation of textile printing machines and impression drums therefor.

Fig. 1 is a more or less diagrammatic end elevation of the printing machine embodying the present invention.

Fig. 2 is a sectional detail through the axis of the impression drum of Fig. 1 and an associated printing roll wherein the fabric engaging portion of the drum has an axial length approximately equal to the width of the fabric, the printing roll being longer.

The printing machine embodying the present invention includes a pair of end frames **10**, but one frame being illustrated in Fig. 1. An impression drum **12** is rotatably supported by and is disposed between the frames, the impression drum being large in diameter and composed of cast iron or equivalent material having a smooth cylindrical periphery. The drum may be hollow. The drum is provided with end journals **14** rotatably supported by anti-friction bearings **16** in a box **18** which is vertically slidable in guideways **20** under control of an adjusting screw **22**. A plurality of engraved printing rolls **24, 26, 28, 30** are distributed around the periphery of the drum and are driven at the same peripheral speed as the drum by suitable gearing, not shown, as is common in the art.

The journals **32** of the printing rolls are supported in anti-friction, as ball, bearings **36** and are removably retained in slides **38** which are movable in guideways **40** toward and away from the impression drum as is usual practice. The position of the slides and the pressure of the rolls on the fabric on the drum being determined by adjusting screws **42**.

The printing rolls are removable from the slides and can be removed therefrom and positioned in hooks **44** of the frame in the common manner. A color tray or font **46** is associated with each roll and is suitably carried by the frame and is adapted to contain a color or dye that is deposited upon the periphery of the associated roll by a furnisher brush or roll **48** engaged with the periphery of the engraved roll and rotated thereby. A doctor blade **50** of suitable construction is associated with each printing roll and bears upon the periphery thereof to wipe the color off the high parts of the surface of the roll.

The fabric A to be printed passes between spreader rolls **52, 54**, of usual construction, or the equivalent, and thence over a press roll **56** that is adjustable toward and away from the impression drum and by which press roll the fabric is pressed onto the periphery of the drum. The fabric is thus carried by the drum from one printing roll to the other and after contact with the final printing roll leaves the drum and passes to drying cans or other drying means not herein illustrated. Any suitable equivalent for the spreader rolls **52, 54** can be employed provided the means employed guides the fabric onto the periphery of the impression drum without material tendency for lateral displacement. The printing drum of the present invention is so arranged that there is no substantial tendency of lateral drift of the fabric while it is on the drum.

If, owing to the nature of the fabric being printed or other reasons, there is a harmful tendency of the fabric to drift out of absolute alignment so that the design does not register properly in places with the printing roll, or if the nature of the design is such as to require very extraordinary accuracy of registration, some device should be used to secure absolute registration and avoid harmful drift. There are many such devices well known for securing accurate registration of the fabric, some of them automatic, and some one of these devices should be used.

The cylindrical periphery of the impression drum is provided with a facing **58** of a material which I have discovered to be highly advantageous for multiple color textile printing and which permits the heretofore used blanket and back-grey to be eliminated. Said material is "neoprene" which is applied in plastic form in an uncured state to the periphery of the cylinder to form a layer thereon from ¾" to 1" thereabouts thick in the finished drum.

The applied material is then cured by heat to bond it to the drum and to form a facing having the desired properties. The surface of the facing layer is then machined or ground smooth and true.

A doctor blade **60** is associated with the surface of the impression drum and bears against the face thereof, the doctor preferably being a metal plate. The doctor removes the printing material that is deposited on the surface of the facing and cleans the facing. A cleaning pad **62** may also bear against the surface of the facing to remove color not removed by the doctor so that the drum is always clean at the time of passing under the press roll **56** and into contact with the fabric. Ordinarily, however, the cleaning pad is not necessary.

It is a characteristic of the neoprene facing that it can be thoroughly cleaned of the printing medium during the travel of the facing so that there is little or no color remaining on the surface that can damage the fabric. A rubber facing on the other hand cannot be wiped clean but usually will retain enough color to damage the fabric.

The idea of omitting the blanket and back-grey and making a special lapping for the impression cylinder against which the fabric to be printed is directly pressed as it passes between the printing rolls and the lap impression cylinder was suggested nearly one hundred years ago but the lapping suggested for the impression cylinder was a cloth lapping of which there were twenty or thirty rounds, which did not prove to be practical.

My solid layer of neoprene of absolute uniform density and high resistance to compression, high tensile strength and uniform great resiliency is the only wrapping of which I am aware which will take the impression of the printing rolls through the fabric to be printed and will enable the blanket and back-grey to be omitted.

Neoprene is a material made by E. I. Du Pont de Nemours & Co. Inc. It is an artificial, as contrasted with a natural, product having many rubber-like properties but characterized by a greater tensile strength, higher compression factor, a greater ultimate elongation and being less absorbent than rubber, will withstand most oils and acids without harmful loss of strength and elasticity better than rubber and is substantially unaffected by contact with the printing media. It is also characterized by being uninfluenced by the repeated pressures it receives

by the printing rolls or at least very slightly influenced.

I have found that, whereas, a facing of rubber will ultimately creep and become loose on the drum, a facing of neoprene does not creep but remains bonded to the drum. A facing of rubber is displaced locally under the pressure of the printing roll and becomes bulged in front of the nip between the drum and roll and thereby tends to shift the fabric circumferentially of the roll which tends to broaden and smudge the print lines and throw the impressions of the various rolls out of exact registration with each other.

A rubber facing not only due to its bulging under pressure but also due to its lesser resistance to compression produces a relatively large surface area of contact between the fabric and the printing roll which results in broadened and smudged print lines so that it is difficult to get sharp, clean-cut impressions. Neoprene, on the other hand, by reason of its lesser freedom of bulging and higher compressive factor produces more nearly a line contact between the fabric and the printing roll with the result that sharper impressions are produced and registration of the prints of the successive rolls is maintained.

A facing of rubber and especially a rubber facing sufficiently hard to resist displacement under printing pressure not only is so hard that it is liable to damage the copper or zinc faced impression rolls but also soon becomes permanently indented with the character of the surface of the printing rolls so that good impressions are not made when the printing rolls are replaced by others having a different surface pattern. I have discovered that neoprene on the other hand, is sufficiently resilient to avoid damage to the printing rolls and also is not readily liable to become permanently indented by virtue of its high compression factor and other characteristics. Thus a roll faced with neoprene has a long useful life without having to dress down its surface. By reason of the ability to clean the neoprene facing in a simple manner, and also because of its other durable properties the blanket and back-grey can be eliminated and the fabric to be printed applied directly to the neoprene facing.

One of the characteristics of the neoprene facing particularly effective for the present invention is that it has a higher friction than rubber so that the fabric on the face of the neoprene facing adheres firmly after having been pressed into engagement therewith by the press roll 56. As a consequence of the firm engagement between the fabric and the neoprene facing the fabric is held on the impression roll without harmful displacement of the fabric axially of the drum with the result that accurate registration of the successive imprints of the printing rolls is certain. The characteristics of the neoprene facing are such that the blanket and back grey are eliminated along with the tendency of lateral shift between these parts.

The lack of lateral shift of the fabric relative to the printing rolls also permits a considerable saving in printing material. Heretofore the printing rolls had to be made longer than the width of the fabric in order to insure the printing of the entire width of the fabric regardless of the lateral shift thereof. Printing material on an end portion of a printing roll that projected beyond the edge of the fabric heretofore was deposited uselessly upon the back-grey. With the present invention the printing roll need only have a length equal to or very slightly greater than the width of the fabric or the roll can be longer and the facing of the impression drum need only be as wide as the width of the fabric, as is illustrated in Fig. 2. With the arrangement and with a long roll, the printing material on the projecting end parts of the roll is not used so that a considerable economy of printing material results.

Neoprene is a polymer of chloroprene. As used in the present facing it is a compound or mixture of neoprene with other materials which develop desirable properties, somewhat in the manner of the natural rubber art.

The neoprene facing of the present invention is a compound consisting preferably of:

	Parts
Neoprene	100
Soft whiting	85
Carbon black	28.5
Glue	11.5
Zinc oxide	10
Light calcined magnesia	10
Cottonseed oil	2
Wood rosin	5
Sulphur	1.5
Phenyl-beta-naphthylamine	2

As stated heretofore, the above plastic mixture is spread onto the metal face of the impression drum and is then cured by heat or vulcanized, a suitable cure being a temperature of 287° F. for forty-five minutes.

The ingredients, and the proportions thereof, of the mixture can be changed in a suitable manner to develop and accentuate selected characteristics, and while the above composition represents a suitable one, it is not the only composition that can be employed.

Whiting serves mainly as a filler and to some extent is a stiffener. Other fillers such as barytes, asbestine, fossil flour, etc., can be used, although whiting has the less adverse effect on the physical properties of the resultant compound.

Carbon black is also a filler but it also improves the tensile strength and oil resistance and stiffness of the resultant compound. There are various types of carbon black which modify the character of the resultant compound somewhat.

Glue acts as a binder and increases the resistance of the compound to certain aromatic hydrocarbons and chlorine bearing solvents and reduces the oil absorption of the compound. The use of glue is desirable but glue can be omitted at times when the compound contains other substitute materials. For instance, a form of carbon black known as "gastex" to a substantial degree imparts to the resulting compound the same properties as glue.

The zinc oxide, sulphur and carbon black are vulcanizing accelerating agents for the compound. The sulphur, however, is not essential for neoprene as it is with rubber. Sulphur, however, lowers the cool flow and permanent set of the resultant compound. The zinc oxide improves the density of the compound but other metallic oxides, for instance, litharge can be employed. The wood rosin renders the resultant compound less absorbent but other analogous materials such as pine tar, abietic acid may be substituted.

The calcined magnesia improves the density of the resultant compound and, in addition, in combination with zinc oxide increases the modulus and tensile strength of the vulcanized product.

The cottonseed oil is mainly a plasticizer and may be replaced by other oils as linseed, tung.

The phenyl-beta-naphthylamine imparts oil resistivity to the resultant compound and is also an anti-oxidant improving the resistance of the material to deterioration by light and air. Other antioxidants such as phenyl-alpha-naphthylamine and those known in the rubber art may be employed, although not so advantageously.

The formula given, however, represents one producing a compound very suitable for the purpose.

In the claims the word "neoprene" is intended to refer to a vulcanized compound containing not only neoprene but other ingredients by which the desirable characteristics of neoprene for the purpose of this invention are developed.

If desired the printing rolls may be engraved wider than the fabric to be printed and the neoprene faced impression cylinder may be as wide as the engraving on the printing rolls. Also my neoprene faced impression cylinder may be used with a blanket and back-grey and printing rolls and will be much better than the impression cylinders of the prior art.

I claim:

1. A multiple-color textile printing machine including the combination of an impression drum having a neoprene facing, a plurality of printing rolls cooperating with said drum, and means for applying a textile fabric directly to the face of the neoprene facing of said drum.

2. An impression drum for a textile printing machine, said drum having a neoprene facing.

3. A multiple-color textile printing machine including an impression drum having a neoprene facing, the drum projecting endwise beyond the ends of the neoprene facing, a plurality of printing rolls cooperating with said drum, and means for applying a fabric directly onto the face of the neoprene facing of said drum, said neoprene facing being approximately co-extensive in width to the width of the fabric and said rolls being materially longer than the width of the fabric, the faces of said drum confronting the end parts of said rolls being of smaller diameter than the diameter of said neoprene facing.

4. A multiple-color textile printing machine including an impression drum having a neoprene facing, a plurality of printing rolls cooperating with said drum, means for applying a fabric to be printed directly onto the neoprene facing of said drum, and mean in constant engagement with said facing for cleaning said face between the last and the first printing rolls to constantly present a clean facing under said first printing roll.

5. A multiple-color textile printing machine including an impression drum having a neoprene facing, a plurality of printing rolls cooperating with said drum, means for applying a fabric to be printed directly onto the neoprene facing of said drum, and means for cleaning said face between successive rolls and prior to the passage of said face under one roll from a preceding roll.

6. A multiple-color textile printing machine including an impression drum having a neoprene facing, a plurality of printing rolls cooperating with said drum, means for applying a fabric to be printed directly onto the neoprene facing of said drum, and means for cleaning said face between the last and the first printing rolls, and said means including a doctor bearing constantly on the moving face of said facing.

7. A multiple-color textile printing machine including the combination of an impression drum having a facing, a plurality of printing rolls cooperating with said drum, means for guiding a textile fabric toward said drum and holding the fabric against deleterious lateral movement, and means for applying the fabric directly onto the face of said drum facing, said facing being comprised of a thick layer of neoprene compound vulcanized to said drum and having an impervious face, and means for wiping said face clean of color between printing rolls and prior to the passage of said face under one roll from a preceding roll.

8. A printing couple for printing on porous webs, such as textile fabric, subject to penetration of the ink through the fabric, said couple comprising a printing roll, a coacting impression roll having a facing of a polymer of chloroprene which is impervious to the ink, chemically inert with respect thereto, resilient and of sufficient mechanical strength not to creep during the printing operation and to regain its original form after relief from printing pressure; and mechanical means for removing ink from said impression roll.

9. A printing couple for printing on porous webs, such as textile fabric, subject to penetration of the ink through the fabric, said couple comprising a printing roll, a coacting impression roll having a facing of a polymer of chloroprene which is impervious to the ink, chemically inert with respect thereto, resilient and of sufficient mechanical strength not to creep during the printing operation and to regain its original form after relief from printing pressure; and a doctor coacting with said impression roll and serving to remove ink substantially completely therefrom.

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