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Thermal Energy Conservation In Rotary Printing And Property Development

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Abstract—*Textile printing may be a term used for applying colors to material in numerous styles and patterns. In textile printing the complete material is uniformly colored and therefore the patterns area unit well outlined. The textile material printing forms a district of the textile finishing method. In material printing, the styles area unit applied to the material by 3 methodologies- roller method, flat screen and rotary screen methodology. Rotary printing is wherever pictures that area unit to be written area unit actuates round the cylinder. Any quite substance will be written employing a rotary printer like paper, cloth, etc. The rotary printer consists of a hollow screen through that the print paste is forced into the material. The rotary printing is most typically used recently for attire materials. The material is generally written within the rotary as there's no stress like stretching and pull of the material shouldn't happen. The present rotary printing devices area unit designed to print woven material and conjointly material. These machines will print the material solely on one facet. Hollow material has 2 layers once two-dimensional. We've got to print the material one facet, dry and once more we've got to batch and print on another facet. However the current machine will print the material on either side at the same time. The rotary printing device consists of compressing blades to squeeze out the printing paste and 2 rotary screen circumferences meeting tangentially and rotating in opposite directions. the sides of the compressing blades and therefore the tangential contact line of 2 screens meet in a very single line. the material is fed from high to bottom at an equivalent speed as that of the peripheral speed of rotary screen. {the 2|the 2} screens area unit connected with two finish ring that area unit connected to gears that successively is connected to one shaft. the material passes between 2 screens and therefore the 2 compressing blades squeeze the printing paste and therefore the color penetrates through the screen and offers the specified style. To dry the printing paste on 2 sides' single submit to drier can enough. to finish the printing on either side of the hollow material single pass can do. However in typical machine the material should be dried doubly to urge the print on either side. Rather than heating material doubly it's enough to heat material just once to finish print on either side. The thermal energy needed to heat the material only once is saved by this machine.*

Keywords—Double facet, tubular, tangential, knitted, squeezing, circumferences, drying.

1. INTRODUCTION

Textile printing is that the method of applying color to material in definite patterns or styles. In properly written materials the color is secured with the fiber, therefore on resist laundry and friction. Textile printing is expounded to coloring however, whereas in coloring correct the complete material is uniformly coated with one color, in printing one or a lot of colors area unit applied thereto insure components solely, and in sharply outlined patterns.

Energy conservation is obtained by varied authors. [1]The author obtained energy conservation by recovery of warmth. In textile drying method rather than victimization heat energy of condensation of steam they used superheated steam at high speed to sty the material. When drying the water from material conjointly as super-heated steam. An equivalent steam once more heated and re-circulated to dry the material. Seventy fifth of warmth will be recovered. [2] In Asian country most of the energy demand is met by oil. The value of oil is unsteady and therefore the provide is additionally uncertainty. Therefore Government of Asian country passed energy conservation act 2001 this created provision for putting in place of Bureau of Energy.

Efficiency a body incorporated underneath the act for supervision and observation the efforts on energy conservation. [3]To conserve energy some a part of energy used is also recovered. In textile business setter's area unit won't to dry the wet material. Air beginning from the setters is employed to heat the incoming water to vessel. Therefore the potency of the system will increase.

In printing, picket blocks, stencils, inscribed plates, rollers, or silk-screens will be wont to place colors on the material. Colorants utilized in printing contain dyes thickened to stop the color from spreading by capillary attraction on the far side the boundaries of the pattern or style.

Traditional textile printing techniques is also generally classified into four styles:

•Direct printing, within which Colorants containing dyes, thickeners, and therefore the mordents or substances necessary for fixing the color on the material area unit written within the desired pattern.

•The printing of a mordant within the desired pattern before coloring cloth; the color adheres solely wherever the mordant was written.

•Resist coloring, in that a wax or alternative substance is written onto material which is afterward colored. The waxed areas don't settle for the dye, going uncolored patterns against a colored ground.

•Discharge printing, within which a bleach is written onto antecedently colored materials to get rid of some or the complete color.

Printing was at the start by screen printing. Next development is flat bed screen printing. Next development is roller printing. Then the event is Rotary printing. In Rotary printing a designed rotary screen is rotating. During this field the energy conservation is within the space of rotary printing. Endless blanket is taking possession horizontal plane on top of that the material is fed. The

material moves horizontally on the blanket. An equivalent is employed to print the material. Woven material printing on one facet is enough. However knitted material is entirely completely different from woven fabric. The material is in hollow type and FIG. 1. Shows the standard rotary printer already in use. Principle of this machine is explained here. Ordinarily the hollow material is two-dimensional.

To finish the printing, each layers and either side should be written. To print on both facets initial one side is written and dried. Once more the material is batched and written on alternative facet. Initial facets are dried continually only once over that of the second facet, otherwise 2 materials will be slit opened and print at single time. However this slit open faces a tangle, once the material is slit open the sting can curl and type a roll. To avoid curling the sting should be adhesive to two cm per facet therefore the material on either side should be used additional no matter the diameter of material two.5 cm per facet is wasted.

If we have a tendency to print as hollow type, when one facet is written the material shrinks because it is that the property of the material. The shrinkage is proportional to the coverage of the print. once it's batched and alternative facet is written the sting area unit having white on one facet and overlap on another facet because the material shrinks the shades on another facet failed to match therewith of initial facet, therefore whereas protrusive a garment either facet should be separated and wont to end the garment. The printing principle of the present rotary printer is shown in figure 1

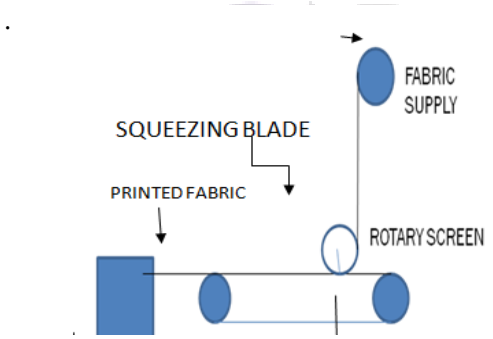


Figure 1: Principle of existing rotary printing with compressing blade

Which is to be written is batched in a very roll type and is fed to the conveyor by material provide rolls. material is gulped up the side of the conveyor and therefore the conveyor moves .Designed screen with finish rings that is connected to the ability is rotating on the surface of the highest facet of the material that is moving on. Printing paste is provided through a pump. Compressing blade is employed to squeeze the paste. style within the screen transferred to the material. Material when the printing is fed in to the drier. The property of the material is it'll shrink when printing and drying proportional to the printing.

2. Principle Of Freshly Designed Rotary Printing With Compressing Blade

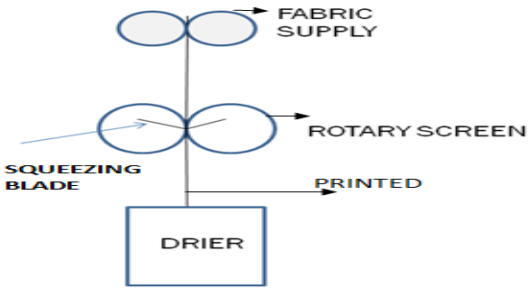


FIGURE 2: Principle of freshly designed rotary printing with compressing blade

The fabric movement is from high to bottom vertically. In roller printing the material movement is from bottom to high. All told alternative printing ways material moves horizontally. The compressing result is finished by the 2 blades. The trial has been taken and was excellent. The printing was verified for penetration sharpness and shade variation. All everything except shade variation with typical machine. The shade variation was decreased and nearly zero. Following area unit the benefits and savings of warmth energy.

3. Objective

The main objective of the current invention is to develop each facet synchronous printing mechanism for hollow material. The second objective of the current invention is that it conserves thermal energy.

4. Working Principle

Rotary screen may be a wire mesh cylinder wherever the look for the material (1) will be created. The dye is poured within the screen and is transferred to the material. The 2 rotary screens (2) area unit placed parallel to every alternative. The circumference of 2 screens is engaged and therefore the feed rollers (3) feed the material. There are units compressing blades (4) that area unit wont to squeeze the printing paste. The compressing pressure is redoubled by rotating the compressing blades which can type a skinny strip, rather than a line in contacting points of screens and blades. Two finishes of screens area unit fitted with end rings (5) that area unit connected with 2 gears (6) of pitch circle diameter of 204 metric linear units. The gears area unit connected to one shaft (7). Material is passed between 2 screens from high to bottom vertically downward through the compressing blades placed opposite to every alternative and within the rotary screen. Compressing takes place and therefore the style is written on either side of the material.

This principle also can be used for multiple color print, for this a cloth carrier should be introduced in conjunction with the material to stop the material from shrinking when the print.

5. Brief Description Of The Drawings

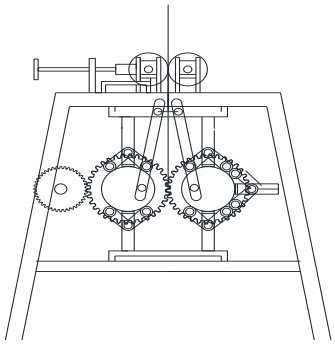


Fig 3: shows the front read of the material rotary printer

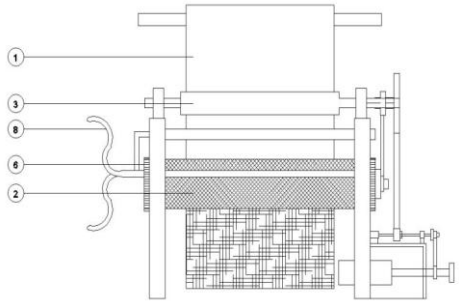


Fig 4: shows the view of the material rotary printer

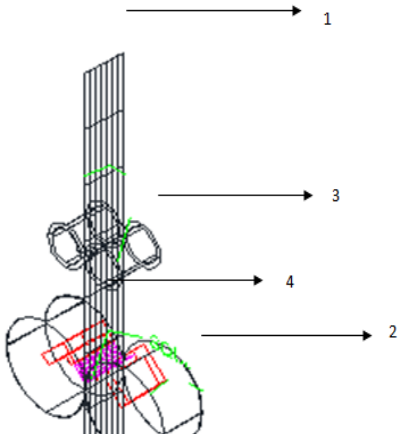


Fig 5: shows the 3D read of the material rotary printing principle

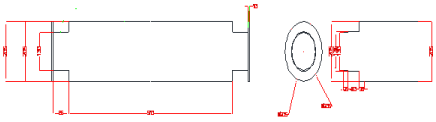


Fig 6: half-dozen shows the horizontal read of the rotary screen

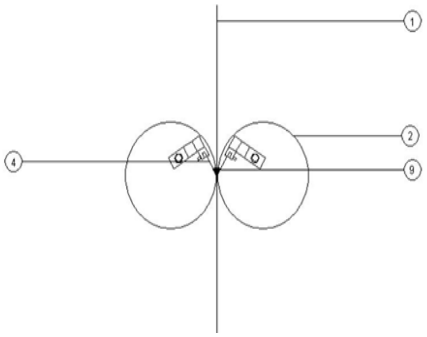


Fig 7: shows the total sectional read of rotary printer

6. MACHINE DETAIL

Over all dimension of the machine is Length = 1505 metric linear unit breadth = 990 metric linear unit and height = 1493 metric linear unit. Rotary screen diameter is 204 metric linear unit printable breadth = 800 metric linear unit. Rotary screen is wire mesh cylinder. The look will be created during this screen and therefore the dye will be poured within the screen and might be transferred to material. 2 screens placed parallel to every alternative and therefore the circumference area unit touching one another. The circumference of 2 screens is meshing to rotate in other way. 2 finishes of screens area unit fitted with end rings. Each screen is connected with 2 gears of pitch circle diameter of 204 metric linear units. Range of teeth area unit sixty eight. Module of gears is three. Gears area unit connected as shown in fig. Drive mechanism

Motor two horsepower at 2880 rev. Motor pulley-block 5cmintermediate shaft motor pulley-block is connected to a100mm v pulley-block of a hundred and ten metric linear units and one hundred fifty metric linear unit diameter V pulley-block is connected to driving shaft. Driving shaft has on e v pulley-block and 2 gears that area unit connected to 2 ends of screen Gears of three module and forty four teeth. Speed of feed roller and peripheral speed of screen should be synchronized.

Speed of motor = 2880 rev.Speed of intermediate shaft = Nr X D2/D1 =2880X50/75=1920.

Rpm Speed of provide roller Ns =NiXD4/D3=1920X75/450 = 320rpm.

Speed of driving shaft = Nd = NsXD6/D5 =320X110/150= 234.66 rpm

Man Hours needed

- Na = 2(N1+N2)
- N1 = range of man hours needed for operational the machine
- N2 range of man hours needed to batch the material
- For planned machine
- Nb = Man hours needed for planned machine

After Modifying the Machine

Man Hours needed

- Nb = N1+N2
- N1 = range of man hours needed for operational the machine
- Speed of screen Nr= NdXTr/Td =234.66X44/68=151.83 rpm
- Peripheral speed of rotary screen πDrNr/60=πX204X151.83 = 1622 mm/s
- Velocity of feed roller = πDfXNs=πX95X320/60=1592 mm/s
- Difference in speed = 1622- 1592 = thirty mm/s to keep up the stress within the material

7. Energy Saving Calculation

Thermal energy is employed to heat the material and evaporate the Paste wont to print. Knitted material may be a circular fabric. To print either side twofold the material should pass the printer. Energy = Energy needed to heat the material doubly +energy needed to evaporate the printing paste.

Thermal energy needed (Qa)

Q1 = MfCpf(T2-T1) ---- (1)

Q2 = Mp(Cpp(Ts-T1)+L) -------- (2)

Qa = 2XQ1 +Q2 --- (3)

When modifying the machine thermal energy needed (Qb)

Q1 = MfCpf(T2-T1) ----------(4)

Q2 = Mp(Cpp(Ts-T1)+L) ----------(5)

Qb = Q1 +Q2 ---------- (6)

Thermal energy saving

Qa = two X Q1 +Q2 (Existing process) ----(7)

Qb = Q1 + Q2 (New process) --------(8)

Qa - Qb = Q1 = MfCpf(T2-T1) ----------(9)

Man hours saving

- N2 range of man hours needed to batch the fabric

Man Hours Saving

- Na – Nb = 2(N1+N2) – (N1+N2) =N1+N2

Case Study- hollow Printing

- Fabric = one hundred forty GSM
- Colour – white
- Print – Flower
- No. of colors – three
- Coverage -90%
- Quantity – 1750 Kgs

Time Taken

- Fabric checking time = half-dozen Hours (300 Kg/Hr)
- Stitching time = five Hours (350 Kg/Hr)
- Printing time = thirteen hours (158 Kg/Hr)
- Curing time = five.5 hours (300 Kg/Hr)
- Batching time = 2X3 = half-dozen Hours

Expected Saving Time

- Printing time = thirteen hours
- Both sides area unit written at the same time for printing = 13/2 = half-dozen.5 hours
- Batching time = 2X3 = half-dozen Hours
- Batching time saving = three hours
- Printing machine with twenty five bhp power and four persons as operators

Saving

- Printing
- Power saving = half-dozen.5X25 = 162.5 Kwh
- Man-hour saving = 4X6.5 = twenty six man- hours
- Batching three kW motor and one person
- Power Saving = 3X3 = nine kwh

Man-hour saving = threeX1 = 3 man hours

Total Saving

Man hour saving = 26+3 = twenty nine man hours

MACHINE HOURS needed

- M = 2XM1 (for double facet print
- M1 = Machine hours for single facet print

When MODIFYING THE MACHINE

MACHINE HOURS needed

- Mb = M1
- M1 = Machine period of time for single print

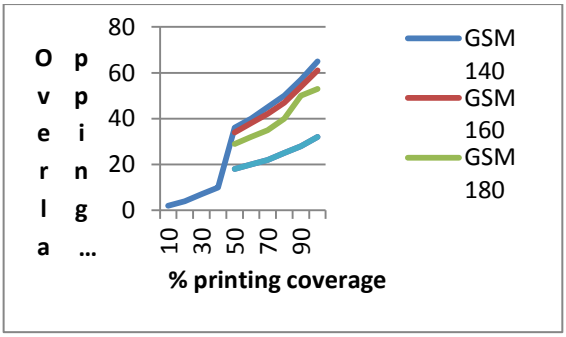
MACHINE HOUR SAVING

- Ma = 2M1
- Mb = M1
- Ma-Mb=2M1-M1 = M1Hours

Of input have some energy conservation. Nowadays we have a tendency to live within the Technological world. Nowadays the tendency of soul is to urge a lot of for fewer works. Everybody needs to figure underneath really sensible surroundings and particularly underneath the fan.

No one needs to figure underneath dangerous condition. nowadays physical work isn't welcome by the human. Technology solely will minimize the person power needed and might minimize the physical work of soul. We are able to see however technology developed and therefore the advantage of the event. 3 decades past an automobile will go up to a distance of 15-16 metric linear units per metric capacity unit. Because the technology improves the automobile runs twenty to twenty five metric linear units per metric capacity unit.

Two wheelers once endure forty metric linear units per metric capacity unit of gasoline, however nowadays we are able to see a 2 wheeler running up to a distance of 70-80 metric linear units per metric capacity unit. Printing was at the start by screen printing. Next development is flat bed screen printing. Next development is roller printing. Then the event is Rotary printing. In Rotary printing a designed rotary screen is rotating. During this field the energy conservation is within the space of rotary printing. Endless blanket is taking possession horizontal plane on top of that the material is fed. The material moves horizontally on the blanket. An equivalent is employed to print the material. Woven material printing on one facet is enough. However knitted material is entirely completely different from woven fabric. The material is in hollow type and conjointly it stretches once loaded. Whereas printing the material each layer should be written. Two layers area unit fashioned whereas a hollow material is two-dimensional. To finish the printing, each layers and either side should be written. To print on both facets initial one side is written and dried. Once more the material is batched and written on alternative facet. Initial facets are dried continually only once over that of the second facet, otherwise 2 materials will be slit opened and print at single time. However this slit open faces a tangle, once the material is slit open the sting can curl and type a roll. To avoid curling the sting should be adhesive to two cm per facet therefore the material on either side should be used additional no matter the diameter of material two.5 cm per facet is wasted. If we have a tendency to print as stuff type, when one facet is written the material shrinks because it is that the property of the material. The shrinkage is proportional to the coverage of the print. Once it's batched and alternative facet is written the sting area unit having white on one facet and overlap on another facet because the material shrinks. The shades on another facet failed to match therewith of initial facet, therefore whereas protrusive a garment either facet should be separated and wont to end the garment. The printing principle of the rotary machine is shown in figure 1.



8. CONCLUSION

Generally the machine which is used to print woven fabric is used to print knitted fabric. But the property of the knitted material is different from woven material. Tubular knitted fabric is having two layers when flattened. Fabric is elastic in nature. Normal machine can print one side and has to dry the paste second side again and have to heat the fabric to dry to finish the printing of tubular knitted fabric it has to be printed side by side. But in this present machine both facets can be printed by passing the fabric once. In olden machine pas the fabric by printing one side and again have to dry the fabric and paste and again have to dry and print the second side. But in this method printing on both facets can be printed at the same time. So the fabric can be heated only once to complete the printing. So the thermal energy required to heat the fabric once is preserved and is equal to Cpf(T2-T1) per Kg of fabric printed.

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