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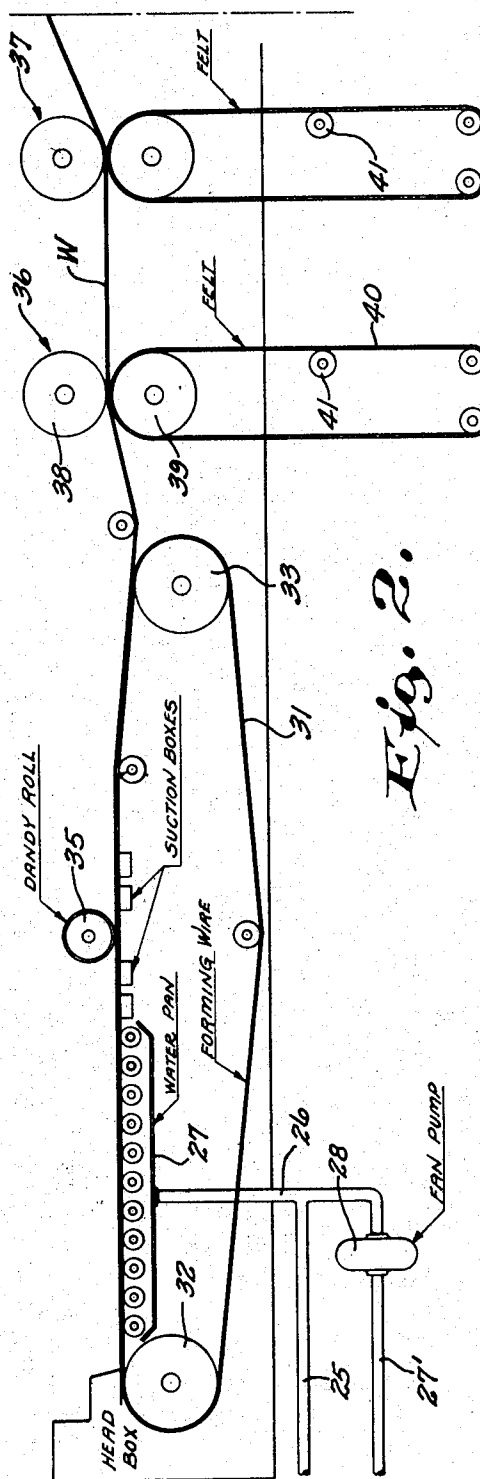
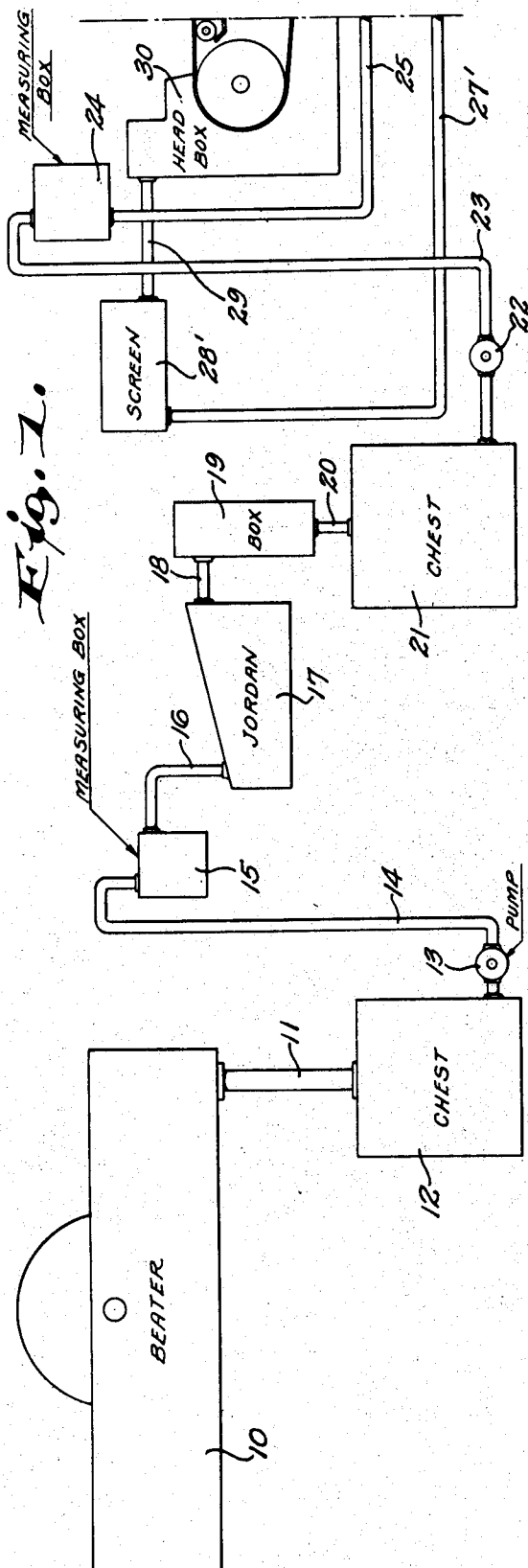
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2,214,641

PROCESS OF PRODUCING ROTOGRAVURE PAPER AND THE LIKE

Filed July 17, 1937

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 3.

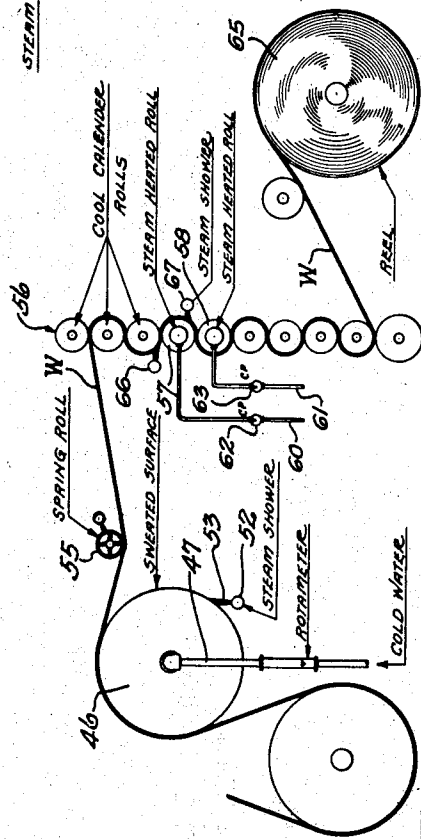
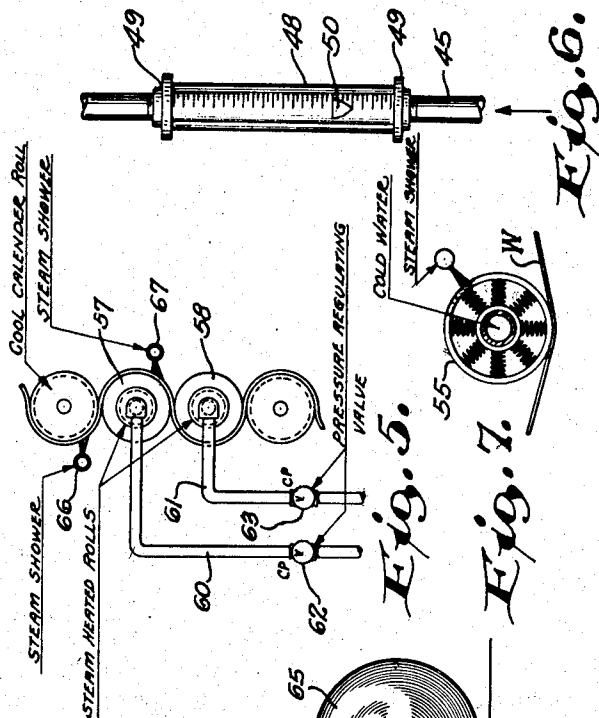
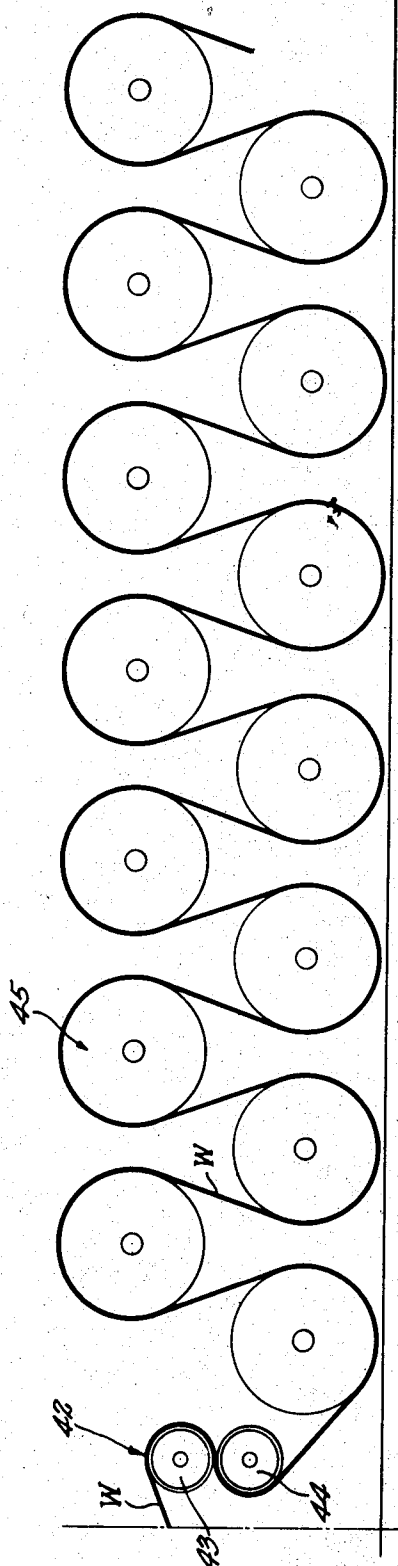


Fig. 4

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UNITED STATES PATENT OFFICE

2,214,641

PROCESS OF PRODUCING ROTOGRAVURE
PAPER AND THE LIKE

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Application July 17, 1937, Serial No. 154,140

5 Claims. (Cl. 92—40)

This invention relates to the production of paper adapted for rotogravure printing or for uses having similar requirements.

In making paper for rotogravure printing it is necessary to give the printer a sheet of paper with as perfect a plane surface as possible. If the paper maker could produce a perfect plane this would be the ideal for the printer of rotogravure paper. This would permit perfect contact with intaglio cylinder and reproduces all details of image engraved thereon. The values would be in direct ratio to the papers approach to the true plane. The principal value of rotogravure is its close resemblance, through optical illusion, to a continuous tone picture, a large portion of which value is secured through the surface resistance of the paper by giving the ink an opportunity to spread before drying instead of setting by absorption.

Therefore the industry requires a sheet with a smooth plane surface, having a "skin" or surface hardening to give the desired reproduction and yet of such character as to retain its printing opacity and color without blackening and the strength to withstand high speed press operation.

In the past, the paper mills have attempted to produce these qualities in paper for rotogravure by various methods of machine operation. Some mills calendered the sheet very high but the deep pits from wire, felt, etc., could be seen in the sheet and were not ironed out. Other mills tried to improve the surface by a minimum of felting and using smoothing rolls and breaker rolls to try to get a plane surface. This paper used by the printer was still unsatisfactory because while the sheet appeared improved as to its surface it did not print smoothly; did not reproduce the full tonal values; required more ink; and caused show through. Still others tried to develop this plane surface and skin effect by running a sheet of paper through a size tub and with a high moisture content into the machine calender stacks. This developed the trouble of blackened and crushed paper, off-color paper, streakiness, loss of opacity and very unsatisfactory running conditions.

One of the principal objects of the present invention is to provide an apparatus for and method of producing paper which will fulfill all of the requirements of rotogravure printing and of accomplishing this as a continuous operation on a paper making machine with a minimum modification of the machine and with the addition of comparatively few and entirely practical supplementary or modifying instrumentalities.

The present invention produces a smooth sheet of paper which has hardened skin surfaces, the surfaces presenting a glazed or glossy effect similar to Cellophane but the sheet still retains its capability of taking ink, the property of absorbing the ink while permitting spread or color development and has opacity, color, strength and minimum show through. Furthermore, the blackening effect so evident in a sheet that contains a high moisture content and has been highly calendered is avoided.

In carrying out the present invention in a paper making machine it is necessary of course, to incorporate in the stock or pulp at some point in the manufacture of the sheet, special materials which will respond to the treatment to give the surfaces and body of the sheet the desirable properties mentioned. We employ the materials usually employed in making printing paper, and starch, soaps, glucose, and resins or mixtures of these materials. These special materials may be incorporated in the stock or pulp in the beater, they may be added at the fan pump, may be applied to the web as it is being formed on the wire by means of the dandy roll, may be applied to the sheet at the smoothing rolls, or may be incorporated therein at some point in the battery of driers as with regular size tub or breaker rolls and in water box on calender rolls.

Whatever may be the particular place or point of incorporation the present invention does propose to form a web of paper on the forming wire of a paper making machine in the usual manner, then pass the sheet between the presses, then run it through one or more pairs of smoothing rolls, then through an extended battery of driers with or without breaker rolls incorporated therein until it is dried to 95% bone dry at the last drying drum.

At this point the wire side of the sheet is surface moistened and this is best accomplished by sweating the exterior surface of the last drier drum.

Sweating the exterior surface of the last drier drum may be conveniently effected by running a controlled amount of cold water into the interior of the drum and subjecting the exterior thereof to a steam spray or shower.

As the sheet of paper leaves the last drier its top side is surface moistened and this may be conveniently accomplished by running the top side of the sheet under the usual spring roll and sweating the exterior surface of this spring roll in the same manner as on the last drier.

After running under the spring roll the sheet of

paper is calendered, that is, it is passed between the calender rolls which make up a tier or stack. To accomplish the purposes of the present invention the sheet must be calendered in a special manner, as follows: The sheet is calendered by passing it through two nips of unheated top calender rolls. Next it is hot calendered or hot ironed by passing it through two nips of steam heated calender rolls, the temperature of which is properly controlled. Before the wire side of the sheet is passed between the first nip of the steam heated calender rolls it is subjected to the action of a steam spray. Before the sheet passes between the second of the two nips of heated calender rolls its top side is similarly steam sprayed. Thereafter the sheet is run between a series of unheated calender rolls and is then reeled.

From the foregoing it will be understood that the invention in its broader aspects consists in forming a sheet or web having incorporated therein at some convenient point suitable surfacing material, drying the sheet, surface moistening the sheet and then ironing or calendering the sheet with both unheated and heated rolls, the action of the hot rolls being supplemented by steam sprays.

It has been found that with this treatment the sheet is dampened just sufficiently to respond to the calendering or ironing to take the hard skin or glazed effect while leaving the body of the sheet so constituted and characterized as to retain in the sheet opacity, color, correct ink reactive properties, and the other characteristics which adapt it for rotogravure printing or for similar usage.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a fragmentary diagrammatic view illustrating the instrumentalities ordinarily employed for conditioning and delivering the stock to the forming wire of a paper making machine;

Figure 2 is a similar view showing part of the paper making machine comprising the head box, forming wire, and one or more presses;

Figure 3 is a similar diagrammatic view showing how the sheet is carried through the smoothing rolls and an extended battery of steam driers;

Figure 4 is a fragmentary diagrammatic view showing the last two driers, the calender stack and reel, and illustrating diagrammatically how the last drier is sweated and the provisions made for steam treating the sheet and hot calendering it in the calender stack;

Figure 5 is a fragmentary view in end elevation and on a somewhat enlarged scale showing the steam heated and adjacent rolls of the calender stack and associated instrumentalities;

Figure 6 is a fragmentary view in elevation showing the rotameter employed to indicate the amount of water supplied to the last drier and facilitate regulation thereof; and

Figure 7 is a fragmentary view partly in end elevation and partly in section illustrating the spring roll.

Referring to the drawings and more particularly to Figure 1, the numeral 10 designates the beater from which the stock is discharged

through pipe line 11 into chest 12 and then delivered from pump 13 through pipe line 14 to a measuring box 15 from whence it is conveyed through pipe 16 to a Jordan 17 and then through pipe 18 to box 19 and thence through pipe 20 to chest 21. From the chest 21 the stock is delivered by pump 22 to pipe line 23 to a measuring box 24. The outlet pipe 25 from this measuring box is connected, as will be seen from Figures 1 and 2, to a pipe 26 which receives the liquid from a collecting or water pan 27 underlying the forming wire. This pipe 26 connects to the intake of a fan pump 28 which delivers the stock through a pipe line 27' (see Figures 1 and 2) to the screen 28' from whence it is conveyed through the pipe line 29 to the head box 30.

The head box 30 delivers the stock to the forming wire 31 adjacent the breast roll 32 around which and the couch rolls 37 the other guide and stretch rolls, the forming wire runs in the usual manner. A dandy roll 35 is co-operatively related to the forming wire.

These several conventional instrumentalities of a paper making machine have been diagrammatically illustrated and briefly referred to inasmuch as the present invention contemplates incorporating the special material in the stock at a number of points. For example, it may be added to the stock at the beater 10, supplied thereto at the fan pump 28, or applied to the web by the dandy roll 35 on the forming wire. It may be also added later on in the handling of the sheet in the machine, as before indicated.

The sheet or web W formed on the forming wire 31 is carried through the first and second presses designated generally at 36 and 37.

Each of these presses has an upper roll 38 and a cooperable roll 39. A felt 40 co-acts with each roll 39 and contacts the wire side of the sheet as it passes through the nip of the press rolls. Suitable guide rolls 41 are provided for each felt.

Leaving the second press the web is carried through at least one pair of smoothing rolls designated generally at 42 (see Figure 3).

Each pair of smoothing rolls comprises an upper roll 43 and a lower roll 44. One of these rolls, for example the upper roll, has a hard metallic surface, usually chromium plated, while the other has its surface at least, constituted of rubber or other resilient material.

The web is carried from the smoothing rolls through an extended battery of driers designated generally at 45, these driers consisting of a series of steam heated drying drums and the usual auxiliary apparatus. The sheet is dried to 95% bone dry as it approaches the last drier.

The present invention proposes to surface moisten the wire side of the sheet or web at the last drier drum which is designated at 46 (see Figure 4). In accomplishing this the exterior surface of the drum is sweated or caused to collect moisture or condensate on its exterior. The sweating of the drum may be conveniently effected by controlling its temperature and subjecting its exterior to a steam shower or spray. The best method we have found for controlling the moisture is to supply a controlled amount of cold water sprayed at known temperature in the interior of the drum. For this purpose a water supply pipe 47 is extended through one of the trunnions to connect with the spray inside of the drum 46. The other trunnion is utilized to remove an excess amount of water in the usual way. The cold water contacting the inner wall of the drum 46 maintains the temperature of the

drum between 70° and 80° Fahrenheit. To facilitate the maintenance of this drum temperature a rotameter is incorporated in the supply pipe 47 and as shown in Figure 6, may comprise simply a graduated transparent or glass tube 48 suitably connected by fittings or couplings 49 to sections of the water supply pipe 45. A tapered plug 50 floats in the transparent tube 48. By means of the rotameter the operator determines the position of the plug which is effective to maintain the proper drum temperature. A steam shower pipe 52 supplied with exhaust steam at one pound pressure parallels the descending side of the drier drum 46 and has a row of perforations forming steam jets 53, the jets impinging on the surface of the drum and as this surface is cold, the steam is condensed and the drum is properly sweated.

As the sheet leaves the last drier drum 46 it passes under a spring roll 55. The spring roll 55 is also chilled by cold water supplied and exhausted through its hollow trunnions in order to sweat its surface and is equipped with a steam shower as in the case of the drier drum. In this way the top of the sheet is adequately surface moistened at this point.

Leaving the spring roll the sheet passes to the calender stack 56. This stack is made up of a vertical tier or stack of calender rolls of conventional construction except that two of the rolls designated at 57 and 58 are steam heated. The other rolls are not heated in accordance with the usual practice. From Figure 4 it will be seen that the sheet in passing to the calender is first passed through two nips of two unheated calender rolls. It is next passed through the two nips of heated rolls and afterwards through the nips of unheated rolls. For the purpose of heating the rolls 57 and 58 steam supply pipes 60 and 61 are led to the hollow trunnions thereof. In these pipes pressure regulating valves 62 and 63 are incorporated to control the steam pressure at eight pounds.

From the calender the web or sheet of paper passes to the reel 65.

Prior to the passage of the web around the first steam heated calender roll 57 its wire side is subjected to the action of a steam spray 66. Likewise the top side of the sheet is subjected to the action of a steam spray 67 as it passes between the nip of the calender rolls 57 and 58.

To obtain best results with a paper making machine of the character shown, the steam supply to the hot calender rolls is under eight pounds pressure at a temperature of 250° Fahrenheit. Suitable regulators are provided for this purpose.

The temperature of the last drier drum 46 and also of the spring roll 55 is maintained between 70° and 80° Fahrenheit by suitably controlling the supply of cold water thereto, as for example in the manner described in connection with the drier drum 46.

The paper sheet produced by the present invention has strength, color, opacity and both surfaces thereof are hard skinned, glazed, smooth and substantially planar. The sheet is admirably adapted for rotogravure printing. It has the strength to withstand high speed press operation. It will take ink in such manner that the ink adheres thereto with slow and slight absorption thereby permitting spread or color development resulting in a close resemblance to a continuous tone picture and this with minimum show through. Blackening or streaking is avoided.

An exemplary formula which may be employed with good results is as follows:

	Parts by weight
Starch	10
Clay	100
Stearin	5
Glucose	1
Total	116

34.8 pounds of this surfacing material is used per one hundred pounds of paper making materials.

While we have shown and described one apparatus in which the invention may be embodied and one way in which the method may be practiced it is to be understood that the particulars of description and illustration are exemplary rather than restrictive and that various changes and variations may be resorted to without departure from the spirit of the invention or the scope of the subjoined claims.

The invention claimed is:

1. The herein described process of producing rotogravure printing paper on a paper-making machine having a series of drier drums, a calender stack with unheated top rolls, heated intermediate rolls and unheated bottom rolls, and a spring roll between the drier rolls and the calender stack which comprises forming a sheet, incorporating a composition including a loading material and a starchy material in the sheet prior to its travel over the last drier drum, surface moistening the wire side of the sheet at the last drier drum, surface moistening the top side of the sheet at the spring roll, calendering both sides of the sheet between the unheated top rolls of the calender stack, steam spraying and hot calendering both sides of the sheet in the next heated rolls of the calender stack, and then calendering both sides of the sheet through the remaining unheated rolls of the calender stack.

2. The herein described process of producing rotogravure printing paper on a paper-making machine comprising driers, and a calender having heated and unheated rolls which consist in forming a sheet, incorporating a composition including a loading material and a starchy material in the sheet before it reaches the last drier, surface moistening both sides of the sheet as it leaves the driers, calendering both sides of the sheet with unheated rolls, subjecting both sides of the sheet to steam sprays and to hot calendering with heated rolls, and then again calendering the sheet with unheated rolls.

3. The herein described process of producing rotogravure printing paper on a paper-making machine having a series of drier drums, a spring roll, and unheated and steam-heated calender rolls which comprise forming a sheet, incorporating a composition including a loading material and a starchy material in the sheet before it reaches the last drier, sweating the exterior surface of the last drier drum to surface moisten the wire side of the sheet, sweating the surface of the spring roller to surface moisten the top side of the sheet, passing the sheet through two nips of unheated calender rolls, then passing the sheet through two nips of steam-heated calender rolls after first steam spraying the wire side and then the top side of the sheet, and finally passing the sheet through a series of unheated calender rolls.

4. The hereindescribed method of producing rotogravure printing paper which comprises

forming a web of paper, incorporating a composition including a loading material and a starchy material in the web, felting and pressing the web, drying the web, surface moistening both wire and top sides of the web, calendering the web with unheated rolls, subjecting both surfaces of the web to steam sprays and hot ironing both surfaces thereof, and finally ironing both surfaces of the web again with unheated rolls.

5. The hereindescribed process of producing rotogravure printing paper which comprises forming a sheet and incorporating in the sheet a composition including a loading material and

a starchy material required to produce the desired surface in the resulting sheet, subjecting the sheet to rolling pressure, drying the sheet to approximately 95% bone dry, surface moistening both wire and top sides of the sheet, calendering both sides of the sheet with unheated rolls, subjecting both sides of the sheet to steam sprays and hot calendering both sides thereof, and finally calendering both sides of the sheet again with unheated rolls.

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