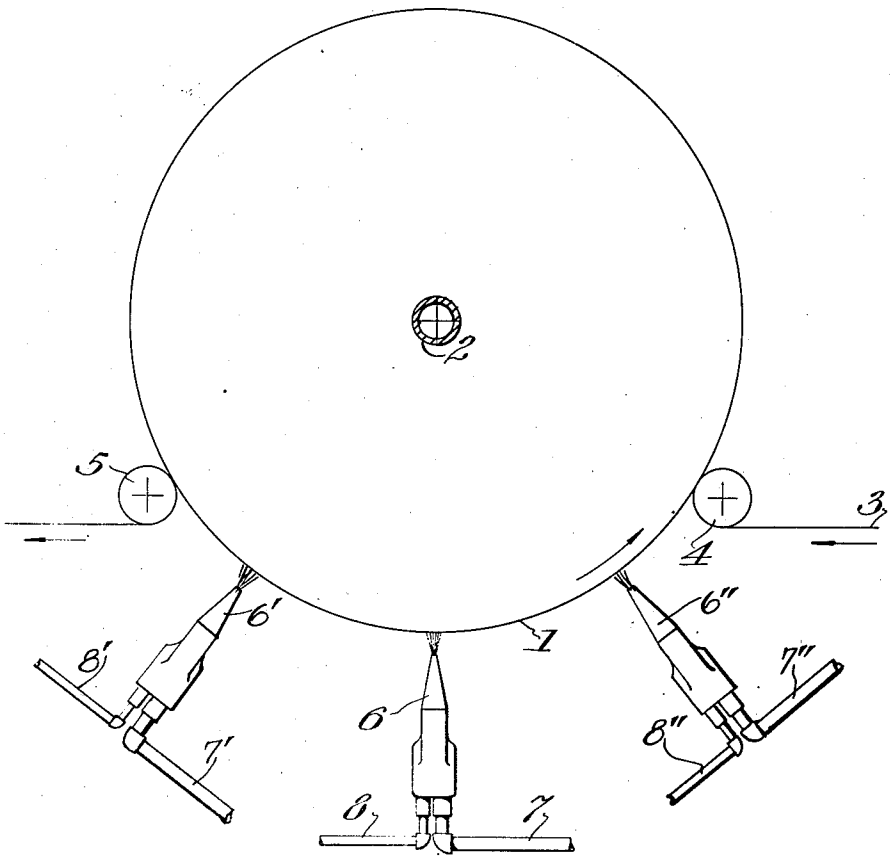
Jan. 28, 1936. W. J. MONTGOMERY ET AL 2,029,273

PROCESS OF COATING PAPER

Original Filed Jan. 25, 1929 2 Sheets-Sheet 1

Fig. 1.



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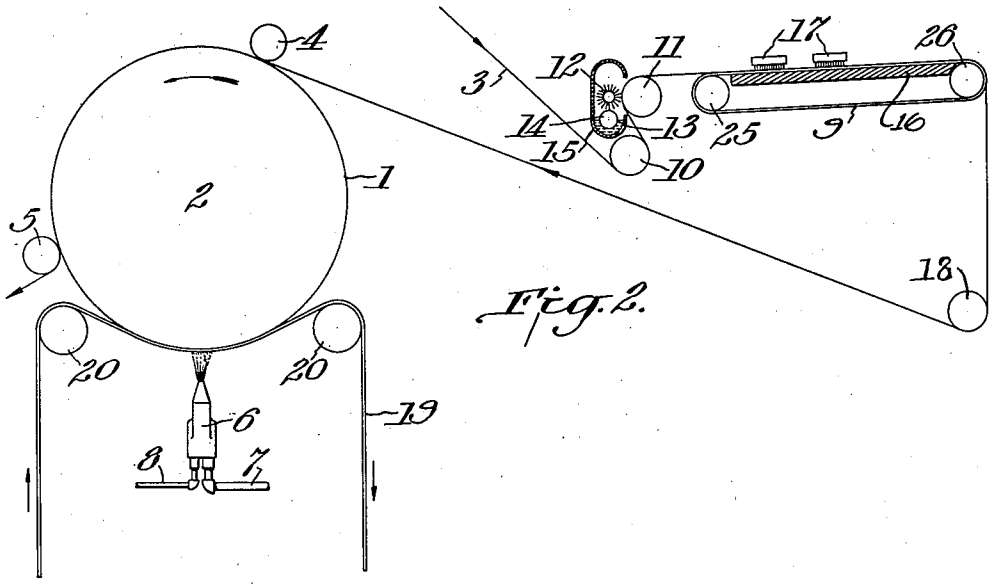


Fig. 2.

Fig. 3.

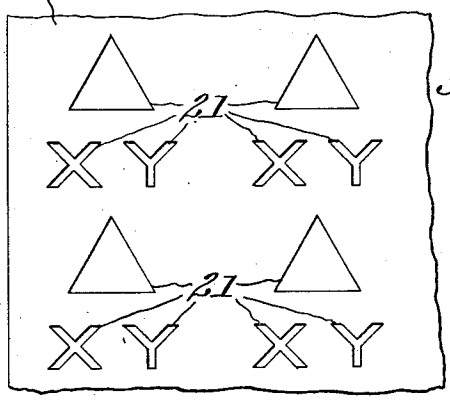
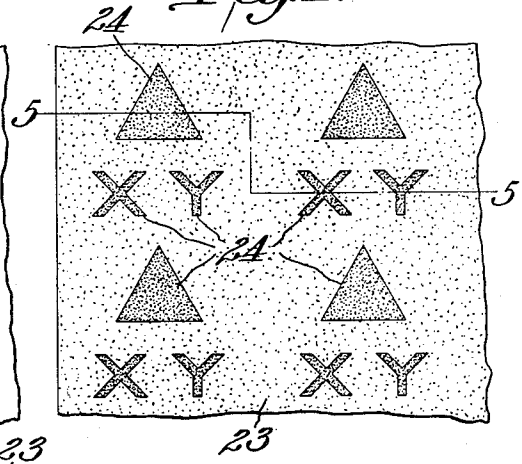


Fig. 4.



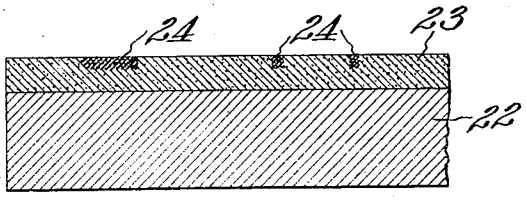


Fig. 5.

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UNITED STATES PATENT OFFICE

2,029,273

PROCESS OF COATING PAPER

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Application January 25, 1929, Serial No. 335,016

30 Claims. (Cl. 101—426)

This invention relates to a process of applying coating in the form of a continuous layer or layers or in the form of mechanographs to paper, including coated paper, card board and the like.

In an application Serial No. 158,837, filed Jan. 3, 1927, now Patent No. 1,719,166 issued July 2, 1929, in the name of Donald B. Bradner, one of the present applicants, there is described a process of calendering mineral coated paper according to which the coated paper is pressed against a solid finishing surface while the coating is in a fluid condition and the coating is hardened while in contact with said surface and subsequently detached therefrom, whereby it acquires a cast surface corresponding to that of the finishing surface. In carrying out said process the coating composition and the finishing surface must be so selected or prepared that after the coating has hardened it may be easily and substantially completely detached from the finishing surface.

The present invention makes use of the same principle of hardening a coating while in contact with a solid finishing surface.

One essential difference between the process of the present invention and the process of said patent is that according to the present invention coating is first deposited on a finishing surface and then transferred to the paper, whereas according to the patent coating is deposited on paper and contacted with a finishing surface without transfer of coating either to or from the finishing surface.

In other words the present invention comprises depositing coating upon a suitable finishing surface, hardening the deposited coating while in contact with said finishing surface, either before or after said deposited coating is hardened causing the paper to adhere to it and thereafter cleanly separating the paper with the coating from the finishing surface.

The invention is illustrated by the following detailed description in connection with the accompanying drawings in which

Fig. 1 is a diagrammatic representation of a vertical side elevation of an apparatus suitable for carrying out one procedure in accordance with the invention.

Fig. 2 is a similar view of apparatus showing the preliminary conventional coating of the paper followed by the application of a coating in the form of a design.

Fig. 3 is a plan view of a portion of the stencil belt.

Fig. 4 is a plan view and Fig. 5 is a section on line 5—5 of Fig. 4, of a piece of paper which has been coated in accordance with the invention.

Referring to Fig. 1 of the drawings, 1 is a cylinder mounted to revolve on the axis 2. The cylinder is hollow and is provided with means for heating or cooling it e. g., the axis 2 may be in the form of a perforated pipe for the introduction of steam or water. The outer surface of the cylinder provides the finishing surface. 3 is the paper which passes, as indicated by arrows, under the press roll 4, around the cylinder 1, and under the take-off roll 5. The paper may come from any suitable source of supply (not shown), such as a storage roll or a paper making machine, it may be either coated or uncoated and either wet or dry as will be explained later. The press roll 4 may be supplemented by other press rolls for holding the paper in contact with the cylinder or by a travelling apron. The assembly 6—7—8 represents means for depositing coating on the cylinder 1. 6 is a spray nozzle or atomizer of known construction for delivering the coating composition onto the cylinder; 7 is a pipe delivering the coating composition to the spray nozzle 6, and 8 is a pipe for supplying compressed air to the spray nozzle. Assemblies 6'—7'—8' and 6''—7''—8'' may be employed when it is desired to apply a plurality of layers of coating to the cylinder.

In the operation of this apparatus according to a specific embodiment of the invention, paper on which a coating has been freshly deposited and which is still in a wet, plastic and adhesive condition is fed continuously over the press roll 4, which may be rubber covered, on to the cylinder 1. At the same time coating is deposited on the cylinder 1 by the spray nozzle 6. Depending upon the width of the paper a suitable number of spray nozzles, properly spaced, may be used to produce a substantially uniform and continuous coating on the cylinder. The cylinder is heated with steam at substantially atmospheric pressure. As the paper passes on to the cylinder its wet coating is firmly pressed into contact with the coating on the cylinder by the press roll 4, and as the paper passes around the cylinder it and the coatings are dried, the temperature of the cylinder and its speed being adjusted to this end, so that when the paper reaches the take-off roll 5 the coatings are firmly bonded together and to the paper and, provided suitable coating compositions and finishing surfaces are used, the coatings are readily detached from the finishing surface at the take-off roll 5. Should any coating be deposited on some part of the finishing

surface that does not come into contact with the paper, for instance beyond the edges of the paper, this coating may be removed by brushing or wiping without harming the paper.

A suitable combination of finishing surface and coating composition for application to the finishing surface in the described procedure is a smooth, highly finished chromium surface such as may be obtained by electroplating chromium upon copper upon cast-iron and a coating composition composed of 100 parts of china clay, about 260 parts of water, 15 parts of casein dissolved with sodium carbonate and 2 parts of sodium stearate, the parts being by weight. This coating composition may be used on the paper also, provided the quantity of water is reduced, so that it will not flow back under the press roll 4.

The product of the described procedure is a double coated paper, that is, a paper having two layers of coating on the same side. The two layers of coating may be of the same or different composition, for instance, the coating next to the paper may be a relatively inexpensive composition, such as 100 parts of china clay, 25 parts of uncooked starch, 175 parts of water, the parts being by weight applied to the paper and then contacted with steam to gelatinize the starch according to the method described in an application by Donald B. Bradner Serial No. 147,200 filed November 8, 1926, now Patent No. 1,733,524, issued Oct. 29, 1929, whereas the coating applied by transfer from the finishing surface may be a more expensive composition having some special quality such as color, water-proofness or the like, desired in the finishing coat, for example, 100 parts of china clay, 30 parts of casein dissolved in ammonia water, 4 parts of ammonium stearate and 260 parts of water, the parts being by weight.

In the foregoing illustrative example the coating on the finishing surface is described as being deposited by spraying in the form of a substantially continuous layer. Instead of a substantially continuous layer of coating, a design, produced for instance by blocking off areas of the finishing surface by means of a stencil, may be deposited on the finishing surface and then transferred to the paper. In place of spraying any other suitable mechanical method of depositing the coating may be employed. For instance, the coating may be made up in the form of a paste or ink and deposited by means of a printing mechanism either in the form of design, such as discrete figures, printed text, pictorial representation or the like, or as a continuous layer, according to the known printing methods. More than one deposit of coating either of the same or different composition or color and either superposed or side by side may be applied to the finishing surface.

Apparatus for applying coating in the form of a design and the product are shown in Figs. 2, 3, 4 and 5. Referring to Figs. 2 and 3, 1 is the cylinder from which coating is transferred to the paper, 2 the axis of the cylinder, 3 the paper, 4 the press roll, 5 the take-off roll, and 6, 7 and 8 the means for depositing coating on the cylinder 1 all as described in connection with Fig. 1. 19 is a travelling flexible metal endless belt which is suitably perforated with the designs which it is desired to reproduce on the paper, and 20, 20 are guide rolls for holding the belt 19 in contact with the roll 1. The paper 3 coming from any suitable source (not shown) passes over the guide roll 10 and into contact with the rotating brush 12 which picks up coating from the roll 14 and deposits it on the paper, the roll 14 serving to convey coating from the body thereof 13 carried in the pan 15. The coated paper is carried by the belt 9 which travels on the rolls 25 and 26 and is supported by a slate slab 16. The freshly applied coating on the paper is spread by the action of reciprocating brushes 17, 17 which contact with the paper over the slab 16. The paper then passes over the roll 18 to contact with the cylinder 1. In the operation of this apparatus coating is sprayed onto the cylinder 1 through the perforations 21 in the belt 19 and the resulting design is then transferred onto the paper as described in connection with Fig. 1. The design produced is diagrammatically illustrated in Figs. 4 and 5. Referring to Fig. 5, 22 marks the paper web, 23 the continuous coating and 24 the coating which is applied in the form of a design.

The finishing surface need not be in the form of a cylinder as described but may take other forms, for example, an endless belt.

Among materials affording suitable finishing surfaces may be mentioned chromium, nickel and Monel metal. Chromium has been found to afford the most satisfactory finishing surface. With a highly finished chromium surface, such as may be obtained by electroplating and polishing, commercial water-color printing inks are reasonably satisfactory. Coatings or inks of the type comprising pigment or dye and casein, for example, 100 parts of china clay, 15 parts casein dissolved in ammonia water and sufficient water to give a thick paste, give good results on finishing surfaces of chromium. Such compositions with an addition of a small amount of soap such as 2 parts of ammonium stearate give good results with a finishing surface of chromium as well as with nickel and Monel metal.

In the foregoing examples the paper contacted with the coating on the finishing surface was described as carrying a wet or plastic coating upon its surface. It is to be understood, however, that the contacting paper need not be coated. In case it is coated, the selection of a suitable coating composition depends to some extent on whether the coating on the finishing surface is present as a continuous layer or only parts of the finishing surface are covered with coating. In the latter case the uncoated portions of the finishing surface will come in contact with the coating on the paper. It is essential of course that the coating on the paper be tightly bound to the paper, and it must also separate from the finishing surface after said coating has hardened. Compositions containing pigment, soap and casein similar to those mentioned above may be satisfactorily used for this purpose. On the other hand, if one or more continuous layers of coating are deposited on the finishing surface, the coating deposited directly on the paper does not come in contact with the finishing surface, except insofar as the coating on the paper may penetrate the coating on the finishing surface. Another coating composition suitable for deposition on the paper is 100 parts dry china clay, 175 parts of water and 25 parts of uncooked starch,—the parts being by weight. This composition is deposited on the paper in any suitable way and then contacted with steam to gelatinize the starch, as described in said application in the name of Donald B. Bradner, Serial No. 147,200, filed November 8, 1926, now Patent No. 1,733,524, and then delivered directly to the chromium finishing surface carrying the coating to be transferred to the paper.

The coating may be deposited on the paper and the paper contacted to the coated finishing surface before the coating on the paper has hardened. Or the paper may be coated and the coating allowed to harden, e. g., dry, as is done in the normal manufacture of coated paper, and the paper then rewetted to render the coating plastic and adhesive just prior to contacting with the coated finishing surface.

Having stated the general principles of the invention and discussed certain embodiments thereof as applied to transferring coating from a suitable finishing surface on to paper which already carries a coating, we will now consider some of the numerous possible variations or modifications thereof. In the first place the paper delivered to the finishing surface may be coated or uncoated and either wet or dry depending upon whether the coating on the finishing surface is dry or wet. In case the paper delivered to the finishing surface is wet this condition may be the result of rewetting or a freshly formed web of wet paper may be used directly. Also the vehicle or wetting agent of the coating need not be water but may be any other suitable liquid. Likewise the process is not limited to the use of coatings which harden on drying but contemplates the use of coatings which may be hardened in any other way, e. g., by cooling. It follows that in drying wet coatings the invention is not limited to the use of elevated temperatures such as are produced by steam heating. Thus the coating may be deposited upon a relatively cold finishing surface and the paper contacted therewith either before or after complete or partial drying and finally dried at ordinary or elevated temperatures. In general any condition which will provide for adhesive contact between the coating on the finishing surface and the paper may be employed. Moreover, the invention is not limited to the use of mineral coating compositions, but may employ any other composition which fulfills the following requirements: it must be capable of being hardened in contact with a solid finishing surface; of being firmly cemented to a sheet or web of paper; and of being substantially completely removed from said finishing surface as an integral part of the paper without destroying the finish imparted by the finishing surface. For example, a transparent coating composition containing no pigment such as a solution of casein in ammonia water with a small addition of soap and with or without addition of soluble dyestuff is quite satisfactory for use on a polished chromium surface.

The expedient just referred to of delivering freshly formed and still wet paper web to the finishing surface advantageously may be carried out in conjunction with the operation of a paper making machine in which the paper before being completely dried, is pressed against a drying cylinder such as is used in the so-called Yankee dryer, it being only necessary to provide a drying cylinder having a suitable non-adhering finishing surface, for instance a chromium plated surface, and to provide means for applying a coating to be transferred to the paper web from the drying cylinder. In this case the adhesive in the coating acts as a cement to bind the coating to the paper.

It will be seen that according to the present invention a substantially continuous coating or layer may be transferred from the finishing surface to uncoated paper or a substantially continuously coating may be transferred to coated paper on which the coating may be either substantially continuous or in the form of a mechanograph, or coating in the form of a mechanograph may be transferred to uncoated paper or to coated paper on which the coating is either substantially continuous or in the form of a mechanograph.

By the term "mechanograph" as used in this description and in the appended claims, we mean mechanically reproduced text, lettering, decorations or pictorial representations in one or more colors, such as are produced for example by known methods such as by printing, stenciling or lithography, and readily distinguishable under the microscope from photographs or hand paintings. As will be apparent, a plurality of layers of coating may be transferred to the paper either in the form of substantially continuous coatings or as mechanographs or both. The coatings may be transparent, opaque, white or colored so that a great variety of combinations and effects is possible.

It may produce double coated paper as described above by contacting paper carrying a wet coating with a finishing surface upon which a substantially continuous coating has been deposited. Or it may produce a single coated paper by contacting uncoated paper with a finishing surface carrying a substantially continuous coating. Or it may produce paper with coating having an inlaid effect by contacting paper carrying a substantially continuous plastic coating of a given color with a finishing surface carrying a discontinuous coating of a different color or combination of colors in the form of mechanographs. In this case a novel effect is produced in that the transferred coating is embedded in the coating on the paper and the resulting composite coating is given a cast surface corresponding to that of the finishing surface. When a highly polished finishing surface is used in this connection a product of remarkable beauty having the appearance of certain decorated and glazed porcelains, may be obtained. Another novel effect is obtained by transferring discontinuous coatings in the form of colored or multicolored mechanographs to uncoated paper. In this case the transferred mechanographs are characterized by having a cast surface corresponding to that of the finishing surface. As will be apparent, other combinations of coatings in the form of substantially continuous layers and mechanographs on the paper and on the finishing surface may be devised. All of the products so obtainable are characterized by the fact that the coating transferred from the finishing surface has a cast surface while the parts of the coating initially deposited on the paper contacting with the finishing surface also may be given a cast surface.

By the term "depositing a fluid coating" we include all methods of applying coating composition alone to the finishing surface, as distinguished from contacting coated paper with the finishing surface.

By the phrase "cementing paper to the coating on the finishing surface" we include all methods of causing said coating to firmly adhere to the paper by virtue of adhesive material either on the paper or in said coating or both. Of course if the adhesive in said coating is the cement present, said coating must be fluid while in contact with the paper and later hardened.

By the term "fluid coating" we include highly viscous pastes as well as liquids of low viscosity.

By the term "paper" we include paste board, post card and cardboard, as well as thin paper.

By the term "cast surface" we mean the coating surface hardened in contact with the finishing surface, and characterized by having a finish similar to that of the finishing surface.

By the term "non-adhering finishing surface" we mean a surface upon which fluid coating can be hardened and from which said hardened coating can be substantially completely separated without impairing the finish imparted to it by said finishing surface.

We claim:

1. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing a fluid aqueous coating upon a hard non-adhering finishing surface, cementing paper to said coating, separating the paper together with the coating from said finishing surface, and hardening the coating to a non-plastic cast condition on said finishing surface prior to the separation thereof.

2. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing a fluid aqueous coating upon a hard non-adhering finishing surface, contacting paper with said coating, hardening said coating to a non-plastic cast condition on said finishing surface, and separating the paper together with the coating from said finishing surface.

3. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing a fluid aqueous coating upon a hard non-adhering finishing surface, hardening said coating to a non-plastic cast condition on said finishing surface, cementing paper to the hardened coating, and separating the paper together with the coating from the finishing surface.

4. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing a fluid aqueous coating upon a hard non-adhering finishing surface, continuously contacting paper carrying a coating with said fluid aqueous coating, hardening said fluid aqueous coating to a non-plastic cast condition on said finishing surface, and continuously separating the paper together with the coating from said finishing surface.

5. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing a fluid aqueous coating upon a hard non-adhering finishing surface, hardening said coating to a non-plastic cast condition on said finishing surface, continuously cementing paper carrying a coating to the hardened coating, and continuously separating the paper together with the coating from the finishing surface.

6. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing a fluid aqueous coating upon a hard non-adhering finishing surface, continuously contacting paper carrying an aqueous coating with said fluid aqueous coating, hardening said coatings to a non-plastic cast condition on said finishing surface, and continuously separating the paper together with said coatings from said finishing surface.

7. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing a fluid aqueous coating upon a hard non-adhering finishing surface, hardening said coating to a non-plastic cast condition on said finishing surface, continuously contacting said hardened coating with paper carrying an aqueous coating, cementing the paper to said hardened coating, and continuously separating the paper together with said coatings from the finishing surface.

8. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing fluid aqueous coating upon a hard non-adhering finishing surface, contacting wet paper with said coating, hardening said coating to a non-plastic cast condition on said finishing surface, drying the paper, and separating the paper together with the coating from the finishing surface.

9. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing fluid aqueous coating upon a hard non-adhering finishing surface, hardening said coating to a non-plastic cast condition on said finishing surface, contacting wet paper with said coating, drying the paper and separating the paper together with the coating from the finishing surface.

10. In the manufacture of paper which is at least partially covered with coating having a cast surface, the hereindescribed process which comprises depositing fluid aqueous coating upon a hard non-adhering metallic finishing surface, heating the coating to harden it to a non-plastic cast condition on said finishing surface, continuously contacting a web of paper carrying an aqueous coating with said hardened coating, drying said aqueous coating on the web, and separating the paper together with said coatings from the finishing surface.

11. The process for the manufacture of paper as defined in claim 2 in which the finishing surface is metallic.

12. The process for the manufacture of paper as defined in claim 3 in which the finishing surface is metallic.

13. The process for the manufacture of paper as defined in claim 4 in which the finishing surface is metallic.

14. The process for the manufacture of paper as defined in claim 5 in which the finishing surface is metallic.

15. The process for the manufacture of paper as defined in claim 6 in which the finishing surface is metallic.

16. The process for the manufacture of paper as defined in claim 7 in which the finishing surface is metallic.

17. The process for the manufacture of paper as defined in claim 8 in which the finishing surface is metallic.

18. The process for the manufacture of paper as defined in claim 9 in which the finishing surface is metallic.

19. The process for the manufacture of paper as defined in claim 2 in which the coating is deposited on the finishing surface in the form of a mechanograph.

20. The process for the manufacture of paper

as defined in claim 3 in which the coating is deposited on the finishing surface in the form of a mechanograph.

21. The process for the manufacture of paper as defined in claim 4 in which the coating is deposited on the finishing surface in the form of a mechanograph.

22. The process for the manufacture of paper as defined in claim 5 in which the coating is deposited on the finishing surface in the form of a mechanograph.

23. The process for the manufacture of paper as defined in claim 6 in which the coating is deposited on the finishing surface in the form of a mechanograph.

24. The process for the manufacture of paper as defined in claim 7 in which the coating is deposited on the finishing surface in the form of a mechanograph.

25. The process for the manufacture of paper as defined in claim 8 in which the coating is deposited on the finishing surface in the form of a mechanograph.

26. The process for the manufacture of paper as defined in claim 9 in which the coating is deposited on the finishing surface in the form of a mechanograph.

27. The process for the manufacture of paper as defined in claim 10 in which the coating is deposited on the finishing surface in the form of a mechanograph.

28. In the manufacture of paper which is at least partially covered with coating having a cast surface the hereindescribed process which comprises depositing a fluid coating in the form of a mechanograph upon a non-adhering finishing surface, cementing paper to said coating, separating the paper together with the coating from said finishing surface and hardening the coating to a non-plastic cast condition on said finishing surface prior to the separation thereof.

29. The hereindescribed process which comprises applying coating in the form of a mechanograph to a traveling non-adhering finishing surface, continuously contacting a web of paper with the coating on said surface, hardening said coating while in contact with said surface and with the paper whereby the coating becomes bonded to the paper, and then continuously and substantially completely removing the hardened coating and the paper from said surface.

30. The hereindescribed process which comprises applying coating in the form of a mechanograph to a traveling non-adhering finishing surface, hardening said coating, continuously adhesively contacting a web of paper with said hardened coating whereby the coating becomes bonded to the paper and continuously and substantially completely removing the hardened coating and the paper from said surface.

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