(No Model.) 2 Sheets—Sheet 1.

W. B. HOWE & M. D. KNOWLTON.

COATING PAPER WITH PARAFFINE.

No. 344,965. Patented July 6, 1886.

Fig. 1.

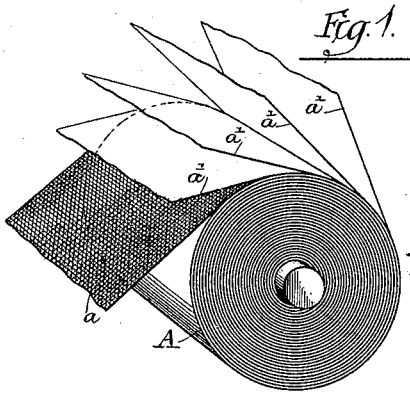


Fig. 2.

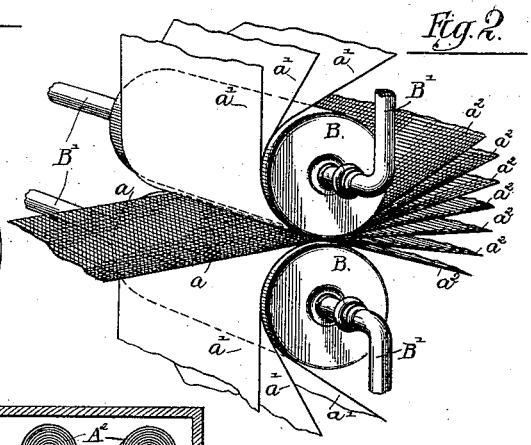


Fig. 3.

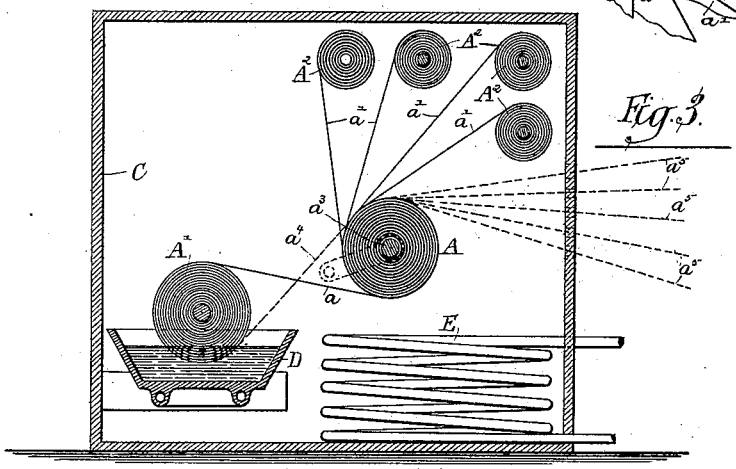
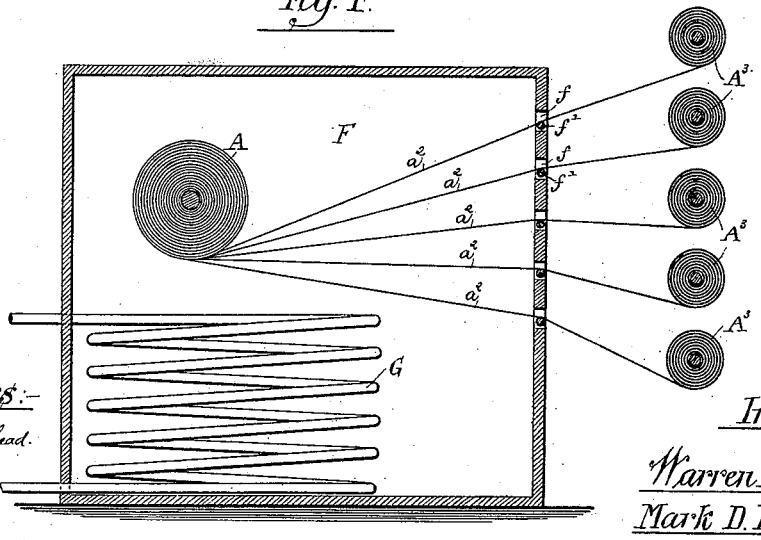


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

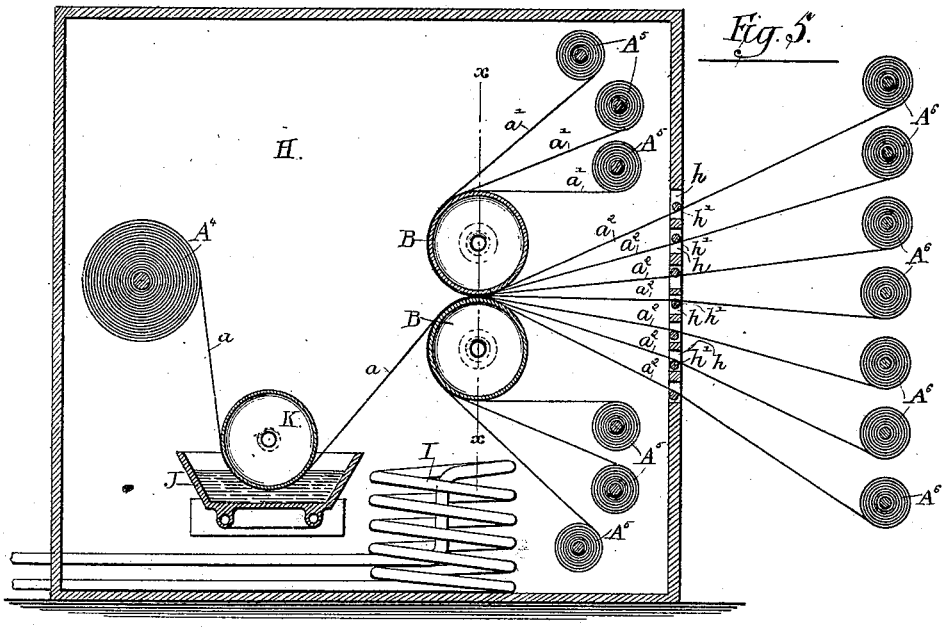
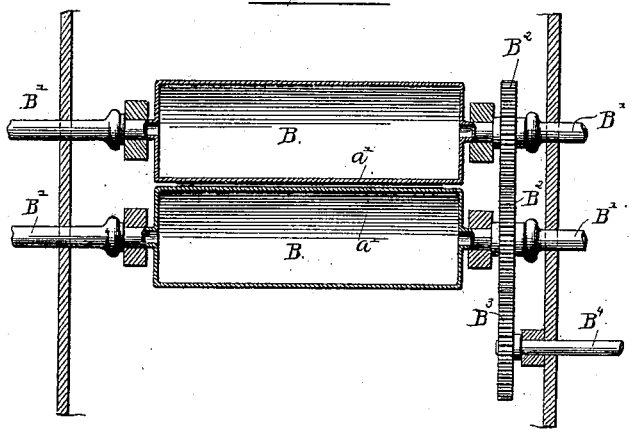


Fig. 6.



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UNITED STATES PATENT OFFICE.

WARREN B. HOWE AND MARK D. KNOWLTON, OF CHICAGO, ILLINOIS.

COATING PAPER WITH PARAFFINE.

SPECIFICATION forming part of Letters Patent No. 344,965, dated July 6, 1886.

Application filed April 14, 1886. Serial No. 198,860. (No model.)

To all whom it may concern:

Be it known that we, WARREN B. HOWE and MARK D. KNOWLTON, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Coating Paper with Paraffine; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

In the manufacture of paraffined or waxed paper, as usually heretofore conducted, melted paraffine has been applied to the paper in such manner as to fully saturate and coat the paper therewith, thus requiring the removal of the surplus paraffine as a separate step in the process.

A main object of this invention is to provide an improved method of and means for making waxed or paraffined paper whereby the quantity of paraffine originally applied to the paper may be limited or restricted to an amount which it is desired that the finished product should contain, thus rendering unnecessary the removal of a superabundance of the applied material and thereby simplifying and cheapening the process and improving the product.

The improved method constituting our invention consists, as its essential or principal steps, in placing or holding one or more thicknesses or layers of paper to which paraffine has been previously applied in contact with or between other unparaffined thicknesses or layers of paper, and then applying heat to the several layers thus brought into contact with each other, so as to cause the melting of the paraffine in the paraffined layer or layers and the absorption of a part of the paraffine by the unparaffined sheets, with the result that the said paraffine is evenly distributed throughout all of the layers or thicknesses thus held or compacted together. In carrying out the process embracing the steps mentioned the paraffine originally taken up by or contained in the paraffined layer or layers may obviously be distributed through or in a greater or less number of unparaffined layers, so that by varying the relative number of paraffined and unparaffined layers or thicknesses the amount of the material absorbed or taken into each layer may be accurately determined and limited, and paper produced containing the precise quantity of paraffine desired.

Inasmuch as each individual sheet or thickness of paper of the several sheets operated upon in the manner above described will be less than fully saturated, there will obviously be no surface paraffine upon any of the layers of a mass or body made up and heated in the manner described tending to cause said layers to adhere to each other, so that when the layers or thicknesses are separated no superfluous paraffine requiring removal will be present thereupon. We usually prefer in practice, however, to separate the layers or thicknesses in the presence of heat, or to apply heat sufficient to melt the paraffine in the thicknesses after they have been separated, so that the paraffine taken up by the paper may be more perfectly diffused therein and evenly distributed upon the surface thereof, as hereinafter more fully explained.

One practical and desirable way of carrying out the process above set forth which we have successfully practiced consists in applying paraffine to a single endless strip or web of paper and then rolling said strip or web into a compact mass with other unparaffined strips or webs, the compact mass or roll thus formed being subjected to heat sufficient to melt the paraffine either during the process of rolling or afterward, so as to enable the paraffine to become distributed evenly throughout all the layers of the roll.

Another practicable way of carrying out our invention is to pass one or more paraffined layers or thicknesses of paper together with several unparaffined layers or thicknesses through or between heated presser-rollers, whereby the several paraffined and unparaffined layers or thicknesses are pressed closely together, so as to cause the absorption of the surplus paraffine from the paraffined layer or layers into those that are unparaffined, with the result of evenly distributing the paraffine in the manner above set forth.

The process hereinbefore set forth may be carried out furthermore by folding or compacting together a series of sheets or layers of paper, some of which have been previously paraffined, so as to bring the several layers into contact with each other otherwise than

by rolling them or by passing them between rollers—as, for instance, a series of paraffined and unparaffined sheets may be piled one upon another, so as to form a body or mass of paper, and the sheets thus placed may be held in contact with each other by suitable clamping or pressure devices, and subjected to heat while thus held, so as to cause the even diffusion of the paraffine throughout the entire mass in the manner hereinbefore stated.

The means for paraffining paper, forming part of our invention, comprises an improved apparatus or device, whereby the process above described may be conveniently carried into effect, as will hereinafter fully appear.

The invention may be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a perspective view showing several long sheets or webs of paper, one of which has been paraffined, rolled together for the purpose of distributing the surplus material in the paraffined layer throughout the other layers of the roll. Fig. 2 is a perspective view showing two heated presser-rolls and a paraffine-saturated sheet, passing together through said rolls. Fig. 3 is a sectional view of an apparatus for carrying out my improved process, comprising a heated chamber, a tank for paraffine, and several paper-rolls, as will be hereinafter described. Fig. 4 is a sectional view of a heated chamber, within which a roll similar to that shown in Fig. 1 may be placed, for conveniently unrolling the paraffined paper therefrom. Fig. 5 illustrates in vertical section a heating-chamber containing devices for paraffining a series of sheets in the manner illustrated in Fig. 1. Fig. 6 is a sectional view taken longitudinally through the rollers shown in Fig. 5, upon line $x\ x$ of said figure.

A, Figs. 1, 3, and 4, indicates a roll of paper formed by rolling together a single sheet or strip, a, of paper which has been fully saturated with paraffine, or which contains an amount of paraffine greater than is desired in the finished product, and several sheets or strips, $a'\ a'$, of unparaffined paper. By subjecting the roll A thus formed to heat sufficient to melt the paraffine contained in the paraffined layer the melted paraffine will, by capillary action, become evenly diffused throughout the entire mass of the roll. A roll such as is shown in Fig. 1 may obviously be made up with more than one previously-paraffined sheet with the same result as when only one paraffined sheet is employed, the relative number of paraffined and unparaffined sheets, of course, being proportioned to give the required amount of paraffine in the product. The extent to which the unparaffined paper will absorb the paraffine from the paraffined layer or layers in the roll, or, in other words, the number of sheets or bulk of paper within which the quantity of paraffine contained in one or more of the layers will become distributed, is found to depend upon the temperature employed to heat the roll, the quantity or thickness of the paper, and to some extent upon the tightness with which the paper is rolled or compacted together. A relatively high temperature is found to promote the flow or diffusion of the paraffine, as is also the close contact of the layers of the mass. With paper of the kind commonly employed, when rolled with moderate tightness or closeness, the paraffine is found to become absorbed by and diffused through a relatively large number of unparaffined sheets, so that a paper may be made in the manner described, which is much less than fully saturated, and which, therefore, while being sufficiently water-proof, has a dry surface, and does not greatly differ in appearance from unparaffined paper.

In Fig. 2 I have illustrated another means for carrying my invention into practice, in which is employed for pressing or holding several paraffined and unparaffined layers of paper together a pair of opposing presser-rollers, B B, herein shown as heated by steam entering the rollers through pipes B′ B′, but which in practice may be heated by other means, as may be found convenient or desirable. In this instance paraffine originally applied to and taken up or absorbed by a sheet or layer, a, of paper is distributed in a number of unparaffined sheets or layers, $a'\ a'$, by passing the said several layers $a\ a'\ a'$ together between the heated rollers B B, the paraffined sheet or layer a being desirably arranged to form the middle sheet or layer of the several layers passing between the rollers, so that there will be an equal number of unparaffined sheets or layers upon each side of it, into which the surplus paraffine in the layer a will become absorbed. The several sheets or layers are preferably separated after passing the rollers, as indicated at $a^2\ a^2$, and it is found that after the several layers or sheets are separated each of said sheets or layers, including the layer a, originally paraffined, will contain practically equal quantities of paraffine.

Fig. 3 illustrates an apparatus for winding a paraffined sheet into a roll with unparaffined sheets or webs of paper in the manner illustrated in Fig. 1. This apparatus comprises a closed chamber, C, within which is placed the paper-roll A, together with a paraffine-tank, D, a roll, A′, of unparaffined paper, which is located over the tank in position to dip at its lower part into the paraffine contained in the said tank, and a heating-coil, E, whereby the space within the chamber is maintained at a desired temperature above the melting-point of paraffine. In this case the single sheet or web a takes up a supply of paraffine by the rotation of the roll A′ in the paraffine contained in the tank D, and said sheet or web is wound upon the roll A, together with several strips or webs $a'\ a'$, which are unwound from a series of rolls, $A^2\ A^2$, also located within the said heating-chamber. By the use of an apparatus of this kind the paraffine applied to the layer or web a is retained

in its melted state, while the said web is being wound upon the roll A, and the said roll and the several unparaffined layers A' A' are brought together in a heated state, and at the same temperature above the melting-point of paraffine, so that the distribution of the paraffine from the strip or web *a* to the other parts of the mass of paper within the roll A takes place immediately and continuously while the roll is being wound, and the roll remains at a desirably-high temperature until the paraffine originally contained in the strip or web *a* is evenly distributed throughout the mass. Upon removing the roll A from the heated chamber C after being rolled in the manner described the several layers of paper unwound therefrom will be found to be evenly saturated, and may be used as a marketable product without further treatment, and said roll may be sent direct to the consumer without previously unwinding it.

The central shaft, a^3, upon which the roll A is wound, will, in an apparatus like that shown in Fig. 3, be extended at one end through the side of the chamber C, and will be provided with a belt-pulley, or with a crank, as indicated in dotted lines in said Fig. 3, or otherwise arranged so that it may be rotated for the purpose of winding the paper thereon.

In a prior application, No. 193,363, for Letters Patent of the United States for an improvement in the art of paraffining paper, filed by Warren B. Howe upon the 26th day of February, 1886, is described a process by which the amount of paraffine entering the paper may be limited by applying it to the paper when the latter is held in a compact mass or roll. One way of carrying out the process set forth in such prior application, therein described, consists in drawing a long sheet or web of paper from a compact mass or roll mounted over a paraffine-tank, so as to dip into the paraffine contained in said tank.

It will be observed that the means for applying paraffine to the layer or sheet *a* (shown in Fig. 3) is similar to that above referred to as being described in said prior application, the amount of the paraffine taken up by the said layer *a* in the apparatus shown in said Fig. 3 obviously being limited, or less than will fully saturate and coat the said layer, by reason of the facts that the outer surface only of said sheet is exposed to the melted paraffine, and that a considerable part of the paraffine taken up by the said sheet, when the rollers are arranged as shown in the said Fig. 3, will be absorbed by the inner sheets of paper upon the roll before the outer layer is separated therefrom.

We find it desirable in some cases to limit the amount of paraffine taken up by the sheet or layer *a*, to which the paraffine is originally applied, and this may be done either in the manner above stated and shown in Fig. 3 or otherwise. In carrying out the process constituting our invention, therefore, paraffine may be applied to the initially-treated sheet or layer in such manner as to less than fully saturate the said sheet or layer in either of the ways described in said prior application, or by any other method or process found convenient or practicable. In case it is desired that the said sheet or layer *a* should retain and convey into the mass or roll A a greater quantity of paraffine than will be taken up by said sheet or layer when the apparatus shown in Fig. 3 is employed, the roll A A' may be reversed, so as to run in the opposite direction from that shown, and the paraffined sheet drawn from the roll A' at a point near the bottom of the latter, so that it may leave the roll near the level of the top of the paraffine in the tank, and thereby retain a much greater quantity of paraffine than it would if taken from the top of the roll. The position of the layer or sheet *a* when drawn from the roll A' in the manner last mentioned is indicated by the dotted line a^4 in Fig. 3.

Although the layers drawn from a roll, A, after the paraffined and unparaffined layers have been rolled together and subjected to heat, either in the manner described in connection with Figs. 1 or 3, will be found to be saturated with sufficient evenness to form a salable article, as above stated, we have found it desirable, in order to give the product a smoother and more pleasing appearance, to subject the several sheets or layers to heat after they have been separated from the roll. The reason for the improved appearance in the paper produced by reheating in the manner described becomes apparent in view of the fact that when the sheets are held in a compact mass portions of the paraffine within the mass will be retained by capillary action between the surfaces in contact, so that when said surfaces are separated small adhering portions of paraffine will be distributed over said surfaces. By heating the sheets after separation any melted paraffine upon the layers will obviously flow or become evenly distributed over the entire surface thereof, so that said surface will be given a perfectly even and smooth appearance.

I have shown in Fig. 4 a device which may be employed for unwinding in the presence of heat a roll, A, such as is shown in Figs. 1 and 3. Said apparatus consists, principally, of a chamber, F, heated by a coil, G, or otherwise, and provided with means for sustaining the roll A therein, and with exit-openings *f*, provided with guide rods or wires *f'*, through and over which the several paraffined layers a^2 from the roll A may be carried to a series of rolls, A^3, upon which the sheets are separately and finally wound, said layers obviously being cooled in their passage through the air at an ordinary temperature between the exit-opening of the chamber and the roll A^3, so that the paraffine therein becomes hard before the paper is again rolled.

When an apparatus such as is shown in Fig. 3 is employed for carrying out our improved process, the several layers composing

the roll A may be separated within the chamber C thereof by carrying the several layers from the said roll outwardly through suitable apertures in the said chamber in the manner indicated by the dotted lines a^5 in said Fig. 3.

In Figs. 5 and 6 is shown an apparatus whereby the process may be carried out in the way generally described in connection with Fig. 2, or in such manner that the several steps of paraffining a single layer, bringing the paraffined layer into contact with other unparaffined layers, and then separating the several layers and exposing them to heat after separation are performed as a continuous operation. The said apparatus shown in Figs. 5 and 6 comprises a closed chamber, H, which is heated by a steam-coil, I, or otherwise, a paraffine-tank, J, a cylinder or roller, K, revolving with its lower part within the tank, and two presser rollers, B B, similar to those shown in Fig. 2, located within the said chamber. A^4 is a roll of unparaffined paper, from which the web or sheet *a* is carried partially around and beneath the roller K, so as to cause the immersion of said web or sheet in the melted paraffine contained in the tank J, and A^5 A^5 are a series of rollers, from which are drawn unparaffined strips or webs *a' a'*, which pass partially around the rollers B B, and between said rollers, together with the paraffined sheet or web *a*. The several rollers A^5 A^5 are desirably arranged half above and half below the presser-rollers B, so that an equal number of unparaffined sheets are brought into contact with the paraffined sheet *a* upon each side of the latter in passing through the presser-rollers. The said rollers B are shown as heated by steam-pipes B', and operate in the manner set forth in connection with Fig. 2 to press or hold the several layers in contact with each other while the latter are subjected to heat, and thereby cause the even diffusion throughout all the layers of the paraffine contained in the single layer or sheet *a*. In the sectional view, Fig. 6, suitable driving-gearing for the rollers B B is shown, consisting of intermeshing gear-wheels B^2 B^2, driven by gear-wheel B^3, upon a driving-shaft, B^4. The several sheets, strips, or webs a^2 a^2, passing from the rollers B B, are desirably separated and passed through apertures *h* in the wall of the chamber H to rollers A^6 A^6, upon which the paper is finally wound, suitable guide-rods, *h'*, being provided adjacent to the openings *h* for suitably guiding the sheets to the said rollers A^6. Inasmuch as in this construction the several paraffined layers a^2 a^2 are separated from each other within the heated chamber H, and are thereafter allowed to cool in their passage to the rollers A^6, which are located at a considerable distance from the chamber, the paraffine upon each strip or sheet will be allowed to diffuse itself evenly thereon, and to thereafter become set or hardened before the paper is rolled, so that the same desirable result of giving a smooth and even appearance to the paper is obtained as is described in connection with the apparatus shown in Fig. 4.

It is entirely obvious that the process hereinbefore set forth may be carried out when the paper is in the form of a series of separate sheets by interposing one or more paraffined sheets between a desired number of unparaffined sheets, and suitably holding together or compressing the mass thus formed, and subjecting it to heat sufficient to melt the paraffine. By reason of the inconvenience involved in the handling of a great number of sheets, however, paper of ordinary thickness will usually be treated in the form of long or practically-continuous strips or webs. In the paraffining of thicker paper, strawboard, or similar material it may be found convenient to operate thereon when in separate sheets, as above mentioned.

It will of course be understood that in the use of an apparatus or devices similar to those hereinbefore described more than one layer or thickness of paper may be initially treated or paraffined for the purpose of transferring the paraffine therein contained to other unparaffined layers or thicknesses, the result in the use of one or more than one layer in this manner obviously being practically the same.

An important and principal advantage of our improved process is that means are thereby provided for accurately and perfectly controlling the amount of paraffine applied to the paper, so as to obtain the exact degree of saturation or quantity of paraffine in each layer or sheet that is desired by reason of economical or other considerations.

Certain novel features of construction in the apparatus or devices shown form part of our invention and are covered by certain of the appended claims.

We claim as our invention—

1. The improvement in the art of manufacturing paraffined paper, which consists in placing in contact with each other one or more sheets or layers of paper containing paraffine and other unparaffined sheets or layers of paper, and applying heat to the body or mass of paper thus formed, substantially as described.

2. The method of making paraffined paper, which consists in rolling together one or more sheets or layers of paper containing paraffine and other unparaffined sheets or layers of paper, and applying heat to the roll thus formed, substantially as described.

3. The method of making paraffined paper, which consists in placing in contact with each other a number of sheets or layers of paper, one or more of which contains paraffine, applying heat to the body or mass of paper thus formed, and thereafter separating the layers of the body or mass and applying heat to the said layers after they are separated, substantially as described.

4. The method of making paraffined paper, which consists in rolling together a number of sheets of paper, one or more of which contains

paraffine, so as to form a compact mass or roll, applying heat to the said mass or roll, and thereafter unwinding the roll and separating the layers thereof in the presence of heat, substantially as described.

5. The method of making paraffined paper in continuous lengths or webs, which consists in continuously applying melted paraffine to one or more webs of paper, and thereafter bringing the paper thus paraffined into contact with webs of unparaffined paper in the presence of heat, substantially as described.

6. The method of making paraffined paper in continuous lengths or webs, which consists in continuously applying melted paraffine to one or more webs of paper, and rolling the paper thus paraffined into a compact mass or roll together with webs of unparaffined paper, and applying heat to the mass or roll, substantially as described.

7. The method of making paraffined paper in continuous lengths or webs, which consists in continuously applying melted paraffine to one or more webs of paper, rolling the paper thus paraffined into a compact mass or roll together with webs of unparaffined paper, applying heat to the mass or roll thus formed, and thereafter unwinding the roll and separating the layers thereof in the presence of heat, substantially as described.

8. The method of making paraffined paper in continuous lengths or webs, which consists in continuously applying melted paraffine to one or more webs of paper, rolling the paper thus paraffined into a compact mass or roll together with webs of unparaffined paper, and thereafter unwinding the roll and separating the layers thereof, all of the said several steps being performed in the presence of heat, substantially as described.

9. An apparatus for paraffining paper, comprising a heated chamber, a paraffine-tank located within the chamber, means sustaining a paper-roll, as A′, over the tank, means sustaining other paper-rolls, as A^2 A^2, and a revolving shaft or mandrel, a^3, upon which may be wound the paper from the said several rolls, substantially as described.

In testimony that we claim the foregoing as our invention we affix our signatures in presence of two witnesses.

WARREN B. HOWE.
MARK D. KNOWLTON.

Witnesses:
C. CLARENCE POOLE,
M. E. DAYTON.