(No Model.) 2 Sheets—Sheet 1.

W. B. HOWE.

ART OF PARAFFINING PAPER.

No. 343,375. Patented June 8, 1886.

Fig. 1.

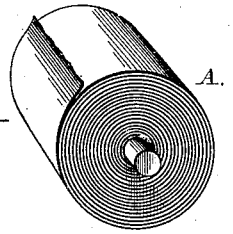


Fig. 2.

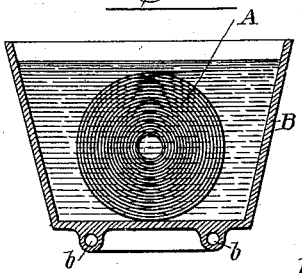


Fig. 3.

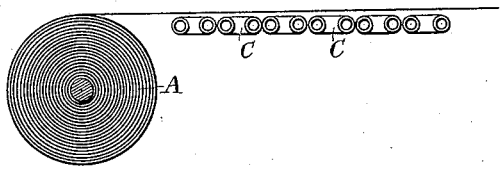


Fig. 4.

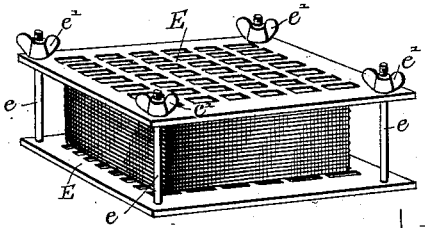


Fig. 5.

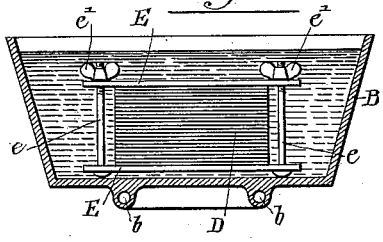


Fig. 6.

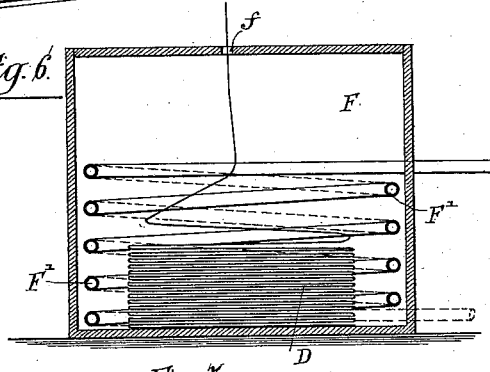


Fig. 8.

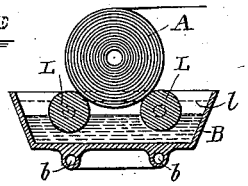
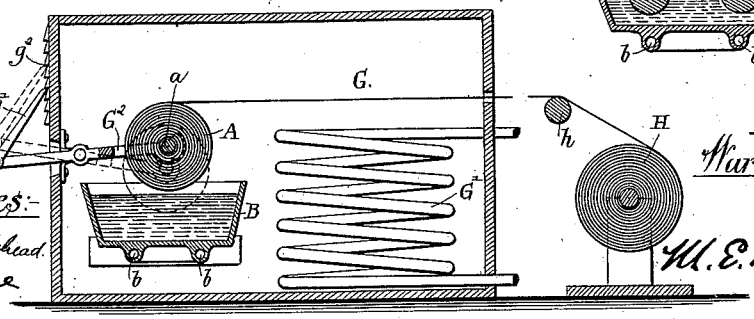


Fig. 7.



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(No Model.) 2 Sheets—Sheet 2.

W. B. HOWE.

ART OF PARAFFINING PAPER.

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Fig. 9.

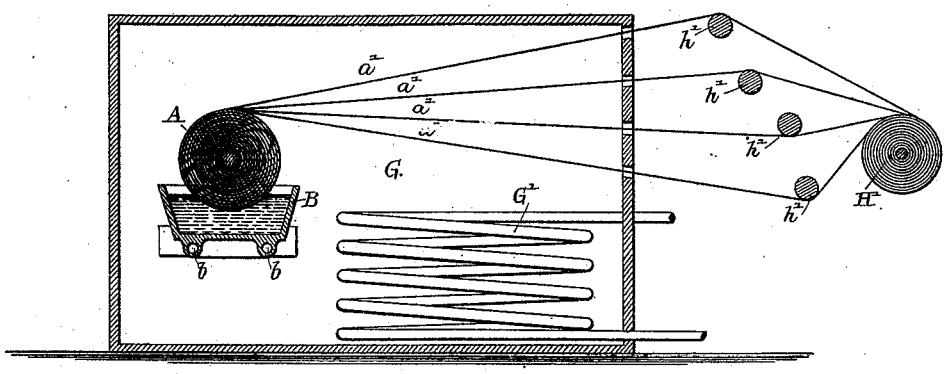


Fig. 10.

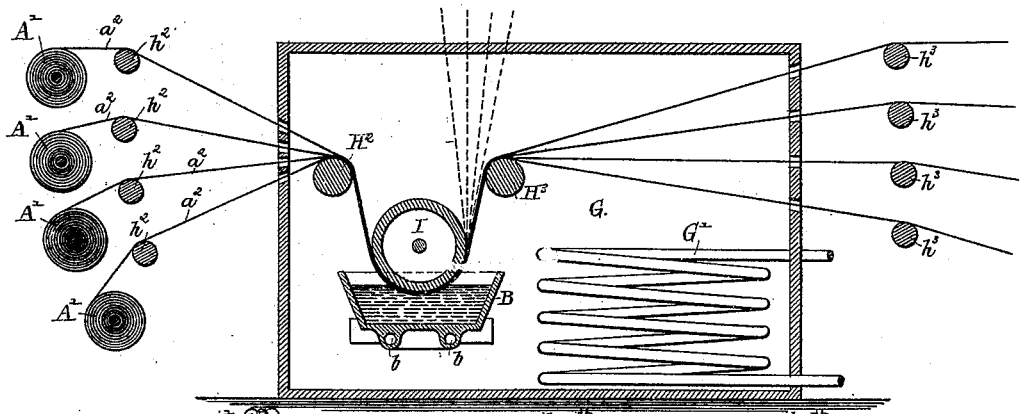


Fig. 11.

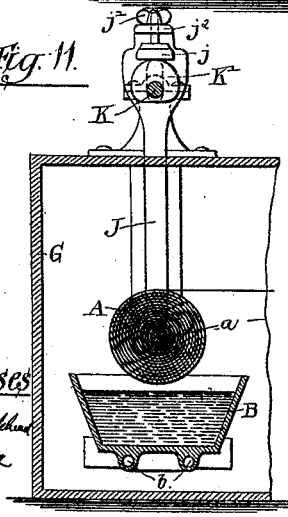
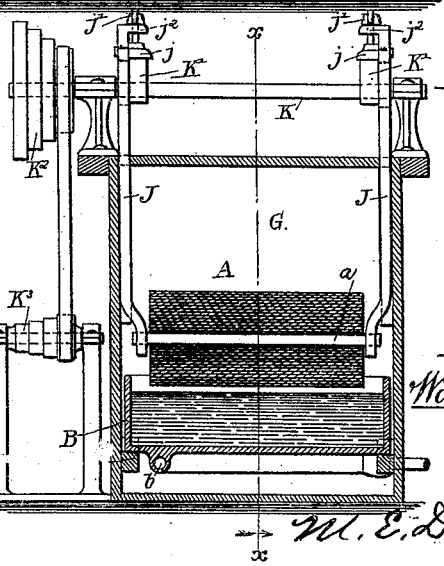


Fig. 12.



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UNITED STATES PATENT OFFICE.

WARREN B. HOWE, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO THIRDS TO ISABEL GAVIN AND MARK D. KNOWLTON, BOTH OF SAME PLACE.

ART OF PARAFFINING PAPER.

SPECIFICATION forming part of Letters Patent No. 343,375, dated June 8, 1886.

Application filed February 26, 1886. Serial No. 193,363. (No model.)

To all whom it may concern:

Be it known that I, WARREN B. HOWE, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in the Art of Paraffining Paper; and I 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.

The object of this invention is to provide an improvement in the art of manufacturing paraffined or "waxed" paper, whereby the quantity of paraffine applied to the paper in making it may be limited to the amount required to make the paper suitably water-proof, with the result of rendering unnecessary the removal of a superfluous amount of paraffine originally applied to the paper, as has been necessary, as a separate step, in the process of manufacture heretofore employed.

This invention embraces both an improved method and an apparatus for paraffining paper; and it consists in the matters hereinafrer described, and pointed out in the appended claims.

The method forming part of my invention consists, essentially, in applying paraffine in a melted state to a body or mass of paper consisting of multifold thicknesses or layers held closely in contact with each other, whereby the paraffine is distributed in the inner layers by absorption through the outer layer or layers of the mass, and the quantity of paraffine taken up and held by each layer is limited to the amount which will naturally be retained within the body of the layer, so that when the layers are separated no superfluous paraffine requiring removal will be present upon the surface of the separated layer.

One way of carrying out the process above stated, which I have successfully practiced, consists in rolling a web or band of paper into a compact roll, inserting said roll into melted paraffine until the latter has permeated throughout the entire body of the roll, and then unwinding the paper from the roll in the presence of heat in such manner as to expose the paper in a single thickness to a temperature above the melting-point of the paraffine. The single thickness is desirably exposed to heat in this manner for the reason that under some circumstances the paraffine contained in the mass of paper will cause the layers to stick together, so that when separated the surfaces which were in contact will present a mottled, opaque, or whitish appearance, which will remain if the separated layer is allowed to immediately become chilled in unrolling the paper, or if the paper is unrolled after becoming cold. By heating the single layer after it is separated from the roll, however, any surface paraffine is caused to flow or diffuse itself evenly upon the paper, and a smooth, even, and translucent appearance is thereby given to the product. In this connection it may be stated that the absorption into the mass of paper of a quantity of paraffine sufficient to cause the layers to adhere to each other when the paraffine is cold will not result in supplying the paper with such an amount of the material as to form a surplus coating requiring removal, it being found that under the circumstances mentioned the separated layer drawn from the roll will not contain a heavier body of paraffine than is commonly present in merchantable paper. It is to be understood, however, that the necessity for the unrolling of the paraffined mass of paper in the presence of heat, or of applying heat to the single layer after it is unrolled, depends upon the quality or thickness of the paper used, the tightness with which it is rolled, and the extent to which it is allowed to absorb paraffine when in its rolled or compact condition. It is entirely practicable, for instance, to so limit the quantity of paraffine originally taken into the roll or compact mass as to enable the layers to be separated after the roll has become cold and without the presence of heat, and to render any after-heating of the single thickness superfluous. I have found, for instance, that by inserting a compact mass or roll of paper for a period sufficiently long to allow it to absorb the melted paraffine in its outer part or portions only, and by subjecting the roll thus treated to heat for a considerable period after it is removed from the paraffine, the paraffine thus absorbed will be distributed throughout the entire mass of paper in such quantities that the layers will have no tend-

ency to stick together, and may be separated, or the roll unwound, without the presence of heat, and the product will form a good merchantable article without further treatment. I have found it practicable, also, especially in the use of paper sufficiently thick or strong not to be readily torn, to unroll or unwind the paper from a paraffine-saturated roll when the latter has cooled to a greater or less extent, even when a sufficient quantity of paraffine has been absorbed to cause the layers to stick together. In this case the paper may be heated after it has been unrolled, to cause the diffusion of the paraffine thereon, as above set forth; or it may be used without the application of heat. It is preferred, however, to unroll the paper in the presence of heat, inasmuch as by so doing the layers may be readily separated, while at the same time the paper is given a smooth and even appearance.

The quantity of paraffine absorbed by or into the compact mass or roll may be limited in several ways—as, for instance, the mass of paper or roll may, instead of being allowed to remain in a paraffine bath or heated chamber sufficiently long to become heated throughout, and thereby placed in a condition to readily absorb the paraffine, be kept at a comparatively low temperature inserted for a short time in the bath, and then heated to cause the absorption into its interior of the limited amount of paraffine absorbed during its immersion in the bath, it being a well-known fact that the heating of paper increases the rapidity of the absorption of paraffine, while, on the other hand, a comparatively low temperature therein causes the paraffine to congeal after it has penetrated only a short distance into the body of the paper, and thereby limits the quantity which may be absorbed in a given time.

A method of treating separating frames or mats, in which the absorption of paraffine is limited in the manner last stated, is set forth in a prior application for Patent No. 173,306, filed August 3, 1885, by the present applicant, said application embracing a method constituting one way of carrying out the invention herein broadly claimed. The quantity of paraffine absorbed by the mass of paper may be otherwise limited by keeping the paraffine bath at a lower temperature, or by compressing the mass or roll more closely, so as to make the latter less porous.

Still another obvious and practicable way of limiting the quantity of paraffine taken up by the mass or roll is to apply the paraffine to the said mass or roll in a limited quantity—as, for instance, by placing or revolving a mass or roll in a tank containing a certain weight or bulk of paraffine in proportion to the weight or bulk of the roll. The process above mentioned, furthermore, may be carried out by folding or compacting the paper into a mass otherwise than by rolling it—as, for instance, paper in continuous lengths may be folded back and forth upon itself, so as to form a rectangular mass, and the layers thus placed may be held in contact with each other by suitable clamping or pressure devices, so that when the mass is subjected to the melted paraffine the quantity of paraffine taken up by the paper will be limited in the same way as when the latter is rolled.

My invention may be more readily understood by reference to the accompanying drawings, in which are illustrated several different means of carrying out the process above set forth, together with the apparatus forming the subject of claims herein.

In said drawings, Figure 1 is a perspective view of a long sheet or strip of paper in the form of a compact roll adapted for the application of melted paraffine in the manner proposed by me. Fig. 2 is a sectional view illustrating a tank containing melted paraffine with a roll similar to that shown in Fig. 1 immersed therein. Fig. 3 is a sectional view illustrating the application of heat to the paper as it is unwound from the roll for the purpose of giving a finished appearance thereto. Fig. 4 is a perspective view of a compact mass of paper consisting of a series of layers placed in contact with each other, the mass being formed by folding a long or continuous strip back and forth and the layers being held in contact with each other by being clamped between opposing perforated plates. Fig. 5 is a view illustrating a similar folded mass with its clamp-plates immersed in a bath of melted paraffine. Fig. 6 is a view showing in section a heated chamber, within which a folded mass of paper (shown in Figs. 4 and 5) may be placed in drawing off or separating the layers. Fig. 7 is a sectional view illustrating a heated chamber adapted for the convenient treatment of paper in the roll, said chamber being provided with a tank for paraffine and with a vertically-movable support for the rod, whereby the latter may be allowed to enter the paraffine at desired times. Fig. 8 is a sectional view of a tank for melted paraffine, and supporting-rollers adapted to sustain a roll of paper over said tank, and adapted for applying paraffine to the surface of the latter. Fig. 9 is a sectional view of an apparatus for applying paraffine in case several strips of paper are rolled together. Fig. 10 is a similar view illustrating the application of paraffine to several thicknesses of paper carried over a roll in contact with each other. Fig. 11 is a detail sectional view of an apparatus for treating paper when in the form of a roll, illustrating devices for dipping the roll in the paraffine automatically at desired intervals. Fig. 12 is a sectional view of the device shown in Fig. 11, taken upon line $x\ x$ of said figure.

In the said drawings, A, Fig. 1, indicates a roll of paper such as will be used in carrying out my invention in the way which I now consider the best one for practical use, this obviously being the most simple and convenient way of forming a compact mass of paper in

which the layers are held with equal pressure closely in contact with each other. In Fig. 2 the roll A is shown as immersed in melted paraffine within a tank, B, which is shown as provided at its bottom with the usual cored passages, *b b*, for the passage of steam to heat the tank. In Fig. 3 the paper is shown as being drawn from the roll over a series of heating-pipes, C, employed to retain the air in the immediate vacuity of the paper at a temperature higher than the melting-point of the paraffine, whereby the latter is caused to flow evenly over the paper, and thereby give a smooth and even appearance to the latter. In case the paper is unwound from the roll before the latter has become cool after its removal from the heated paraffine, the same effect may be produced if the unwinding takes place in the presence of heat or in a room sufficiently warm to prevent the chilling or congealment of the paraffine upon the outer surface of the roll, the paraffine obviously in such case being allowed to distribute itself in the single thickness of paper after the latter has been separated from the body of the roll and before it has become cooled or hardened. As a more simple way of performing the operation of unrolling the paper, whereby the roll is kept warm and the paper drawn therefrom is at the same time subjected to heat, I prefer to inclose the roll during unwinding in a closed chamber, which is suitably heated, and in which the separated layer of paper is exposed to heat for a sufficient time to accomplish the complete diffusion of the paraffine thereon, as above set forth.

Figs. 4, 5, and 6 illustrate the treatment of a continuous strip of paper folded into a compact mass in the same manner as described in connection with the roll shown in Figs. 1, 2, and 3. In said figures, D indicates the mass of folded paper, which is held between clamp-plates E E, preferably perforated to permit the access of the paraffine to the parts of the paper over which the plates are placed, said plates, as shown, being held together by bolts *e*, provided with nuts *e'*. In Fig. 5 the paper held between the plates E E is shown as immersed in paraffine contained in a tank, B, and Fig. 6 illustrates the operation of separating the folded layers of paper—in this case performed in a closed chamber, F, heated by a steam-coil, F', and provided with an opening, *f*, in the top wall of the chamber, through which the paper passes to a suitable roll or reel, upon which it is wound, or elsewhere.

Fig. 7 illustrates an apparatus for carrying out the process forming my invention, in which the roll, instead of being completely immersed and allowed to become permeated throughout at one operation, is partially immersed while the paper is being drawn therefrom. In this operation the paraffine strikes or permeates into the roll in advance of the unwinding of the paper, and the paraffine coming in contact with the roll will pass through the extreme layer thereof, and will become distributed in the adjacent layers of the roll before said outer layer is separated from the roll in unwinding. In said Fig. 7, G indicates a closed chamber containing a tank, B, for melted paraffine, steam-coils G', and a movable support, G^2, for sustaining a rod, A, by means of a mandrel, *a*, inserted through the latter, which engages suitable bearings therefor upon said supports, the paper in this case being shown as drawn from the chamber over a guide-roll, *h*, and wound upon a roll, H, located outside of said chamber. In the use of an apparatus thus constructed the lower part of the roll may revolve constantly in the melted paraffine, or it may be immersed intermittingly, according to the kind of paper being operated upon, the closeness with which it is wound, the quantity of paraffine it is desired to introduce into the paper, and other circumstances. With the kinds of paper commonly used, however, it is found that a desired supply of paraffine will be given by bringing the lower part of the roll into the paraffine during one revolution of the roll at considerable intervals of time, the paraffine taken up by one such dipping serving to sufficiently permeate a number of the outer thicknesses or layers of paper. Any suitable form of movable support for the rollers may be used, that shown in said figure consisting of connected pivoted bars G^2, extending through the walls of the chamber and provided with a pawl, *g'*, engaging a ratchet-plate, g^2, whereby the roll may be held in a suitable position when immersed, and raised and lowered as desired. It will of course be understood that the paper, after its exit from the heated chamber, will be allowed to pass through the cooler outer air for a sufficient time, to allow the chilling or hardening of the paraffine therein. For this purpose the guide-roll *h* will usually be located much farther from the chamber than shown in the drawings, the paper web being therein shown as broken away, to indicate that its part between the said guide-roll *h* and the chamber is considerable.

Another apparatus is shown in Fig. 9, which is generally similar to that shown in Fig. 8, means for moving the roll vertically in this case, however, being omitted from the drawings. In this case the paper roll A consists of four separate strips or strands, *a' a'*, of paper wound together upon the roll, said strips being separated within the heated chamber G by means of guide-rollers *h'*, located outside of said chamber, the strands being arranged to pass over said guide-rollers to a number of rolls or to a single roll, such as is indicated by H', in said Fig. 9. It is of course understood that the roller A may in this case be made vertically movable in the same manner as before described.

Fig. 10 illustrates an apparatus in which the paraffine is applied to several layers or strips of paper passing together in a solid body or mass partially around a revolving cylinder or drum, whereby paraffine applied to the said body of paper will come in contact with the

outer layer and edges of said mass only, and the inner layers thereof will obtain a supply of paraffine by absorption through the outer layer in the same manner as when a single layer or several layers are formed in a roll. As shown in said figure, the chamber G, the paraffine-tank B, and the heating-coil G′ are constructed as hereinbefore described; but over said tank, in place of the roller A, is located a revolving drum, I, arranged to dip in its lower part into the paraffine within the tank, and provided with a smooth cylindric exterior surface, over which the layers of paper to be paraffined pass. The said layers, indicated by a^2, pass from a series of rollers, A′, over guide-rollers h^2, through suitable apertures in the sides of the chamber, and are brought together over a single guide-roller, H^2, from which they pass to the drum I, a second guide-roller, H^3, preferably being provided within the tank near said drum, over which the several layers are trained, and from which they pass through the sides of the chamber to a series of guide-rollers, h^3, after which they may be wound upon separate rollers or a single roll, such as is shown in Fig. 9. The several layers in this construction are desirably separated before passing out of the chamber, in order that they may be separately subjected to heat, for the purpose hereinbefore specified. It will of course be understood that in an apparatus embodying the general features shown in Fig. 10 the guide-roller H^3 may be omitted, and the several layers carried directly from said drum to the roll or rolls upon which the finished product is wound, as indicated in dotted lines in Fig. 10, the construction herein shown being used merely as a matter of convenience, in order to enable the layers to be carried laterally out of the chamber.

The number of layers which can be successfully operated upon at one time by the apparatus shown in Fig. 10 will depend upon the thickness and other qualities of the paper, the speed with which the layers are drawn through the paraffine bath, and the temperature of the chamber and of the melted paraffine. In the use of a considerable number of layers, for instance, the paraffine will be kept at a relatively high temperature and the paper moved slowly, in order to facilitate the absorption of the paraffine into the mass, and to give time for its diffusion throughout all of the layers before they are separated. In operating upon a few layers at a time, on the contrary, the paper may be moved more rapidly, and the paraffine may be kept at a lower temperature, inasmuch as the paraffine will strike quickly through all of the layers as soon as the latter enter the bath. It is to be noted in this connection that the quantity of paraffine applied to the paper, or, in other words, the amount of paraffine absorbed by each layer, may be controlled to a considerable extent by varying the number of layers operated upon at once. This may be more readily understood by a consideration of the fact that the thin coating of fluid paraffine adhering by capillarity to the exterior surface of the outer layer of the several layers passing around the drum, will become absorbed by the other layers; or, in other words, will become distributed equally among said other layers as soon as the several layers pass above or out of the melted material. From this fact it is apparent that in case a considerable number of thin layers are carried together around the drum the adhering fluid coating absorbed by or distributed in the several layers will add to each a quantity of paraffine so inconsiderable as to be imperceptible. In case a small number of layers are present, however—as, for instance, only four—the said adhering coating upon the outer layer will be distributed among the three other layers, so that one-fourth of the said coating will be finally present in each layer. It is to be understood, however, that this additional amount of paraffine absorbed by the several sheets will not give to the latter an amount of paraffine greater than will make a useful product. In case, however, the quantity of material taken up by the paper when operating upon only a few sheets at once, under certain conditions as to heat and speed of movement, is found to be too great, the quantity applied may be readily lessened by moving the paper more rapidly, by decreasing the temperature of the paraffine or of the chamber within which the operation takes place, or by straining the paper more tightly over the drum, so as to decrease the porosity of the mass or body of the paper.

Figs. 11 and 12 of the drawings illustrate a device whereby a roll of paper arranged for carrying out the process in the manner described in connection with Figs. 7 and 9 may be raised and lowered automatically to cause it to dip at required intervals into the paraffine bath, the particular device shown obviously being only one of many which may be applied for the purpose. As illustrated in the said figures, the ends of the mandrels *a*, upon which the roll A is wound, are provided with bearings in vertically-movable bars J, having sliding bearings upon the walls of the chamber G, or other suitable supports, and provided with projections *j*, resting upon cams K′, attached to a shaft, K, in such manner that the said bars and the rolls supported thereby are sustained by the said cams. The said cams are so shaped as to allow the roller to rise and fall during the rotation of the shaft, and the latter is driven at a considerable speed to cause a downward movement of the roll at desired intervals. In the particular construction illustrated, the shaft is provided with a series of belt-pulleys, K^2, whereby it may be driven from a series of pulleys, K^3, upon a counter-shaft, K^4, the pulleys upon the counter-shaft being made considerably smaller than those upon the shaft K, whereby the latter is given a relatively slow speed of rotation.

To provide for adjusting the position of the paper-roller relatively to the surface of the paraffine in the tank B, so as to enable the roll

to be immersed to a desired extent, notwithstanding differences in the size of the roll and in the quantity of paraffine in the tank, the projections *j* are preferably made to slide upon the bars J, and adjusting-screws *j'*, connecting suitable lugs, *j''*, upon the said bars with the said projections *j*, are employed to move the latter, as required, for the purpose above mentioned.

Instead of applying the melted paraffine to the exterior of a roll or compact mass of paper by wholly or partially immersing the said roll or mass in the paraffine, the latter may be applied by suitable intermediate transferring devices—as, for instance, by means of rollers which revolve in a paraffine bath and rest in contact with the said roll during the rotation of the latter. A convenient construction in a device of the kind last mentioned, for applying paraffine to the exterior of a roll, is shown in Fig. 8, in which a paper roll, A, is shown as resting upon and as sustained by two rollers, L, which are provided with suitable bearings at their ends and which dip at their lower parts into paraffine contained in the tank B. (Shown in said figure.) In carrying out my improved process by the use of the device last described, it is entirely obvious that the paraffine carried and applied to the exterior of the paper roll by the supporting-rollers L will be absorbed by the outer layers of the roll in such manner as to keep a number of the said outer layers saturated in advance of the unwinding of the paper, while at the same time the presence is avoided of an undesirable quantity of paraffine in or upon the paper unwound from the roll, by the absorption of any surplus paraffine upon the said outer layer into the mass of the roll before the outer layer is separated from said roll.

The same mechanical features illustrated in Fig. 8 may be employed for sustaining the roll in a desired position relatively to the paraffine when the exterior part of the roll itself is allowed to dip into the paraffine. The dotted lines in said Fig. 8 indicate the level of the paraffine in the tank when the rollers L are used for supporting the roller in the manner last described.

Aside from the obvious advantages existing in the use of the process hereinbefore set forth, as a means of regulating the quantity of paraffine applied to the paper, the product of said process is found to be superior in quality to that heretofore produced, for the reason that in carrying out said process the paper, after the paraffine has been applied thereto, need not be subjected to the action of any rubbing or scraping devices to remove the surplus paraffine from its surface; but the melted paraffine may be, and desirably is, allowed to diffuse itself throughout the paper while hot, and the paraffine then allowed to cool before the paper is brought into contact with any guide surface or roller, so that the paper does not appear streaked and uneven, as is liable to be the case with paper made by processes heretofore used, but presents a smooth, even, and translucent appearance.

Certain novel features of construction in the apparatus herein shown constitute part of my invention, and are covered by the appended claims.

It is entirely obvious that melted paraffine may be applied to a mass or body of paper consisting of a number of separate sheets held closely in contact with each other, with the same result of limiting the amount applied to each sheet as when the paper treated is in a long web or band. By reason of the inconvenience which the handling of a great number of sheets will involve, however, paper of ordinary thickness will usually be treated in the form of a long or practically continuous band or web, as above set forth; but in the use of thicker paper or straw-board it may be found more convenient to treat it in separate sheets, as set forth, for instance, in the prior application, Serial No. 173,306, hereinbefore alluded to.

I claim as my invention—

1. The improvement in the art of manufacturing paraffined paper which consists in applying paraffine in a melted state to a mass or body of paper consisting of multifold thicknesses held in contact with each other, substantially as described.

2. The method of making paraffined paper which consists in applying paraffine in a melted state to a compact roll of paper, substantially as described.

3. The method of making paraffined paper which consists in applying melted paraffine to a mass or body of paper consisting of multifold thicknesses or layers held in contact with each other, and thereafter separating the layers and applying heat to the layers after they are separated, substantially as described.

4. The method of making paraffined paper which consists in applying melted paraffine to a compact roll of paper, and thereafter unwinding the roll in the presence of heat, substantially as described.

5. The method of making paraffined paper which consists in partially immersing a compact roll of paper in a bath of melted paraffine and at the same time rotating the roll and drawing the paper therefrom, substantially as described.

6. The method of making paraffined paper which consists in partially immersing a compact roll of paper intermittingly in a bath of melted paraffine and at the same time rotating the roll and drawing the paper therefrom, substantially as described.

7. An apparatus for paraffining paper, comprising a heated chamber, a paraffine-tank, and means sustaining a paper roll over the tank, substantially as described.

8. An apparatus for paraffining paper, comprising a heated chamber, a paraffine-tank, and a vertically-movable support for sustaining a paper roll over the tank, substantially as described.

9. An apparatus for paraffining paper, comprising a heated chamber, a paraffine-tank, a vertically-movable support for sustaining a paper roll over the tank, and means giving a reciprocatory movement to the said support, whereby the roll may be intermittingly dipped into the paraffine, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

WARREN B. HOWE.

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