May 1, 1934. C. A. THOMAS ET AL 1,957,370

PAPER MANUFACTURE

Filed Aug. 30, 1929

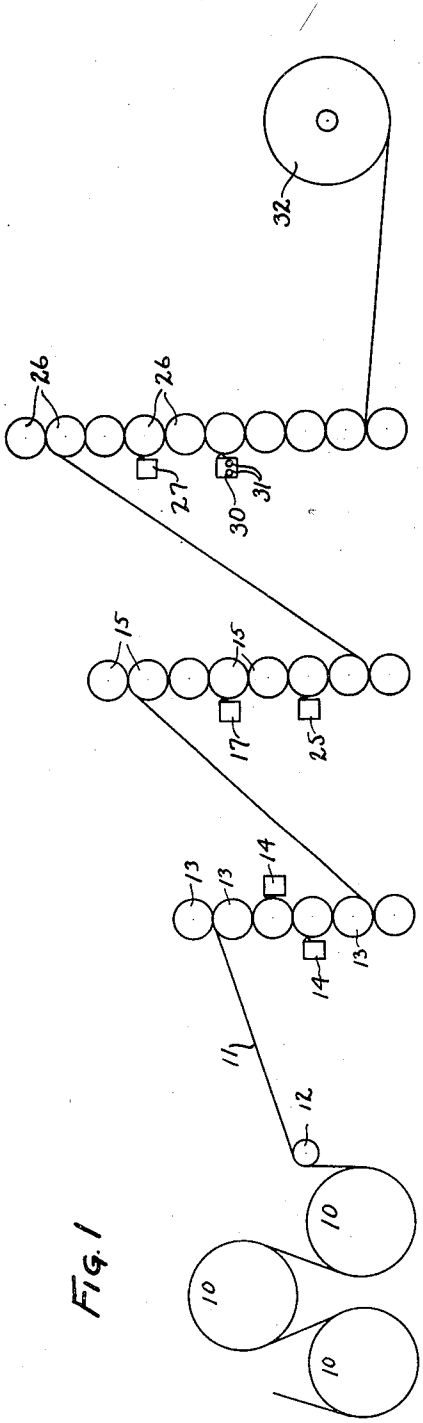


FIG. 1

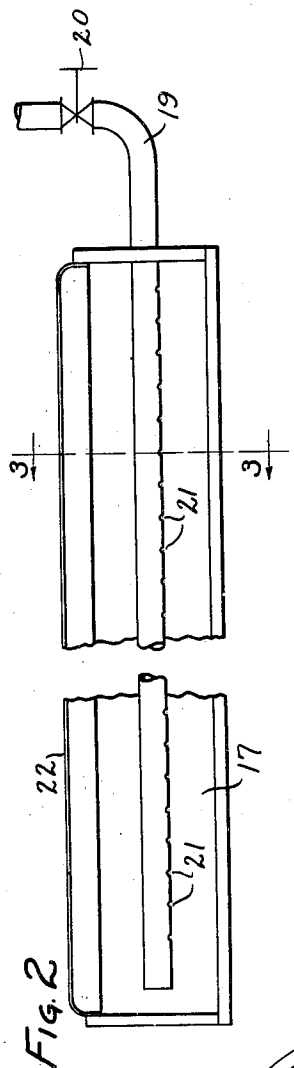


FIG. 2

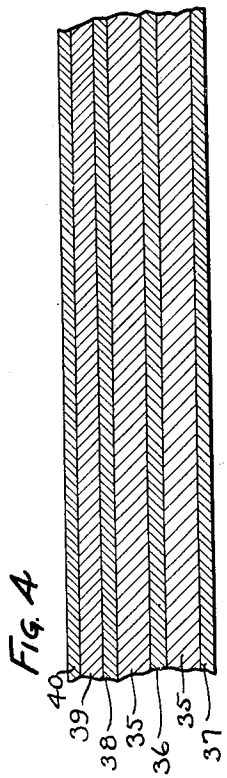


FIG. 4

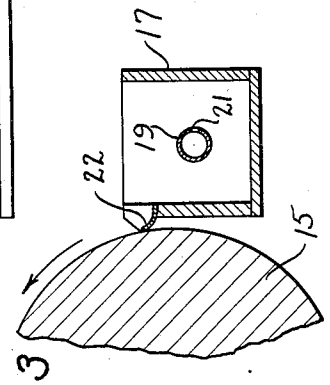


FIG. 3

Inventors

Charles A. Thomas

Joseph H. Swan III

By Maréchal and Noe

Attorneys.

Patented May 1, 1934 1,957,370

UNITED STATES PATENT OFFICE

1,957,370

PAPER MANUFACTURE

Charles A. Thomas, Dayton, and Joseph H. Swan, 3d, Middletown, Ohio, assignors to The Gardner-Richardson Company, Middletown, Ohio, a corporation of Ohio

Application August 30, 1929, Serial No. 389,422

17 Claims. (Cl. 92—40)

This invention relates to the manufacture of paper, and particularly to the manufacture of board adapted for use in the making of containers and the like.

One of the principal objects of the invention is to provide a paper or board which is greaseproof and moistureproof, is sufficiently flexible and elastic to permit bending, is substantially odorless and tasteless, stands up well in use and does not objectionably deteriorate on standing for considerable intervals of time, and is commercially economical.

Another object of the invention is to provide a method of forming such a greaseproof paper or board, which is simple, economical and highly effective, and which permits the formation of the completed product in a single operation or processing.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and appended claims.

In the drawing, which discloses a preferred embodiment of the invention—

Fig. 1 is a side elevational diagrammatic view of apparatus which is constructed to carry out the method of this invention;

Fig. 2 is a side elevational view on an enlarged scale of one of the coating applying means;

Fig. 3 is a vertical sectional view taken on the plane of the line 3—3 of Fig. 2; and

Fig. 4 is a vertical sectional view on an enlarged scale of a piece of container board made in accordance with this invention.

This invention is particularly applicable to the rendering of paper or board, such as container board, impervious to grease, so that containers made therefrom may be used for packaging greasy or oily substances which would otherwise penetrate through the package. When such a product is used for packaging foodstuffs, such for example as peanut butter or the like, it is particularly desirable that the surface of the container board be substantially tasteless and odorless. The coating should be of such character as to form an impervious layer on the surface of the board without pinholes which destroy the effectiveness of the coating, and it should be sufficiently flexible and elastic to permit bending of the board, such as is necessary in the formation of the box or container, without cracking. The coating should also be of a durable nature, and one that will stand up well in use and will not objectionably deteriorate upon standing for considerable intervals of time. In accordance with the present invention, a coated paper product is formed which is unusually efficacious in satisfying the above requirements.

Referring to the drawing, numeral 10 indicates a plurality of drying drums forming part of a paper or board machine for the formation of and drying of the paper or board product. This machine may be of conventional construction having an initial forming zone where the pulp stock is formed into a traveling web, a plurality of press rolls for pressing the formed wet web, and then a plurality of drying drums 10 for drying the pressed web. As any suitable conventional machine for forming paper or board may be used, further illustration of that initial part of the forming machine is not made.

The paper or board indicated at 11 passes over a guide roll 12 and thence to a first calender stack having calender rolls 13. Any conventional form of calender stack may be used; as shown, a first calender stack of six rolls is provided, some of the rolls having water boxes 14 for applying a film of water to the rolls and thence to the paper to assist in the calendering treatment, which serves to smooth down fuzz or protruding fiber and provide a good finish upon the paper product. The calendered sheet then passes to a second calender stack, comprising eight rolls indicated at 15, where a second calender treatment is given.

Associated with one of the rolls 15 is a coating applying trough 17, shown more in detail in Figs. 2 and 3. This trough comprises a rectangular box to which coating solution of a greaseproofing nature is supplied from a suitable supply vat (not shown) through pipe 19 having control valve 20. Pipe 19 extends substantially throughout the length of trough 17 and has perforations 21 through which the coating solution is uniformly supplied to the trough. The trough 17 is spaced slightly from the surface of the calender roll 15, and the upper lip of the trough is provided with a flexible strip or rubber flap 22 which bears against the surface of the calender roll and over which the coating solution flows onto the surface of the calender roll in controlled amount. The film of coating solution thus applied to the surface of the roll is carried by the roll to the nip thereof into contact with one surface of the paper, and the pressure of the calender stack permits a controlled thin film of the coating solution to be applied to this surface of the paper.

The greaseproofing coating composition applied at this point comprises rubber latex, a water solution of an oil insoluble adhesive such as sodium silicate, and an alkaline compound such as ammonia or sodium hydroxide adapted to main-

tain the coating in an alkaline condition. The rubber latex is a relatively concentrated water solution or emulsion of the pure sap of the rubber tree in colloidal state. The addition of an oil insoluble adhesive such as sodium silicate to the rubber latex imparts superior characteristics of adhesiveness and greaseproofness, thereby providing an excellent composition for this purpose. Rubber latex has qualities of elasticity and spreading ability, and enables a relatively thin film of the coating to be used with satisfactory covering power and with the formation of a substantially impervious layer. Rubber latex is also found to possess an advantageous characteristic in that it lays the fuzz which may be protruding from the surface of the paper and covers up irregularities of the surface; it is also a good moistureproofing and waterproofing agent. The paper or board thus formed may be bent, such as is necessary in the formation of containers, without objectionable cracking of the coating. Other alkali metal silicates, such as potassium silicate can be used in place of sodium silicate; but from the standpoint of economy the latter is preferred. The presence of an alkali in the coating prevents deterioration of the same upon standing, and serves to increase the effective life of the coating. A proportion of glycerin or other polyhydric alcohol, such as ethylene glycol, may be added to the coating to further increase the spreading qualities and the resiliency of the coating. The addition of the glycerin is found particularly advantageous where the coating is applied at the calenders, as this tends to prevent objectionable sticking of the coated product to the calender rolls.

In the preparation of the coating composition, the alkali metal silicate is made up in a relatively concentrated water solution. Thus where sodium silicate is used, a solution containing in excess of about 15% sodium silicate is preferred. Satisfactory results may be secured with solutions containing from about 15% to 60% sodium silicate by weight. The alkaline compound such as ammonia is preferably added to the rubber latex, and then the sodium silicate solution and the latex are mixed. Satisfactory results have been secured with compositions containing from 10% to 90% by volume of latex, the balance being primarily a water solution of sodium silicate of the above strength, this composition containing about 1% to 2% by weight of the total solids of an alkaline compound such as ammonia adapted to preserve the alkalinity of the coating.

As an example of a very satisfactory coating composition where one coat is applied to the paper or board, the following is mentioned: sodium silicate solution of about 38% strength and rubber latex containing about 38% by weight of rubber hydrocarbons and the balance water and ammonia, are mixed in the proportions of about 50% by volume of rubber latex and 50% by volume of sodium silicate solution to form the liquid coating composition.

Preferably a plurality of coats of the greaseproofing composition are applied to the board, particularly where the application is made at the calenders. The first coat is preferably made up of a high percentage of rubber latex, such for example as in excess of 50% of rubber latex by volume, and succeeding coats are made with compositions containing a lesser proportion of rubber latex and a greater proportion of alkali metal silicate, the composition of a succeeding coat containing for example in excess of 60% of the alkali metal silicate solution by volume. This imparts high moistureproofing and waterproofing qualities and also high elasticity to the coat which is applied first to the sheet. The outer coat or coats containing higher percentages of sodium silicate impart high greaseproofing qualities to the board. The undercoats also tend to lay the fuzz and provide an impervious surfacing for the outer coats which are more greaseproof in their nature, with the result that a more durable and effective coating is provided.

Very satisfactory results have been secured by the application of three coats; the first coat containing approximately 75% by volume of rubber latex, 15% by volume of a water solution of sodium silicate of a strength in excess of 25%, preferably 38% strength, and 10% glycerin; a second coat containing by volume approximately 40% rubber latex, 50% of sodium silicate solution of the above strength and 10% glycerin; and a third coat containing 10% rubber latex, 80% sodium silicate solution of the above strength and 10% glycerin.

Referring to the drawing, apparatus is disclosed for the application of a plurality of greaseproofing coats as above described. The first greaseproofing coating is applied at the coating trough 17. A second coating is applied by a coating trough 25, which may also be associated with one of the succeeding rolls 15 of the second calender stack, the paper being thus calendered between the separate applications of the coating. The paper then passes from the second calender stack to a third calender stack, shown as comprising ten rolls indicated at 26. A third coating applying trough 27 is associated with one of these rolls for the application of the third greaseproofing coat. The coating troughs 25 and 27 may be constructed similarly to the trough 17.

In accordance with the present invention an overlying water insoluble wax coat is applied over the greaseproofing coating in order to protect the under-greaseproofing coating and to provide a substantially odorless and tasteless outer surface. Very satisfactory results are secured with paraffin, beeswax, Montan wax, or other well known water insoluble waxes. From the standpoint of economy and ease of application paraffin is preferred for this purpose. The overlying wax coat not only protects the under-greaseproofing coat from exposure and deterioration, but also adds to the waterproofness and moisture-proofness of the coating, which is particularly advantageous in the packaging of deliquescent substances, such as crackers for example.

For the purpose of applying the top wax coat a fourth coating applying trough 30 is associated with one of the succeeding rolls 26 of the third calender stack. This trough may be provided with steam coils 31 for maintaining the paraffin in a molten condition, or a composition of paraffin size may be used in place of the paraffin, in which case heat will not be necessary to maintain the wax coating in the proper fluid condition. The wax coating is thus applied to the surface of the calender roll which feeds it to the nip and there applies it to the coated surface of the paper. The calender rolls of the various calender stacks are maintained heated during operation to about 220° Fahrenheit or somewhat higher, and a suitable calender pressure, such as about three to four tons, is applied. The heat applied at this point is found to over-

come to a certain extent objectionable odor from the rubber latex, and the overlying wax coat renders the product satisfactorily odorless. The heat and pressure applied in the calendering treatment smooth out the various coatings, including the final paraffin layer, so that a substantially impervious film is produced. The coated paper is passed from the third calender stack to a reel 32 where it is wound into a roll of paper, or it may be passed directly to cutters (not shown) where it is cut into sheets adapted for making into containers.

In order to further improve the quality of the paper product, the paper or board is preferably first subjected to a sizing treatment before the coating is applied. Thus the board, or the layer of the board forming the outer surface which receives the coating, is preferably a "hard-sized" sheet, or one which has been made up from paper stock to which a sufficient quantity of size, such as rosin size, or paraffin size, has been added as to materially retard the rate at which water or ink penetrates into the sheet. Very satisfactory results are secured by forming a sheet from paper stock to which rosin size has been added at the beater in the proportion of about 80 to 100 pounds or more of size to 1200 pounds of pulp. A sheet which will stand up for approximately five minutes or over in the water drop test, which means that water will not penetrate the sheet in that time, is satisfactory. Or the sheet may be given a surface sizing by an application of a size to the surface of the formed web, using suitable conventional sizing materials such as above specified. The surface sizing may be applied during the formation of the sheet prior to the application of the greaseproofing coating. A material such as starch may be added to the pulp stock in addition to the size, and this assists in producing a final sheet having less fuzz or protruding fibers on the surface. The greaseproofing coating is applied to the hard sized sheet, or on top of the surface sizing, the greaseproofing coating being thereby prevented from objectionably sinking into the sheet with resultant deterioration. The paper or board is thus completely formed by a single operation, the pulp stock being formed into a web and the traveling web being dried and coated, resulting in economy in operation and handling of the product.

Referring to Fig. 4, a section through a preferred sheet of board is disclosed, which is found to be effective for use in containers for the packaging of greasy materials, and which protects the materials from water and damp atmospheric conditions. The sheet comprises inner layers of ordinary board stock 35, with an intermediate layer 36 of asphalt material, such as an emulsion of asphalt and clay. The outer surfaces of the board are formed of good grade liner stock, there being a bottom liner 37 and a top liner 38. The top liner 38 which is adapted to form the interior of the container and to receive the greaseproof coating, is a hard-sized sheet.

This board as above described may be formed on a conventional cylinder mold machine having a number of molds to form the various layers or plies of the sheet, these plies being brought together and united in the ordinary manner. Thus a conveying felt of the forming machine passes first across a cylinder mold containing the bottom liner stock and forms a web, and then passes successively across cylinder molds provided with board stock, asphalt emulsion, board stock, and finally top liner stock to form the complete built-up sheet of container board. The top liner may be surface sized instead of having the size distributed throughout the sheet. The wet board as thus formed is passed through the presses, then dried by the driers 10, and is then calendered; the greaseproof coating 39 is applied in stages with a final overlying water insoluble wax coating 40, the board being subjected to calendering treatment intermediate and after the various coats. This sheet as thus formed is protected from water and moisture tending to penetrate from the outside into the interior of the container by the intermediate asphalt layer, and is made effectively greaseproof, waterproof and moistureproof by the coating applied to the interior surface of the container.

While the forms of invention disclosed herein constitute preferred embodiments thereof, it is to be understood that the invention is not limited to these precise forms, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A paper product of the character described comprising a sheet having a plurality of greaseproof surface coats of compositions of rubber latex and an alkali metal silicate, the composition for a successive coat having a lesser proportion of rubber latex and a greater proportion of alkali metal silicate than the composition of a previous coat.

2. A paper product of the character described comprising a sheet having a plurality of greaseproofing coats of compositions of rubber latex and an alkali metal silicate, the composition of a successive coat having a lesser proportion of rubber latex and a greater proportion of alkali metal silicate than the composition of a previous coat, said coats also containing a polyhydric alcohol.

3. A paper product of the character described comprising a sheet having a plurality of greaseproofing surface coats of compositions of rubber latex and an alkali metal silicate, the composition of a coat first applied to the sheet containing in excess of 60% rubber latex by volume, and the composition of a succeeding coat containing in excess of 60% of an alkali metal silicate solution by volume.

4. A paper product of the character described comprising a sheet having a first greaseproofing surface coat containing by volume approximately 75% rubber latex, 15% sodium silicate solution of a strength in excess of 25%, and 10% glycerin; a second greaseproofing coat containing by volume approximately 40% rubber latex, 50% sodium silicate solution of a strength in excess of 25%, and 10% glycerin; and a third greaseproofing coat containing by volume approximately 10% rubber latex, 80% sodium silicate solution of a strength in excess of 25%, and 10% glycerin.

5. The method in the formation of a greaseproof paper in a continuous operation which comprises forming pulp stock into a traveling web, drying the traveling web, applying a greaseproofing coating containing essentially rubber latex and an oil insoluble adhesive to the traveling web, and calendering the coated web.

6. The method in the formation of a greaseproof paper in a continuous operation which comprises forming pulp stock into a traveling web, drying the traveling web, calendering the dried web, applying a greaseproof coating containing essentially rubber latex and an oil insoluble ad-

hesive to the calendered web, and hot calendering the coated web.

7. A paper product of the character described comprising a sheet having a plurality of superposed greaseproofing coatings containing rubber latex and an oil insoluble adhesive, the proportion of rubber latex being greater and the proportion of oil insoluble adhesive being less in an underlying coating than in an overlying coating.

8. In the manufacture of a greaseproof paper in a continuous operation in which pulp stock is formed into a traveling web and the traveling web then dried, the method which comprises applying a surface sizing to the traveling web, applying a greaseproofing coating over the surface sizing of the traveling sized web, and then calendering the traveling sized and coated web.

9. In the manufacture of a greaseproof paper in a continuous operation in which pulp stock is formed into a traveling web and the traveling web then dried, the method which comprises applying a greaseproofing coating comprising a plurality of layers having different predetermined characteristics to the traveling web, applying an overlying layer of a water insoluble wax over the greaseproofing coating, and then hot calendering the coated web.

10. In the manufacture of a greaseproof paper in a continuous operation in which pulp stock is formed into a traveling web and the traveling web then dried, the method which comprises applying a greaseproofing coating containing a polyhydric alcohol to the traveling web, and then calendering the coated web.

11. In the manufacture of a greaseproof paper in a continuous operation in which pulp stock is formed into a traveling web and the traveling web then dried, the method which comprises simultaneously applying a greaseproofing coating and calendering the traveling web.

12. In the manufacture of a greaseproof paper in a continuous operation in which pulp stock is formed into a traveling web and the web then dried and wound into a roll, the method which comprises applying a plurality of greaseproofing and moistureproofing coatings having predetermined differing characteristics to the traveling web after drying and prior to the winding of the web into the roll.

13. A greaseproof container board adapted for the packaging of greasy materials, comprising a paper sheet having a hard-sized paper surface layer, the exposed surface of the paper surface layer having a flexible greaseproofing coating including rubber latex as an essential ingredient, the coating being maintained primarily on the surface of the sheet by the sizing in the paper surface layer to provide a durable greaseproofing coating.

14. A greaseproof container board adapted for the packaging of greasy materials, comprising a paper sheet having a hard-sized paper surface layer, the exposed surface of the paper surface layer having a flexible greaseproofing coating including as essential ingredients rubber latex and an oil insoluble adhesive, the coating being maintained primarily on the surface of the sheet by sizing in the paper surface layer to provide a durable greaseproofing coating.

15. A greaseproof container board adapted for the packaging of greasy materials, comprising a paper sheet having a hard-sized paper surface layer, the exposed surface of the paper surface layer having a flexible greaseproofing coating including as essential ingredients rubber latex, an oil insoluble adhesive and a polyhydric alcohol, the coating being maintained primarily on the surface of the sheet by the sizing in the paper surface layer to provide a durable greaseproofing coating.

16. A greaseproof container board adapted for the packaging of greasy materials, comprising a paper sheet having a hard-sized paper surface layer, the exposed surface of the paper surface layer having a multiple layer greaseproofing and waterproofing coating, a lower layer of the coating containing a preponderating proportion of rubber latex and a lesser proportion of an oil insoluble adhesive, and an upper layer of the coating containing a preponderating proportion of an oil insoluble adhesive and a lesser proportion of rubber latex.

17. A greaseproof container board adapted for the packaging of greasy materials, comprising a paper sheet having a hard-sized paper surface layer formed from a furnish containing both size and starch, the exposed surface of the sheet having a flexible greaseproofing coating including rubber latex as an essential ingredient, the coating being maintained primarily on the surface of the sheet by the sizing and starch in the paper surface layer to provide a durable greaseproofing coating.

CHARLES A. THOMAS.
JOSEPH H. SWAN, III.