

Oct. 9, 1962

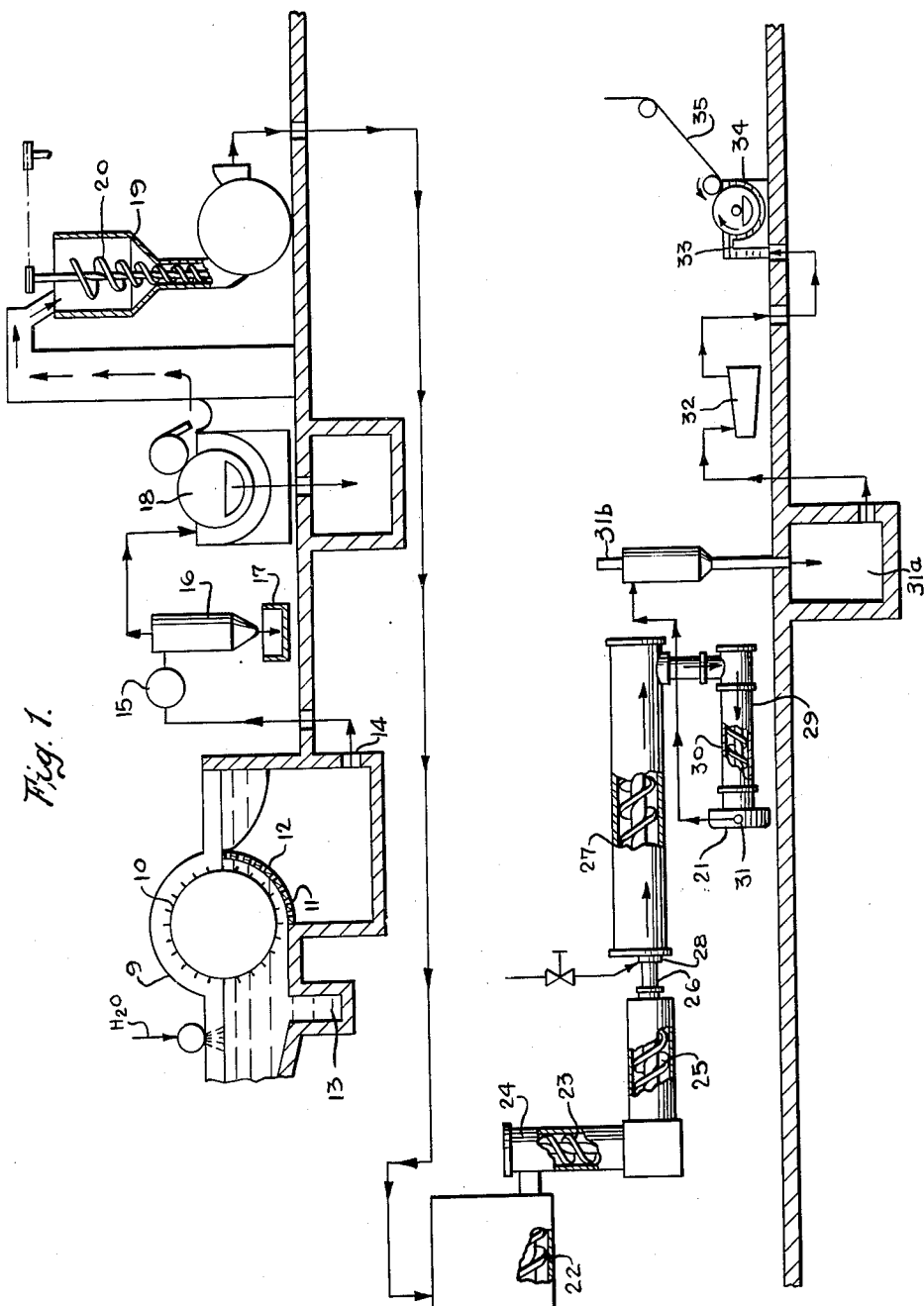
N. H. SANDBERG

3,057,769

METHOD OF PREPARING PAPER OF UNIFORM APPEARANCE

Filed May 16, 1955

3 Sheets-Sheet 1



INVENTOR:
NELS H. SANDBERG,

BY *Robert M. Dunning*
ATTORNEY.

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N. H. SANDBERG

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3 Sheets-Sheet 2

Fig. 3

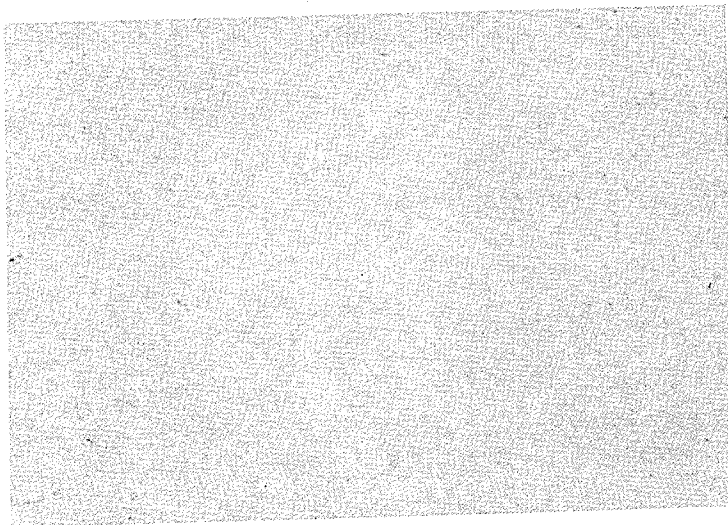
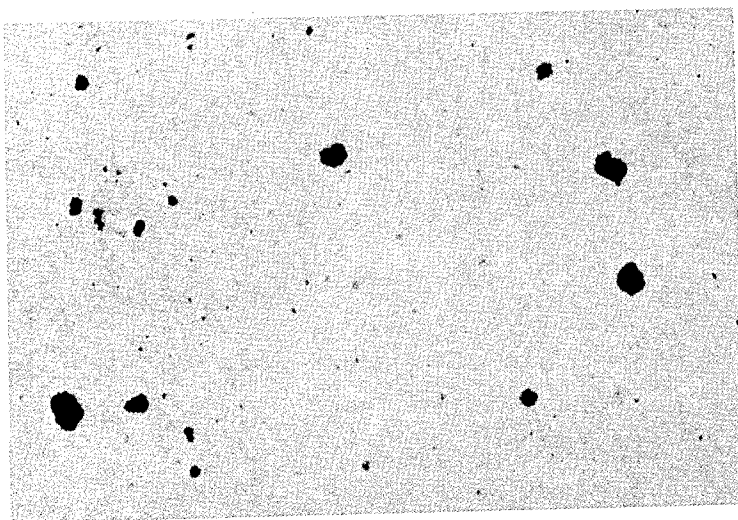


Fig. 2



INVENTOR.

NELS H. SANDBERG

BY

Robert M. Dunning

ATTORNEY

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N. H. SANDBERG

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Fig. 4.



INVENTOR.

NELS H. SANDBERG

BY

Robert M. Dunning

ATTORNEY

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METHOD OF PREPARING PAPER OF UNIFORM APPEARANCE

Nels H. Sandberg, St. Paul, Minn., assignor to Waldorf Paper Products Company, Ramsey County, Minn., a corporation of Minnesota

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7 Claims. (Cl. 162-4)

This invention relates to a paper of uniform appearance, and is herein disclosed as a process for the production of paper having such uniform appearance and improved strength from waste paper stock such as is currently available on the commercial market. That stock consists of many types of paper and paperboard, and usually includes paper and paper board which is coated with, or laminated with, asphalt, wax, tar or resin. Impurities of this type are often present in a quantity of from one percent to five percent and at times as much as ten percent of the available fiber. The present application is a continuation in part of my previous application Serial No. 141,181, filed January 30, 1950, now abandoned.

Waste paper of the type described is used extensively in the production of liner board such as is employed in the manufacture of corrugated board, as well as in the production of paper or paper board. In the past, such liners made of waste papers containing impurities of the type mentioned above interspersed through them large and small drops and lumps of asphalt, tar, wax and resin which interfere with the salability of the paper, interfere with its attractiveness, and impair its strength. These drops or lumps are large enough to introduce serious difficulties in working on the suction cylinders of paper machines by adherence thereto or by becoming enmeshed therein. As a result, a nonuniform layer of pulp is deposited on the screen or cylinder causing thin spots in the finished sheet. The drops or lumps of impurity are often as large as one-eighth inch in diameter or even larger.

In some instances, paper has been made on cylinder machines with intermediate layers of pulp containing asphalt or the other impurities mentioned, and covering layers or outer layers of pulp which is relatively free of such impurities. However, asphalt or tar spots often show through the outer layer or bleed through the outer layer when ink is applied to the sheet. As a result, board which is apparently free of asphalt, tar, resin, and wax sometimes becomes blemished during conversion processes.

Attempts have been made in the past to work unbeaten paper stock containing asphalt, wax, resin and tar in defibrating machines known as the Asplund machine, but it has been found impossible or impractical to do so. It is commercially impractical to sort the stock into grades suitable for one type of work and other grades suitable for other types of work. When mixed stock was fed into the defibrator, it either carbonized because of the high temperatures involved, or carried lumps in the feed which prevented the formation of the necessary plugs to maintain the steam pressure in the defibrator, and introduced adventitious substances and materials unsuitable for paper making and which could not be gotten rid of in commercial paper materials before they entered the defibrator.

Much insulating paper, V-board, and laminated board, are laminated with asphalt or wax. When papers or paper boards of this nature are inserted directly into a defibrator and heated by steam, the paper board faces insulate the asphalt and wax so that it is not properly softened. When this board passes between the discs of the defibrator the asphalt, wax or the like gums up the discs, or pass therebetween as unit lumps.

Because unbeaten paper stock runs irregularly in the

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distribution of asphalt and other materials the presence of the asphalt may cause the fibers to bind together in slugs which go as slugs to the defibrator and interfere with the operation of the defibrator by alternately overloading and starving the defibrator. They may also create a tightly compacted mass which does not disintegrate properly.

When unbeaten paper stock is inserted into a defibrator, the mixture may form balls or lumps within the machine by the adherence together of asphalt bearing portions of pulp. These balls or lumps of pulp are forced between the discs, resulting in the passage of some of the pulp without proper defibrating. The fibers remain adhered together as they are eliminated from the machine, and the resultant product is not of good quality.

It is not possible to completely disperse impurities such as asphalt in a beater or Hydrapulper, regardless of the temperatures employed. In machines of these types, the paper stock is broken up into very small pieces of board and the asphalt remains attached to the fibers in small droplets. This is particularly true in using in the stock asphalt laminated papers such as duplex kraft. Other materials are present in paper such as asphalt laminated sisal tape which does not pulp out in the beater. When broken up so that it cannot be screened out, the small unbeaten pieces of tape appear in the finished sheet. The asphalt droplets attached thereto, as well as other asphalt particles attached to other fibers, spread out and become larger when passing over the paper machine dryers, staining enlarged areas and becoming more noticeable.

From the foregoing description, it will be seen that asphalt, wax, tar or resins found in paper stock made from waste papers cannot be completely dispersed in a beater or Hydrapulper. It is this process which has been employed for years and which has been found ineffective. Furthermore, unbeaten paper stock containing such impurities cannot be fed directly to a defibrator with good results, as the impurities then stick in the grooves of the attrition discs, where the fibers are charred and burned and eventually build up sufficiently to destroy the defibrizing action of the discs.

According to the present invention the foregoing and other objections and disadvantages are overcome and a process is provided which produces a visually perfect paper showing no visible trace of asphalt, wax, tar or resin, when the paper stock containing the usual amount of such an impurity is worked according to the process.

In the form herein described in some detail, the paper stock including the tar and asphalt bearing portions, are described as beaten in an ordinary continuous breaker paper beater or Hydrapulper or other device to form a pulp as usual, which may contain, when it is finished, three to ten percent of fiber and other material carried in the usual water in the beater. This paper stock is too thick to allow any reasonable amount of deleterious materials to settle out, and contains asphalt or tar or resin or wax which is apparently in large drops which tend to adhere together under the beating of the paper beater.

According to the present invention this three to ten percent pulp is then thinned with water to a consistency of usually about one percent solids which also permits the settling of the heavier adventitious material including sand, glass, egg shells, plaster and bits of metal and to wash out anything which would interfere with the proper working of the defibrator.

The diluted pulp is next thickened by an apparatus such as a screen covered suction drum constructed so that the pulp solids are sucked onto the screen periphery of the drum. The pulp picked up by the drum is transferred to a second drum from which it is scraped and carried by a conveyor to a second thickening device. In this second device more water is squeezed out of the pulp to reduce

the water content to about sixty percent to seventy percent of the material present representing forty to thirty percent fibers.

This cleaned and partly dried pulp is shown as put through an Asplund type defibrator. Being already freed from any lumps of the raw material which were destroyed in the paper beater and freed from deposited adventitious refuse, like sand, glass, and small pieces of metal, it is adapted to be heated by the steam under a pressure usually running to about one hundred fifty pounds pressure per square inch and then delivered to the defibrator where it passes between two discs, one rotating practically against the fixed face of the other disc. The pulp is introduced usually through a center opening in the fixed disc and leaves through the periphery of the discs and is thus thoroughly rubbed into discreet fibers as is customary in the defibrator. It is then found that the asphalt and tar and wax and resin are so completely dispersed among the fibers that they are no longer in particles visible to the naked eye. The material leaving the defibrator is then thinned, sometimes further refined and finally made into sheet paper by ordinary procedures. It is found that in the sheet paper the wax and tar and asphalt are no longer visible and practically have no effect on the color of the finished paper. This is true even though the raw material carries several percent of asphalt, depending somewhat on the character of the paper stock in which the asphalt is carried.

Other features and advantages will hereinafter appear.

In the drawings forming a part of the specification:

FIGURE 1 is a diagram showing the steps of the process.

FIGURE 2 is an enlarged photograph showing a sheet formed of pulp containing asphalt as an impurity, in which the asphalt has not been dispersed but is visible to the unaided eye.

FIGURE 3 is a view similar to FIGURE 2 made of stock containing the same percentage of asphalt as the sheet of FIGURE 2, but in which the asphalt is dispersed.

FIGURE 4 is a microscopic enlargement of the dispersed impurity in the fibers.

The accompanying drawing shows diagrammatically one form of apparatus suitable for carrying out the process. In this apparatus waste paper, including paper or paper board laminated with asphalt, or other adherent or coating material, often carrying bits of metal staples and other metal is dumped into the continuous breaker beater 9, and the rotating paper beater knives 10 pulp the mass to a fineness that will pass through the three-quarter inch perforations 11 in the extractor plate 12, allowing some of the heavy reject to settle in the slot 13.

The pulp often carrying about three and one-half percent of fibre and associated material flows out through passage 14 and after being diluted at 15 with water from the next compressing step to seven-tenths of one percent, enters a centrifugal separator 16 which rejects all heavy material, such as sand, glass, and metals, these being conveyed off at 17.

The accepted stock is then thickened at 18 by removing the water mentioned above in a commercial form of thickener and the stock often about ten percent to twelve percent solids, is conveyed to a Davenport press 19 or other dewatering device. The water is normally recirculated to the dilution tank 15.

The Davenport press feed is shown as driven by a vertical screw 20 which forces the pulp between the power driven rotating pressure plates (not shown) of the Davenport or other press producing a uniform feed suitable for feeding to a defibrator 21 where the pulp is next heated to disperse the asphalt or other normally objectionable material.

The stock preferably containing thirty percent solids as it comes from the Davenport press is shown as fed by a horizontal tapered screw 22 to a vertical feed screw 23 in a feed line 24 which rotates to carry the pulp to a horizontal screw plug forming feeder 25 at the intake 26 of

the long horizontal preheater 27. Here the pulp is usually heated by fifty pound steam pressure per square inch to about two hundred and eighty-five degrees Fahrenheit.

The steam preferably enters the preheater through a manifold 28 surrounding the intake 26, thus breaking up the entering pulp and facilitating the preheating of the pulp.

The preheated pulp issues into a short feed pipe 29 where a feed screw 30 forces it between the usual opposed discs of an Asplund type defibrator, and it finally issues from the defibrator at 31 carrying about twenty-five percent of fiber and other solids, with any asphalt or wax, or other analogous usually objectionable material, thoroughly dispersed so finely as to be invisible.

The defibrator, with its attrition discs, is of unusual advantage in the process, as it produces novel and unusual effects upon the product. The discs are adjusted closely enough together to produce a continuous abrading action upon the pulp. As a result, the stock is subject to friction, and the stock temperature is considerably increased for the short time the pulp is between the discs. This appears to be of unusual advantage in dispersing the asphalt or other impurity. The small portions of paper bearing droplets of the impurity, which have previously been subjected to the action of the beaters, are individually heated considerably above the preheating temperature of perhaps two hundred and eighty-five degrees Fahrenheit due to friction between the discs and the pulp. The individual fibers are accordingly divided, and the asphalt or other impurity is simultaneously dispersed into separate micro-particles.

The defibrator has another unusual advantage in the process. The stock is maintained at an elevated pressure (usually above about forty-five pounds per square inch) during the defibrating operation. After the fibers are additionally heated by friction between the discs, the impurities being further heated or melted, the stock is immediately forced through an outlet orifice to atmospheric pressure. As the stock is confined in the outlet passage, the temperature remains high and reduces gradually. However, the sudden reduction in pressure causes the stock to explode, separating individual fibers and causing the impurity carried thereby or therewith to simultaneously become dispersed.

The stock thickening step of the process is of importance to the impurity dispersion, as apparently excessive moisture tends to cool the attrition discs, or at least to maintain them at a temperature nearer to the temperature of the pulp entering the defibrator. For this reason, and for the additional reason that to dilute a pulp will not form a plug at the inlet of the pre-heater, the thickening of the stock is highly advantageous.

The pulp is usually put through further refining as in a jordan 32, preferably after dilution to four percent as in a vat 31a by water coming through a pipe 31b, and thereafter, after further dilution at 33, to two-tenths of one percent, goes to a paper making machine diagrammatically shown at 34.

The paper delivered to its off-bearing belt 35 is found to be of uniform color, despite its content of asphalt of perhaps one percent or more. An increase in the percentage of asphalt or tar beyond about three percent measured on the fiber normally uniformly darkens the sheet slightly.

It has been found that the dispersed particles of impurity may be approximately equal to the diameter of the fibers. The fibers may be of from ten to fifty microns in diameter, and the particles may be up to one hundred fifty microns in diameter depending upon the product desired. However, even these particles are substantially invisible to the naked eye.

FIGURES 2 and 3 provide an actual comparison between sheets made from pulp containing, as nearly as can be determined, the same percentage of impurity. Samples of the same pulp are taken before and after the pulp has been subjected to the action of the defibrator.

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This pulp is made into hand sheets. FIGURE 2 shows the hand sheet made of the pulp before it is subjected to the defibrator. FIGURE 3 shows the sheet made from the pulp after it has passed through the defibrator. The difference is believed obvious, the asphalt and other impurities being clearly visible in FIGURE 2, and finely dispersed in FIGURE 3.

FIGURE 4 of the drawings shows the size of the dispersed particles as compared to the fiber size. For the most part, the particles of impurities comprising the dark spots, are about the same diameter as the fibers, although they can be somewhat larger without being visible to the eye.

It is found that paper made from stock and treated according to the present invention yields a paper definitely stronger than some paper not put through the defibrator and not washed as above described.

Having thus described one embodiment of the invention in some detail, what is claimed is:

1. The process of making a paper of uniform appearance free from normally visible spots from waste paper stock carrying bituminous material which comprises the steps of distintegrating the stock in the paper beater to form a relatively thick pulp carrying all the materials of the stock, thinning the pulp with water to about seven-tenths of one percent to one percent of fiber so that adventitious material may be separated out, thickening the fibrous pulp, expressing water from the fibrous pulp to reach a percentage of about sixty to seventy percent of water and thirty to forty percent of pulp, putting the thickened pulp through a defibration action at an elevated temperature above the boiling point of water and in the presence of steam under pressure of about forty-five pounds to the square inch and making paper from the pulp after defibration.

2. The process of making a uniform paper free from normally visible spots from paper stock carrying a trouble producing proportion of bituminous material such as tar, and asphalt or wax, which comprises the steps of beating the paper stock in a beater to pass the openings of a screen, thinning the stock, passing the stock through a sand separating device, thickening the stock to about ten percent solids, expressing water from the thickened stock to leave about thirty to forty percent fiber, passing the thickened stock through a steam heated defibrator in the presence of added steam under a pressure of about forty-five pounds per square inch, thinning the defibrated stock to about two-tenths of one percent fiber, and making paper from said fiber.

3. The process of making a uniform paper free from normally visible spots from paper stock carrying a trouble producing proportion of tar, asphalt or wax, which comprises the steps of beating the paper stock in a beater to pass the openings of a screen, thinning the stock, passing the stock through a sand separating device, thickening the stock to about ten percent solids, expressing water from the thickened stock to leave about thirty to forty percent fiber, passing the thickened stock through a steam heated defibrator in the presence of steam under pressure of about forty-five pounds per square inch, thinning the defibrated stock to about four percent of fiber, passing the thinned stock through a refining step, finally thinning the stock to about two-tenths of one percent fiber, and making paper from said fiber.

4. The process of making a uniform paper free from normally visible spots from paper carrying in the neighborhood of one percent of tar or wax or asphalt which comprises the steps of beating the paper stock in a continuous breaker beater to pass a three-quarter inch perforated screen to yield a pulp of about three and one-half percent, thinning the stock to a little less than one percent, passing the thinned stock through a centrifugal device to separate sand, thickening the said free stock to about ten percent by removing water, further thickening

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the stock by pressing to produce a stock of about thirty to forty percent solids, heating said stock by added steam to about two hundred eighty-five degrees Fahrenheit, forcing the hot stock through a defibrator under such temperature, thinning the defibrated stock to about four percent, refining the four percent stock in jordan to about two-tenths of one percent of fiber, and making paper sheet from said fiber.

5. The process of making a uniform paper free from normally visible spots from paper containing heavy solid foreign materials and a trouble producing proportion of a bituminous material such as tar, asphalt or wax, which comprises the steps of beating the paper stock to a desired size, thinning the stock to less than about one percent solids, removing the heavy solid foreign materials, thickening the stock to about thirty to forty percent solids, heating said stock by added steam under a pressure of about forty-five pounds per square inch to a temperature above the boiling temperature of water, and abrading the stock while still at an elevated temperature and under pressure to produce friction between the fibers, dispersing the bituminous material in microparticles through the stock, and making paper of the stock.

6. The process of making a uniform paper free from normally visible spots from paper containing heavy solid foreign materials and a trouble producing proportion of a bituminous material such as tar, asphalt or wax, which comprises the steps of beating the paper stock to a desired size thinning the stock to less than about one percent solids, removing the heavy solid foreign materials, thickening the stock to about thirty to forty percent solids, heating the stock under steam pressure to a temperature above the boiling temperature of water by added steam under a pressure of about forty-five pounds per square inch and abrading the stock while still at an elevated temperature and pressure to produce friction between the fibers, expanding the abraded stock to atmospheric pressure, dispersing the bituminous material in microparticles through the stock, and making paper of the stock.

7. The method of producing paper free from normally visible spots from waste paper stock including a trouble producing proportion of an impurity such as asphalt, tar, wax or resin, the process including the steps of beating the waste paper stock to a desired size, thinning the stock with water to about one percent of solids, thickening the beaten pulp to about thirty to forty percent solids, heating the thickened pulp to a temperature above the boiling point of water by subjecting the thickened pulp to direct contact with steam under a pressure of about forty-five pounds per square inch and expanding the stock by suddenly releasing the pressure thereupon while still at an elevated temperature.

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