June 17, 1924. 1,497,809

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PROCESS OF CORRUGATING PULPBOARD

Filed Feb. 25, 1920 3 Sheets-Sheet 1

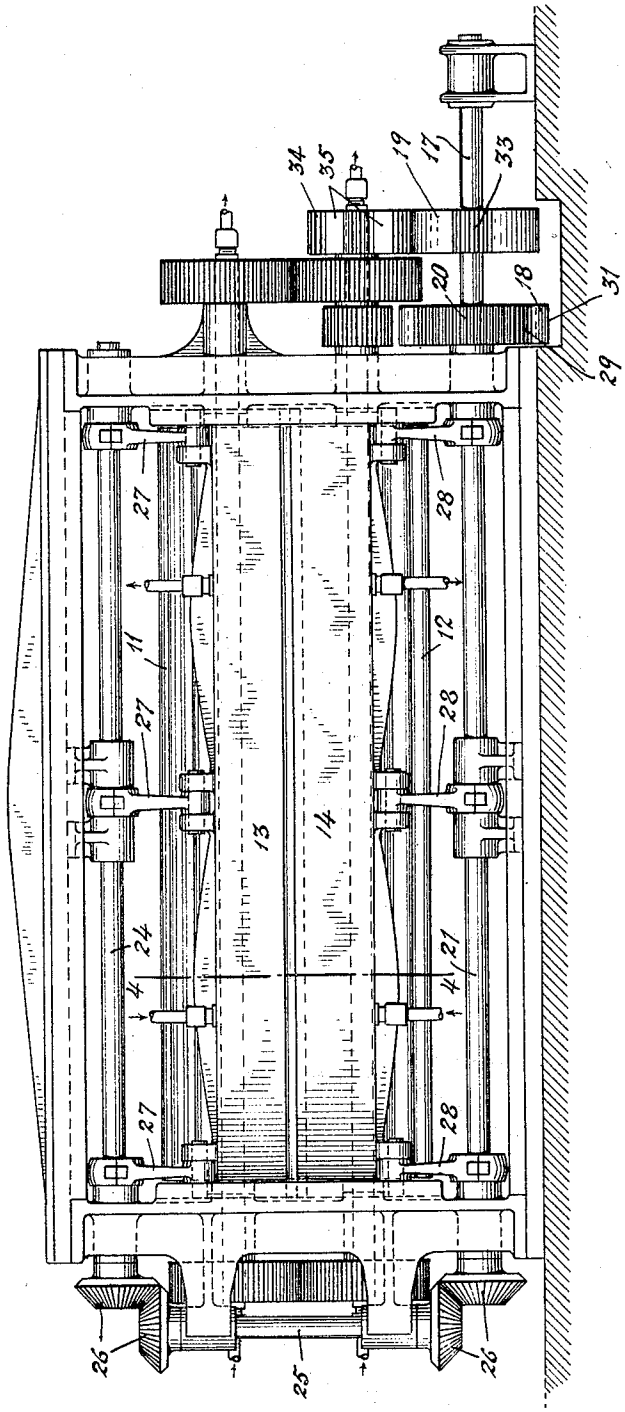


Fig. 1.

WITNESSES

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Filed Feb. 25, 1920 3 Sheets-Sheet 2

Fig. 2.

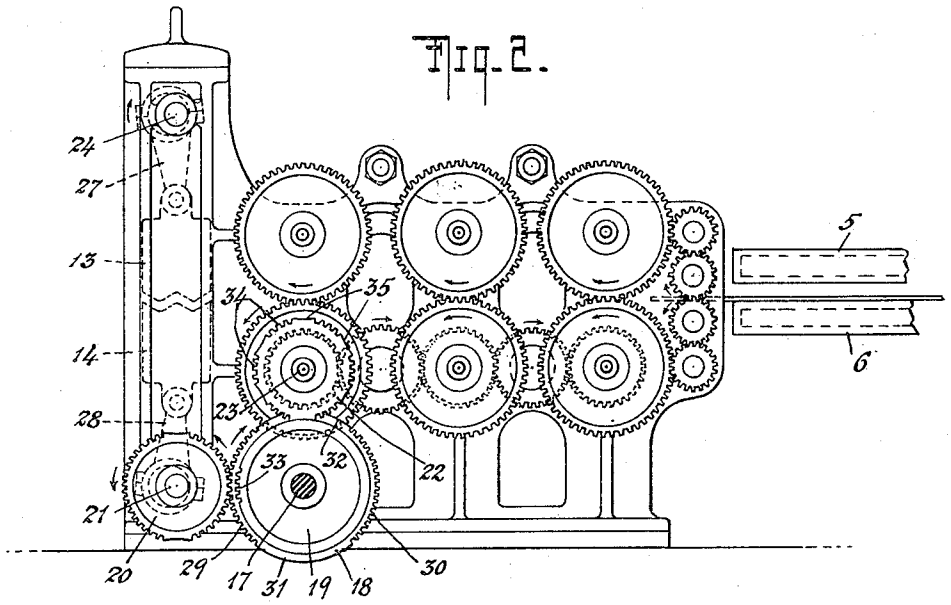
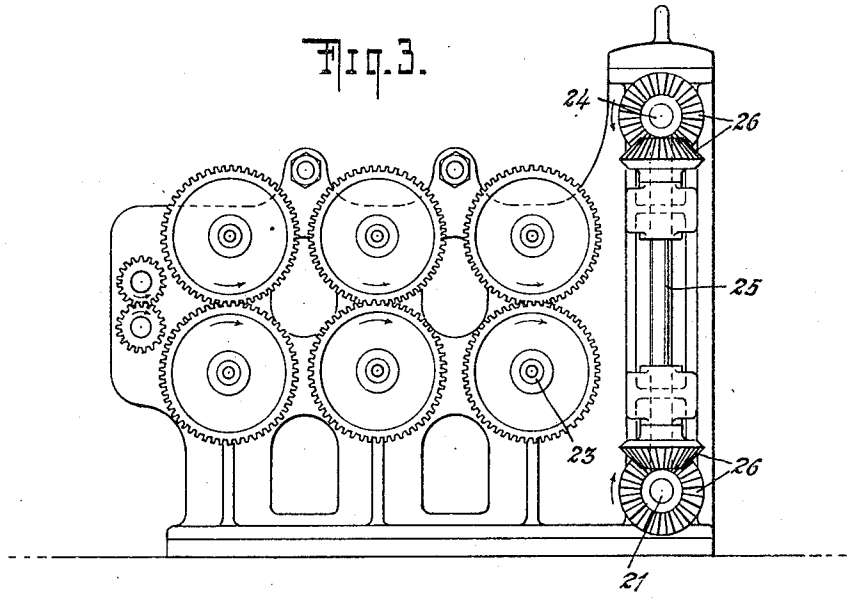


Fig. 3.



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PROCESS OF CORRUGATING PULPBOARD

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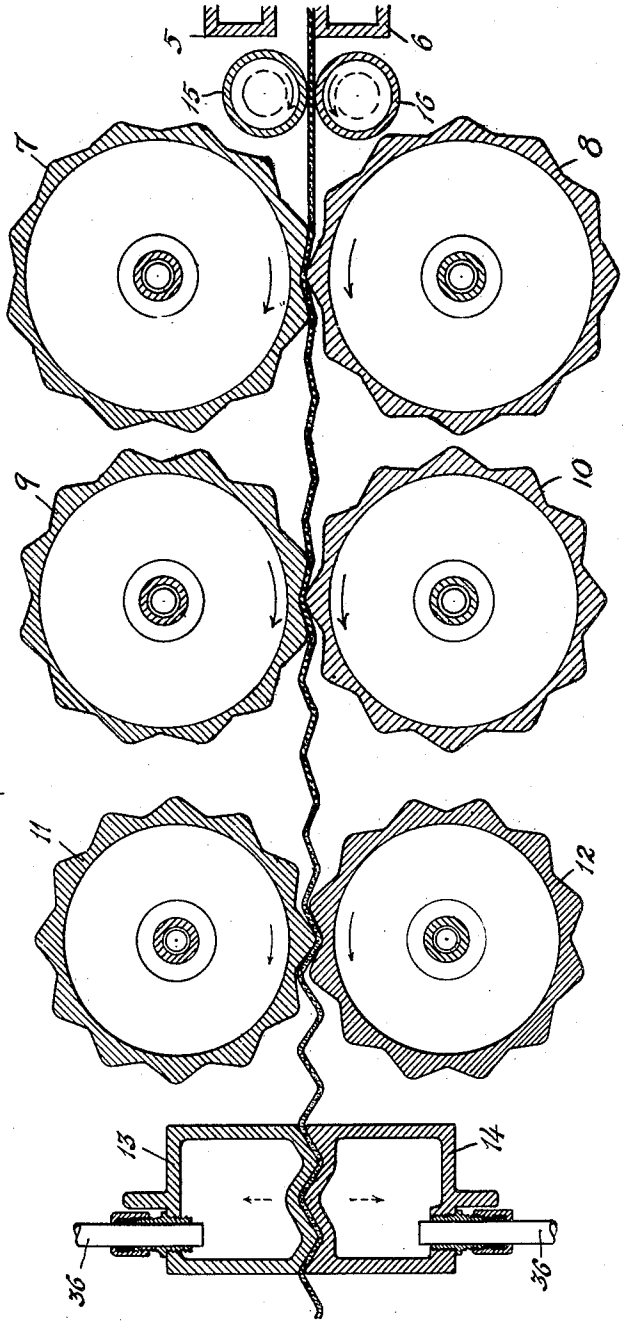


Fig. 4.

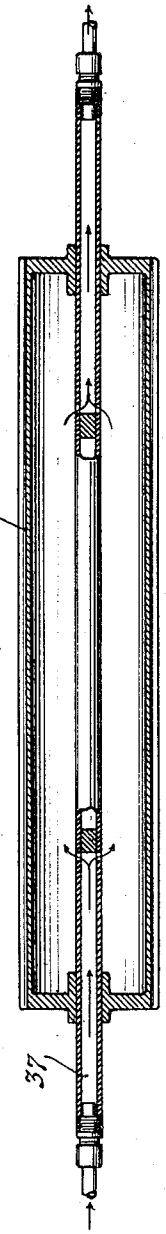


Fig. 5.

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UNITED STATES PATENT OFFICE.

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PROCESS OF CORRUGATING PULPBOARD.

Application filed February 25, 1920. Serial No. 361,280.

To all whom it may concern:

Be it known that I, DANIEL M. SUTHERLAND, Jr., a subject of the King of Great Britain, and a resident of Trenton, county of Mercer, State of New Jersey, have invented certain new and useful Improvements in a Process of Corrugating Pulpboard, of which the following is a specification.

The present invention relates to a process of molding pulp board.

The principal object of the invention is to provide an improved process of making corrugated pulp board from relatively thick stock (for example three eighths of an inch) containing a large admixture, say 35% or more, of pitchy material as for example, mineral pitch, asphalt, resinous compounds of like substance. The process, however, is not restricted to the formation of corrugated sheets, since any desired pattern may be impressed upon the material treated, as will be obvious to those skilled in the art.

Pulp board is usually made by running paper pulp, wood pulp, or the like into a mold, removing the majority of the water by means of pressure, and subsequently drying out the remainder of the water by the application of heat. The board after substantially all the water has been removed, is in what I term a spongy condition and is then subjected to heat and pressure to form a compact board. This invention is particularly concerned with pulp board having a pitchy material incorporated therein as a binder. By the term "pitchy material" I mean to include bituminous, resinous and similar materials which have the property of becoming soft and pliable when suitably heated.

The process of the present invention involves shaping the compacted board while hot. The board may be molded immediately after it is compacted and while still hot, or pulp board which has cooled may be reheated.

The principle of the invention will be best understood from a description of a particular application of the process and a description of an apparatus suitable for use in connection with the invention.

For the purpose of illustration the invention will be particularly described as applied to the formation of corrugated pitch board, that is to say, a corrugated pulp board containing 35% or more by weight of pitch, asphalt, or similar material.

To make corrugated pitch board by my improved process, the compacted pulp sheet while in thoroughly heated condition so that the pitch or other binder is soft, is bent or molded gradually to form the desired corrugations. The temperature of the heated board may be for example 300° F. or higher. As a convenient manner of providing a gradual molding the bending or shaping may be performed in successive steps, each step bringing the board more nearly to the desired shape. The bending or shaping is preferably done under such conditions that heat is continually applied to maintain the heated, and therefore softened condition of the pulp board. The action of the material during molding is not thoroughly understood. It is believed the binder acts as a lubricant when in heated condition and thus facilitates the movement of the fibres relative to each other as the pulp board is molded.

In the accompanying drawings forming a part hereof

Figure 1 is a front view of an apparatus for corrugating pulp board constructed in accordance with the invention;

Fig. 2 is a right side view; and

Fig. 3 is a left side view of the same;

Fig. 4 is a vertical sectional view taken through the center of Fig. 1; the showing being somewhat exaggerated as to the difference in diameters of the several rolls.

Fig. 5 is a detail view of one of the fluted rolls showing the manner of heating the same.

The apparatus shown for the purposes of illustration comprises heating means and molding means. The heating means is shown as a pair of flat heated dies 5, 6. The molding means consists of a plurality of molding dies or pattern dies which are shown as rolls indicated by the numerals 7 to 12 inclusive. Preferably also forming dies 13, 14 are provided to insure the accurate finished shape of the material. Suitable gearing drives the pattern rolls and operates the forming dies.

The heating dies 5, 6 may conveniently be the compacting dies which heat and compact the pulp board from the spongy condi-

tion. In fact the process may be considered as comprising the step of compacting the pulp board to substantially its finished condition before bending or molding as distinguished from a process in which the thick pulp board is simultaneously bent and compacted by the pattern rolls. The pattern rolls are shown as intermeshing fluted rolls arranged to mold or bend the pulp board to form corrugated board.

To mold corrugated board in accordance with the present invention and with the apparatus illustrated a length of the material is heated between the dies 5, 6 and when hot is fed as by the feed rolls 15, 16 to the fluted rolls which gradually mold or bend the board in successive steps to the desired form. If the pulp board has not been compacted previously, the dies 5, 6 should be arranged to compact as well as to heat the material.

By way of example three pairs of rolls are shown. The rolls 7, 8 of the first pair are provided with shallow intermeshing corrugations which give relatively slight bends alternately in opposite directions to the pulp board as it passes therebetween. The rolls 9, 10 of the second pair are more deeply fluted and are arranged to engage and increase the bends formed by the first rolls. The rolls 11, 12 of the third pair are still more deeply fluted and give substantially the final form to the pulp board. If an accurate shaping of the finished article is desired it is further treated between the heated forming dies 13, 14 which are of a shape corresponding to the finished form desired. The diameters of the rolls of the several sets must be such as to feed the proper length of material.

The rolls are preferably driven at a slow speed so that the molding will be accomplished gradually in the sense that each bending operation will be performed slowly as well as in the sense that the molding operation as a whole is accomplished gradually by extending the operation as a whole over a period of time.

Suitable gearing for operating the pattern rolls, the feed rolls and the forming dies alternately in suitably timed relation is conventionally illustrated. As the gearing is arranged, the forming dies are moved toward and from each other and caused to dwell in each extreme position. The dwell of the dies in closed relation causes the application of heat and pressure to be continued for a short interval of time. The dwell in open relation permits operation of the pattern rolls and feeding of the material. Each time said dies are in open position the pattern rolls are all rotated simultaneously through one sixth of a revolution. As shown best in Fig. 2 a power shaft 17 carries two interrupted gears 18, 19 the first meshing with an interrupted gear 20 fast upon the eccentric shaft 21, which operates the lower forming die 14, the second meshing with an interrupted gear 22, secured to the shaft 23 of the pattern roll 12. As clearly illustrated in Fig. 2, all the pattern rolls and the feed rolls are connected by suitable gears to cause the same to travel at one uniform peripheral velocity so that each time the interrupted gear 22 is driven, all the pattern rolls and the feed rolls will be simultaneously driven in the desired direction. By "uniform peripheral velocity" I mean that for each of the rollers, the length of material fed at one operation (one-sixth of a revolution for the pattern rolls, in this particular example), is the same as for the other rollers. The upper eccentric shaft 24, operating the upper forming die 13, is connected to rotate simultaneously with the lower eccentric shaft 21, so that the dies are simultaneously moved toward and from each other.

As shown a vertical shaft 25 (Fig. 3) is connected to both eccentric shafts by miter gears 26, 26. The connections between the eccentric shafts 21, 24 and the respective forming dies 14, 13 are shown as merely suitably connected eccentric rods 27, 28, Fig. 2.

The interrupted gear 18 presents two opposite toothed sections 29 and 30 and two intermediate convex smooth sections 31, 32. The toothed sections are arranged to engage corresponding toothed sections of the gear 20 and, through the mechanism above described, to move the forming dies toward and from each other. The smooth convex sections are arranged to engage corresponding concave locking sections of the gear 20 to cause dwells in the movement of the forming dies while in both open and closed positions. The gear 19 has only one tooth section 33 the remainder of the gear being smooth. The toothed section 33 is arranged to engage any of the corresponding toothed sections 34 of the gear 22 to drive said gear and through it and the connected gearing to drive all of the fluted rolls one sixth of a revolution. The smooth portion is arranged to engage the concave locking portions 35 of the gear 22 to cause a dwell in the movement of the gear 22 and of all the pattern rolls. The gears 18 and 19 are so arranged that the gear 22 through which the pattern rolls are operated is driven only while the forming dies 13, 14 are in separated position. The length of the forming dies is shown as equal to the length of material fed at each driving of the rolls but the arrangement may be varied as desired.

The pattern rolls and the forming dies are preferably heated to maintain the heat of the material during the molding operations. As illustrated the rolls and dies are hollow and provision is made for introducing superheated steam. Pipes 36, 36, Fig. 4 are conventionally shown as arranged to

supply steam to the forming dies 13, 14. The pattern rolls are shown as hollow and as provided with hollow shafts 37 arranged to admit steam to the rolls as conventionally shown in Fig. 5.

The foregoing description is illustrative only and variation in both the process and apparatus will readily occur to one skilled in the art.

I claim:

1. The process of molding pulp board having a pitchy binder incorporated therein which comprises compacting the board, and then molding the same in successive stages while heating it each subsequent stage bringing the article closer to its final shape than the preceding stage.

2. The process of molding pulp board having a pitchy binder incorporated therein which comprises compacting the board, and then molding the same with gradually applied pressure while heating it such pressure being applied in successive steps during each of which the material is heated, each subsequent step bringing the material closer to the final shape than the preceding steps.

3. The process of molding previously compacted pulp board having a pitchy binder incorporated therein which comprises heating the pulp board until the binder is softened and then simultaneously heating and molding the pulp board in a succession of steps bringing it progressively to the desired shape.

4. The process of molding previously compacted pulp board having a pitchy binder incorporated therein which comprises heating the pulp board until the binder is softened and then simultaneously heating, feeding and molding the pulp board in a succession of steps bringing it progresively to the desired shape.

5. The process of molding previously compacted pulp board having a pitchy binder incorporated therein which comprises heating the pulp board until the binder is softened, then heating the pulp board and simultaneously feeding it while molding corrugations therein in a succession of steps which increase the depth of the corrugations progresively, and thereupon compressing the corrugated pulp board thus obtained, while holding it stationary.

6. The process of molding pulp board comprising pitchy material which comprises heating the pulp board and then molding it in successive stages or steps which bring the said pulp board progressively nearer the desired molded shape with continued application of heat during the successive molding steps.

7. The process of molding pulp board having a pitchy binder incorporated therein which comprises first heating and compacting the pulp board and then molding the same with gradually applied pressure, said pressure being applied in a series of steps, each subsequent step bringing the material closer to its final shape than the preceding steps.

DANIEL M. SUTHERLAND, JR.