No. 755,597. PATENTED MAR. 22, 1904.

G. A. LOWRY.

PROCESS OF BALING FIBROUS MATERIALS.

APPLICATION FILED NOV. 2, 1898.

NO MODEL.

Fig-1.

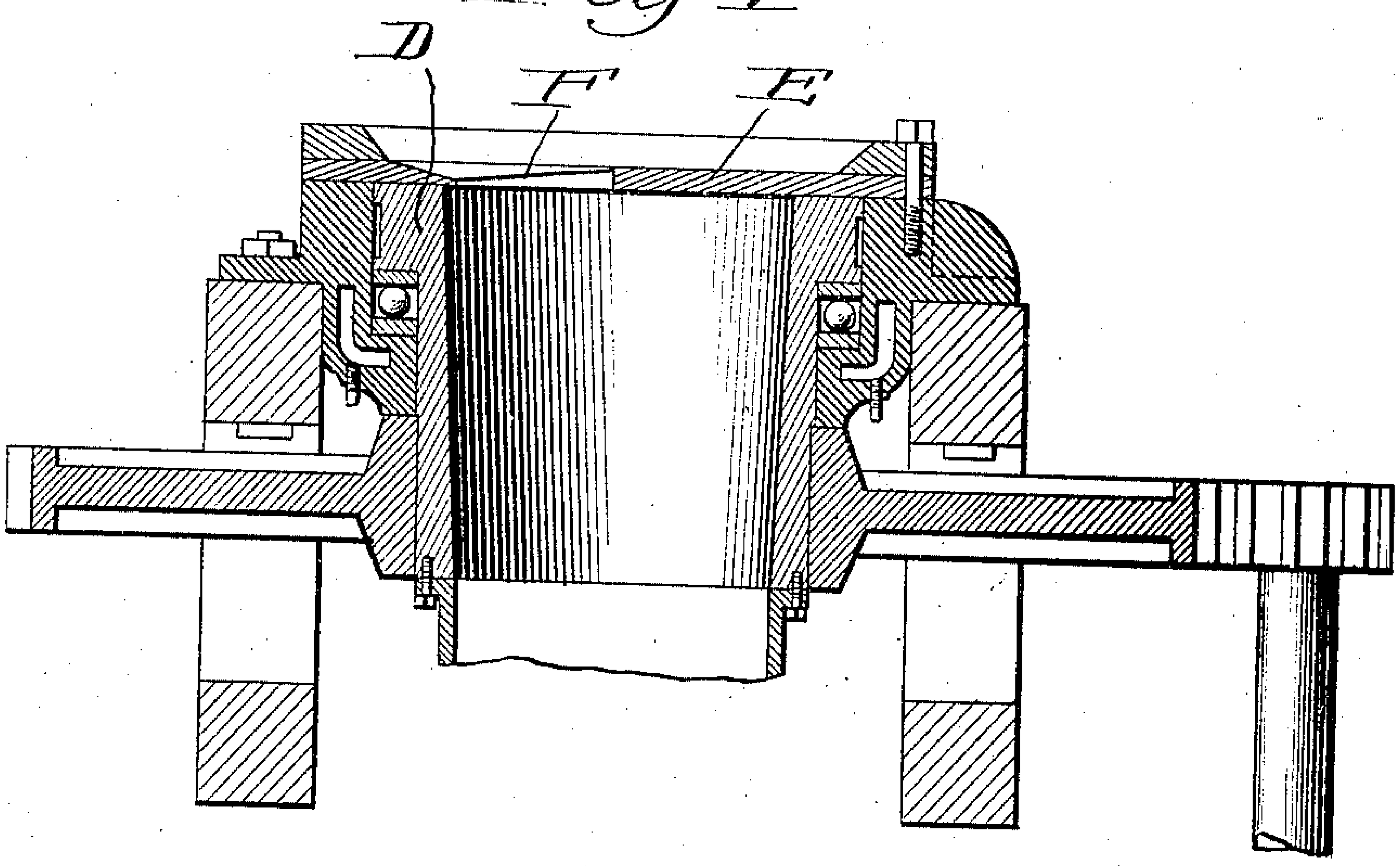


Fig-2.

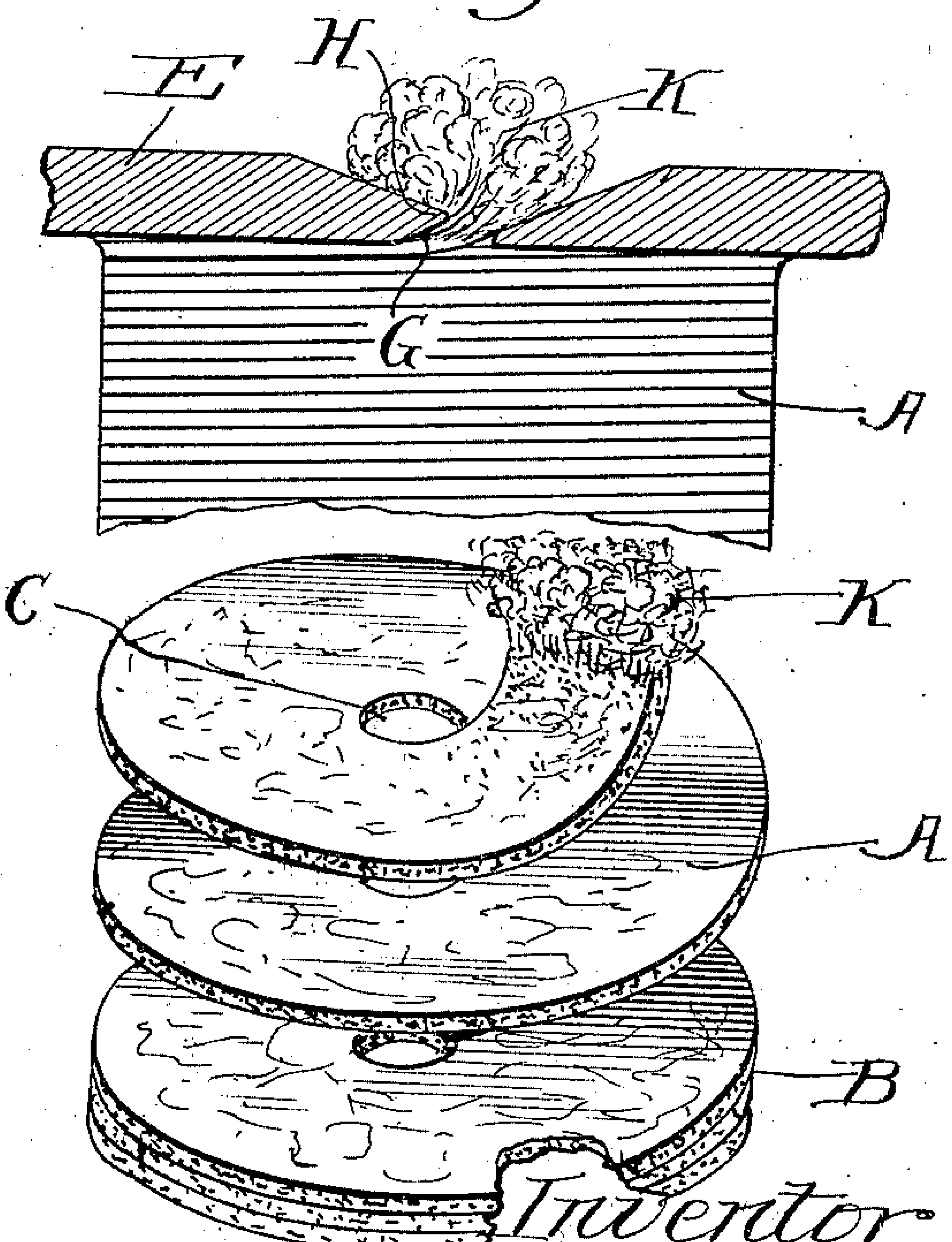
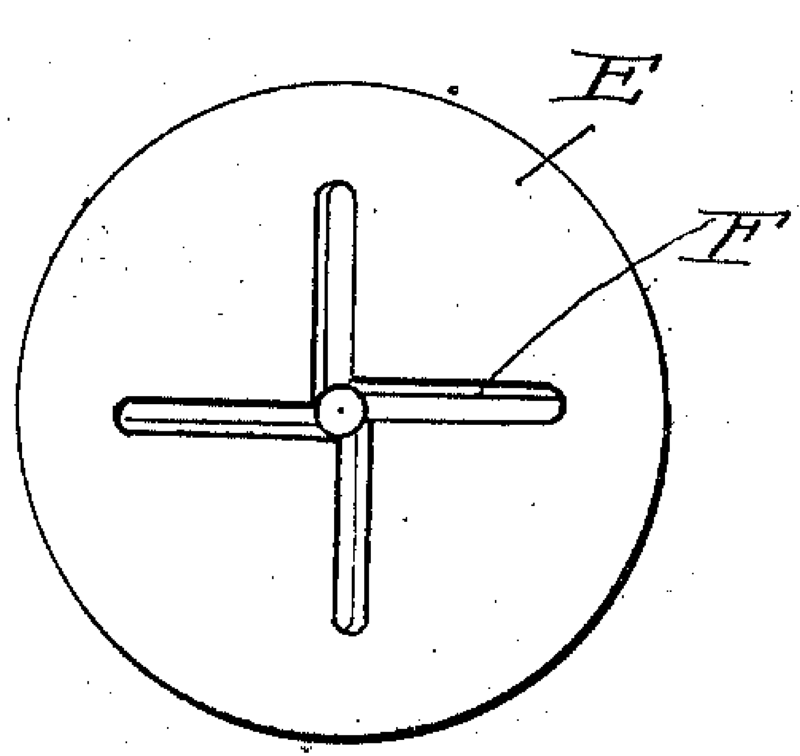


Fig.3



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No. 755,597. Patented March 22, 1904.

UNITED STATES PATENT OFFICE.

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PROCESS OF BALING FIBROUS MATERIAL.

SPECIFICATION forming part of Letters Patent No. 755,597, dated March 22, 1904.

Application filed November 2, 1898. Serial No. 695,286. (No model.)

To all whom it may concern:

Be it known that I, GEORGE A. LOWRY, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Process of Baling Fibrous Material, of which the following is a specification.

This invention relates to the process of baling fibrous material.

The object of the invention is to improve the art of baling fibrous material, whereby the fibrous material may be condensed to a greater degree than has been possible heretofore without injury to the fibers and into a more convenient form.

The invention consists, substantially, in the mode of operation hereinafter set forth, and finally pointed out in the appended claims.

In the process of baling fibrous material—such as cotton, wool, hair, and the like, and particularly in the case of cotton—it is a matter of material consequence to secure a high degree of compression of the material into bale form in order to economize space in the transportation. At the same time it is equally important to secure such compression without injury to the fiber and in a manner that will enable the bale to be readily opened when it arrives at the mills.

It is the purpose of the present invention to provide a mode of operation wherein these desirable objects are secured.

In accordance with the process or method of baling forming the subject of this invention the loose or uncompressed material is fed or supplied little by little and at each moment in the operation a small quantity is compressed to substantially the maximum density required upon the mass of similar material which has already been compressed in like manner. Furthermore, in accordance with this process the material when once compressed is retained in compressed condition, being prevented from expanding again after it has once been subjected to compression. As a result of this method there is at any given time a mass or column of compressed material which is being substantially continuously augumented by the compression of increments of loose material against said column of compressed material previously formed. This plan of compressing the material a little at a time to substantially the maximum density or degree of compression desired and preventing subsequent reëxpansion thereof has many advantages over the common method of baling, in which a considerable mass of loose material is subjected to pressure, and thereby condensed to smaller volume, as in my method a much higher degree of density can be attained and the compressed material remains in better condition and will more readily expand or open up when it is desired to open the bale so as to supply the material in its substantially loose or uncompressed condition for manufacture.

In accordance with the present method each increment of loose or uncompressed material when first acted upon is compressed once for all to the degree of density required and then is prevented from expanding again, said method being thereby sharply distinguished from other methods known or suggested in which either a large mass is to be compressed at once or small amounts are supplied or added to and compressed against a previously-compressed mass, but are not confined so as to prevent reëxpansion, so that in the operation of compressing each new portion of loose material portions of the material that have been previously compressed and have subsequently expanded have to be compressed over again.

In compressing the material into bale form in accordance with the method forming the subject of this invention it is necessary that the compressed material should be confined so as to prevent it from expanding again after the compression of each successive increment has been accomplished.

The practice of the method involves, therefore, a substantially continuous feed or supply of the loose uncompressed material, the compression of the successive increments thus supplied against the column or mass of material that has been previously supplied and compressed, and the confining of the material after compression to retain it in its compressed condition. These results are attained by the performance of certain acts upon the compressed and uncompressed material and by the maintenance of certain conditions during the performance of said acts, as will now be pointed out. One step or act in the method of baling forming the subject of this invention consists in maintaining a relative movement between a column or mass of compressed material and a confining surface or abutment which overlies the end of the column of compressed material formed of increments of loose material previously laid and compressed and upon which such increments are being compressed at each moment in the regular operation of practicing the method. The surface of the compressed material which is thus confined under the abutment is not completely covered, but has a portion exposed, preferably in the form of a narrow strip or line transverse to the direction of travel of the compressed material relative to the confining-surface, and another step or act in the method consists in supplying or depositing the loose material a little at a time upon said exposed strip or line or, in other words, substantially continuously feeding the loose material upon the said exposed surface of the compressed material. The portion of the surface of the compressed material which is thus exposed, and consequently unconfined, is insufficient to admit of substantial expansion of the material at the part thus exposed. The loose material at each moment thus deposited on and coming in contact with the exposed surface of the compressed material is interlaced or frictionally engaged with said exposed material, so that in the relative movement between the compressed material and the confining-surface the said loose material accompanies the compressed material and is thereby drawn between it and the confining-surface and is thus compressed to substantially the density of the column of previously-compressed material. The loose material is thus compressed upon the compressed material substantially along the given line or lines of exposure of the same, and as the said compressed material moves or changes its position relative to the confining-surface a new line of exposure is presented (*i. e.*, the line of exposure travels along the surface of the compressed mass) and the next increment of loose material is acted upon and compressed along this new line of exposure.

The result of continued action as above described is that the loose material is acted upon and compressed at each moment along a given line and when compressed is confined, and thereby prevented from again expanding, and thus in the continued operation is formed into a thin compressed sheet or layer upon the end of the previously-compressed column, which is thus made up of a series or pile of such superimposed compressed layers.

By giving the mass of compressed material a rotary movement about the longitudinal axis of the compressed column and having the exposed line or lines substantially or approximately radial to the axis of the movement the column is made in cylindrical form and of thin highly-compressed flat layers, which are laid spirally upon one another. In the continued practice or operation of this method the compressed column is continually built upon or augmented at one end, and thus grows indefinitely in length, said column being of the sectional shape at right angles to its length that is desired for the bale, and the bale may be removed or separated therefrom when the column has been produced to a sufficient length to provide for such separation of the bale and to leave, as is preferable, a portion as a basis of compressed material for the reception of further loose material in carrying on the process for succeeding bales.

A third act in the operation of forming the bale in accordance with the method forming the subject of this invention consists in detaching a definite length from the compressed column and securing said detached length against expansion. Each detached cylindrical mass of the desired length secured against expansion constitutes a bale. In a column or bale formed in this manner the tendency of the compressed material to expand is mainly in the direction of the length of the column, and the opposite end of the column, as well as the end upon which the loose material is being compressed in the practice of the method, as has been explained, must be supported and confined against expansion.

The fibers of the material that is at each moment being compressed against the previously-compressed mass do not become materially interlocked therewith, as they are principally entangled with fibers immediately surrounding and before and behind them. This will be apparent upon reflecting that only a few of the fibers in the amorphous mass adjacent to the slot are actually in contact with or entangled by the moving surface of the top of the column, but that such fibers are entangled with others immediately surrounding them, before, and behind and that some of the forward fibers with which they are entangled are fibers which have already entered under the abutment, where being pressed between the abutment and the top of the column they are engaged frictionally and carried onward by the movement of the column. It is thus seen that the later and as yet uncompressed fibers enter through the slot, because they are entangled with or hooked to fibers which were with them the instant before in the amorphous mass, and while the fibers entering at any given instant are engaged frictionally and to some extent entangled with the adjacent fibers on the top of the column which entered in the last previous layer they are obviously not so much entangled with them as they are with the fibers which immediately surrounded them in the amorphous mass and are drawn in with them. Hence the compressed layers which are formed by the successive additions of loose material remain as distinct layers in the compressed column, which is readily separated or broken transversely at any point between the adjacent layers. This is an important feature of the invention, for the reason that thereby sampling of the bale may be effected at any point even though the material of the bale is compressed to a great density. Because of this feature also the bale may be readily opened up at the mills. Another and very important result flowing out of this method of operation, in which succeeding fibers are engaged and drawn forward by preceding fibers, is that the general tendency is to draw the fibers parallel with one another and lay them in this condition upon the bale-head side by side and close together, avoiding crossing of the fibers and formation of air-spaces, and thus enabling the maximum amount of fibers to be packed in the minimum space and enabling also an application of a higher degree of compression than could be applied to any mass of cotton in which the cotton fibers had not this definite structural arrangement. When the cotton mass to be baled is an amorphous mass, the application of pressure to the mass of fiber, the fibers being crossed in all directions, tends to cause one fiber to cut another fiber which it crosses, and consequently the limit of pressure which can be applied to such an amorphous mass of cotton is that pressure which will not cause the fibers to cut and damage neighboring fibers. The parallelism of the fibers, which is a result of the mode of operation which I have described above, enables me to apply pressure to such an extent as will fall short of flattening the fiber, while when the fibers are in an amorphous mass, as mentioned above, the pressure cannot be applied beyond the point at which crossed fibers would tend to cut one another.

When the line of exposure of the column to the incoming material terminates at a short distance from the axis of the column, the bales produced as above described have an opening or hole longitudinally through the center thereof. This is also an important feature, for the reason that the provision of such hole or opening facilitates the application of fastenings for securing the bale against the tendency to endwise expansion and also gives ventilation to the bale.

The process above described may be carried out in many different ways. In the accompanying drawings I have disclosed an operative form of apparatus capable of carrying the invention into practice.

Referring to the accompanying drawings, Figure 1 is a broken view, in vertical central section, of an apparatus adapted for use in carrying the invention into practical operation. Fig. 2 is a sectional detail view illustrating the step of compressing the material into thin sheets or layers which are applied spirally upon each other to form the column from which the bales are taken. Fig. 3 is a bottom plan view in detail, showing a form of cap-plate adapted for use in confining the compressed material and in forming the loose material into thin compressed sheets or layers and building the compressed column endwise therefrom. Fig. 4 is a broken view in perspective of a bale produced in accordance with the principles of the invention and illustrating the various steps of the process.

In the particular form of apparatus shown, D designates a receiving-chamber, which in carrying on the process embraces a portion of the compressed column adjacent to the point where it is being built upon or augmented; E, a cap-plate therefor which affords a confining surface or abutment for preventing expansion of the material after it is compressed, said cap-plate and chamber being mounted for relative rotation. The chamber embraces the compressed material, and thereby causes it to have substantially the same movement as the chamber relative to the cap. The cap-plate E is provided with one or more radial slots or openings F, which afford exposed lines or strips on the surface at the end of the compressed column. The under edge G of the far lip H of each slot or opening is beveled off, thus forming a contracting-throat between the under surface of the cap and the top surface of the column confined thereunder. The material in a loose form is fed or supplied in position for the fiber to fall upon and be engaged by the exposed strip or strips of the surface of the compressed mass of material previously operated upon. The loose material is thus drawn under the edge of the lip H and in between the previously-compressed mass and the abutment, being thus compressed, and by the continued operation successive increments of loose material are compressed upon the continuously-traveling lines of exposure and are thereby formed into a thin compressed sheet or layer. The dragging of the loose material into the contracting-throat formed by beveling the under side G of the lip H causes the air to be expelled from the said loose material and subjects the same to a high degree of compression. It will readily be seen that when the fibers of said loose material are drawn parallel the air will be more effectively expelled from between them than when they lie across one another forming innumerable air-cells. In this condition the material drawn into the chamber is formed into a sheet or layer, and by reason of the relative rotation of the cap and chamber (and column of compressed material therein) said sheet is applied in a spiral layer to the end of the column composed of the previously-introduced material.

By interposing suitable resistance to the progress of the body of material through the chamber the desired degree of endwise compression of the column is secured. This resistance may be secured by contracting the internal diameter of the chamber or otherwise, as is evident. By providing the cap with a plurality of slots or openings F the bale will be built up endwise of several thin sheets or bats applied thereto in spiral layers, as above described.

In Fig. 4 the several steps of the process are illustrated, reference-sign B designating the body of the bale; A, the thin spiral compressed layers, a portion of which for the sake of clearness of illustration are shown separated from the main body of the bale; K, the loose material, and C the longitudinal central opening through the bale.

It is to be understood that the particular form of apparatus shown is merely illustrative of an operative form of apparatus for carrying the invention into practical effect; but the present invention does not relate to the particular construction of apparatus employed, as many other specifically different arrangements may be equally well adapted for carrying the process into practical operation. It will also be understood that while this process is best carried out by confining the layers and retaining the compression originally imparted to them, as hereinbefore described, the process is nevertheless useful in cases where the usual compression is released and afterward reapplied, for the reason that when the fibers have been arranged in parallel relation compression to a higher density can always be more readily effected, whether the thickness to be compressed is merely a single layer or whether the fibers be arranged in bulk, as by an aggregation of uncompressed layers.

The phrase "ultimate density," which has been employed in this specification and in some claims, has reference to the fact that the layer or increment is upon its entry as a layer into the bale-forming press compressed to the density of the bale of which thereupon it becomes a part, in contradistinction to those methods of packing in which ultimate density is only attained at a subsequent period.

The phrase "highly compressed" refers to that maximum degree of compression which it is possible to give to fiber without breaking down its natural structure—for example, to a compression just short of that which would flatten or square cotton fiber.

I am aware of the patent to Mead, No. 5,235, dated August 14, 1847, and disclaim all therein shown. In Mead the surface of the bale is not under compression, so that the fibers of the surface layer are at liberty and free to entangle the fibers in the amorphous mass of loose fiber in the feed-box, and the extent of surface exposed varies as the bale grows, one-half of the surface of the growing bale in Mead being exposed to the amorphous mass of cotton in the feed-box, with the result that Mead will draw a proportionately thick or heavy feed, increasing in amount as the bale grows in size. By my method, however, the drawing from the amorphous mass is accomplished by the concatenating action of fibers held in a compressed mass, so that comparatively few fibers are free to operate by concatenation, and the feed is comparatively light or thin by reason of the fact that the width of the slot bears a proper proportion to the length of the staple of the fiber, the slot being, preferably, not so wide as the staple is long, so that fibers are held at one end at least and are also held by friction and engagement with adjacent fibers in the compressed mass. Furthermore, in the method which I have described heretofore only a comparatively small portion of the compressed mass is exposed through a slot or slots, which are fixed in their dimension, so that the layer is of substantially uniform thickness and does not vary, as in the Mead bale. This is an important feature in practice.

Having now set forth the object and nature of the invention and the manner of carrying the same into practice, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent of the United States, is—

1. The method of packing fibrous material which consists in drawing the fibers by concatenation from a mass of loose fibrous material so that they are approximately parallel one with another; highly compressing the material with the fibers thus arranged into a thin sheet of ultimate density, winding that sheet while under compression into the shape of a helix about an axis approximately parallel to the direction of compression and finally confining a group of such convolutions, by extraneous binding means, against expansion.

2. The method of packing fibrous material which consists in generating by concatenation in a mass of loose fibrous material, a stream of fibers leading out therefrom; and expressing the air from the stream by highly compressing the stream between opposed members and forming the compressed sheet in helical convolutions about an axis.

3. The method of packing fibrous material above described, consisting in drawing the fibers by concatenation from an amorphous mass into approximate parallelism, and subjecting the layer so formed in this condition to high compression and securing a multiplicity of such layers together against reëxpansion.

4. The method of packing fibrous material above described consisting in drawing the fibers by concatenation from an amorphous mass into approximate parallelism and compressing the layer so formed in this condition to ultimate density and securing a multiplicity of such layers together against reëxpansion.

5. The method of packing fibrous material above described, consisting in drawing the fibers by concatenation from an amorphous mass into approximate parallelism, and subjecting the fibers when thus arranged to high compression and securing them together against reëxpansion.

6. The method of packing fibrous material above described, consisting in drawing the fibers by concatenation from an amorphous mass into approximate parallelism and compressing the fibers when thus arranged to ultimate density and securing them together against reëxpansion.

7. The method of packing fibrous material above described consisting in drawing the fibers by concatenation from an amorphous mass into approximate parallelism to form a layer, compressing that layer to ultimate density and arranging a multiplicity of layers so formed together to form a bale.

8. The method of packing fibrous material above described, consisting in drawing the fibers by concatenation from an amorphous mass to form a helical layer and arranging a multiplicity of such layers together to form a cylindrical end-built bale.

9. The method of packing fibrous material above described, consisting in drawing the fibers by concatenation from an amorphous mass into approximate parallelism to form a helical layer, arranging a multiplicity of such layers together to form a cylindrical end-built bale, subjecting the layers to pressure to give density and securing them together against reexpansion.

10. The method of packing fibrous material above described, consisting in drawing the fibers by concatenation from an amorphous mass to form a layer; subjecting such layer so formed to high compression and securing together a multiplicity of such layers.

11. The method of packing fibrous material above described, consisting in drawing the fibers by concatenation from an amorphous mass and subjecting the fibers so drawn to high compression and securing the compressed fibers against reëxpansion.

12. The method of packing fibrous material above described, consisting in drawing fibers from an amorphous mass of loose material by the concatenating action of fibers embedded in a compressed mass, and compressing the fibers so drawn.

13. The method of packing fibrous material above described, consisting in drawing fibers in a layer of substantially uniform thickness from an amorphous mass of loose material by the concatenating action of fibers embedded in a compressed mass, and compressing the fibers so drawn.

14. The method of packing fibrous material above described, consisting in drawing fibers in a helical layer of substantially uniform thickness from an amorphous mass of loose material by the concatenating action of fibers embedded in a compressed mass, and compressing the fibers so drawn.

15. The method of packing fibrous material above described, consisting in drawing fibers in a helical layer of substantially uniform thickness from an amorphous mass of loose material by the concatenating action of fibers embedded in a compressed mass and compressing said layer against the compressed mass.

16. The method of packing fibrous material above described, consisting in drawing fibers from an amorphous mass of loose material into approximate parallelism by the concatenating action of fibers embedded in a compressed mass, and compressing the fibers so drawn.

17. The method of packing fibrous material above described, consisting in drawing fibers in a layer of substantially uniform thickness from an amorphous mass of loose material into approximate parallelism by the concatenating action of fibers embedded in a compressed mass, and compressing the fibers so drawn.

18. The method of packing fibrous material above described, consisting of drawing fibers in a helical layer of substantially uniform thickness from an amorphous mass of loose material into approximate parallelism by the concatenating action of fibers embedded in a compressed mass and arranging a multiplicity of such layers together to form a cylindrical end-built bale and securing them together against reëxpansion.

19. The method of packing fibrous material above described, consisting in drawing fibers in a helical layer of substantially uniform thickness from an amorphous mass of loose material into approximate parallelism by the concatenating action of fibers embedded in a compressed mass, compressing said layer against the compressed mass, and arranging a multiplicity of such layers together to form a cylindrical end-built bale, and securing them against reëxpansion.

In witness whereof I have hereunto set my hand, this 22d day of October, 1898, in the presence of the subscribing witnesses.

GEORGE A. LOWRY.

Witnesses:
F. A. BURKE,
CHAS. T. TAMSBERG.