F. S. J. BROOME.

APPARATUS FOR SEPARATING AND GRADING FIBERS.

APPLICATION FILED AUG. 22, 1911.

1,206,408.

Patented Nov. 28, 1916.

3 SHEETS—SHEET 1.

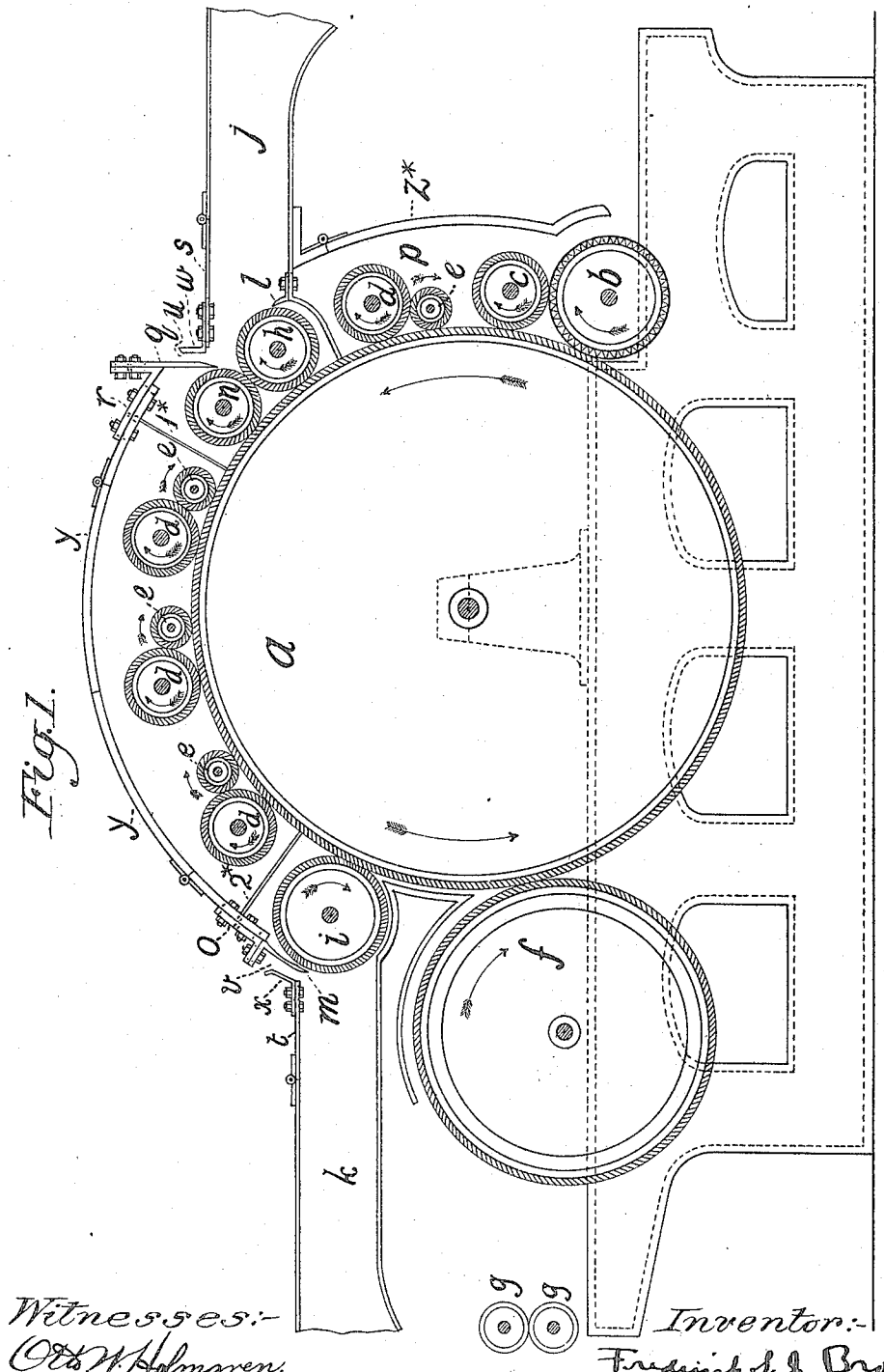


Fig. 1.

Witnesses:-
Otto W. Holmgren.
F. George Barry.

Inventor:-
Frederick S. J. Broome
by his attorneys
Brown & Brownell

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

F. S. J. BROOME.

APPARATUS FOR SEPARATING AND GRADING FIBERS.

APPLICATION FILED AUG. 22, 1911.

1,206,408.

Patented Nov. 28, 1916.

3 SHEETS—SHEET 2.

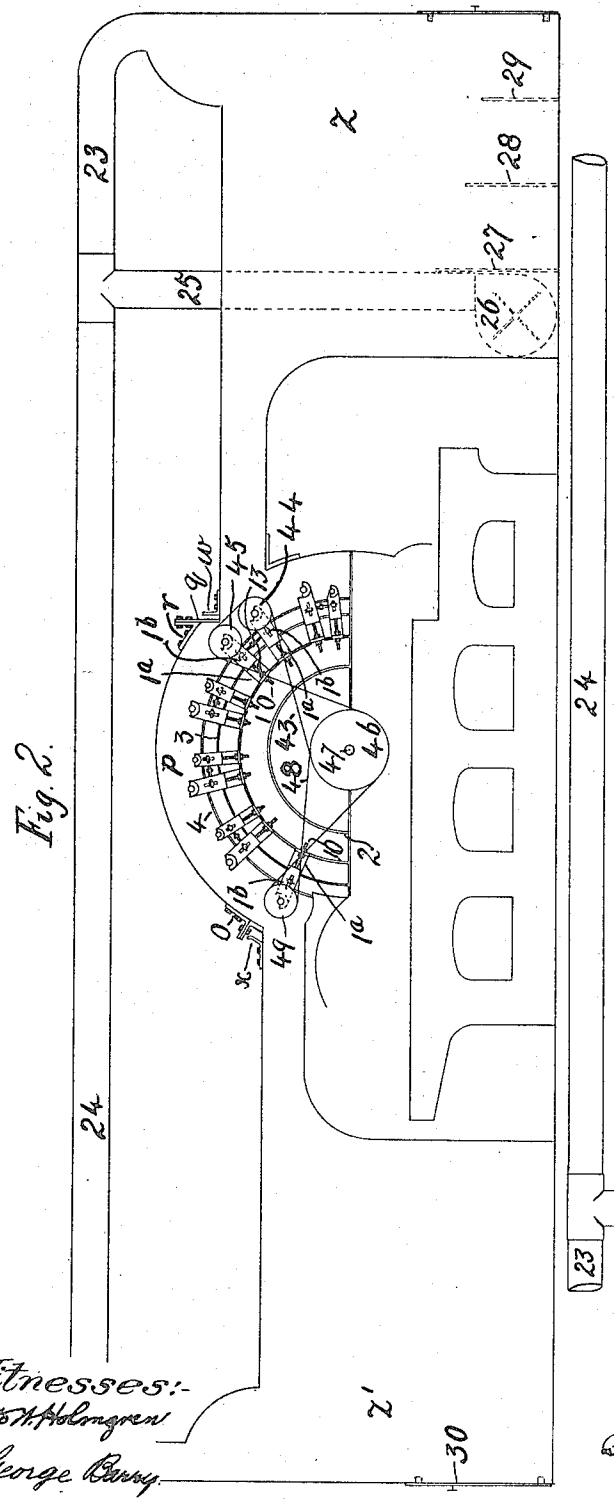


Fig. 2.

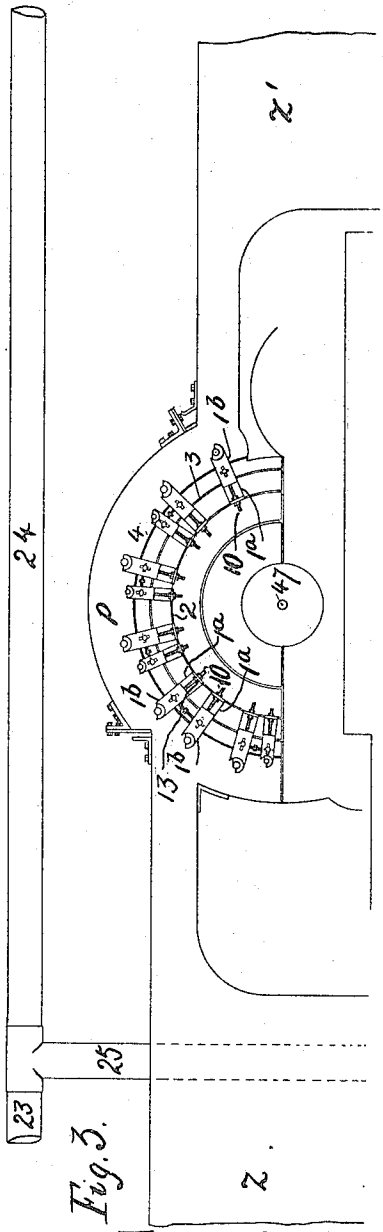


Fig. 3.

Witnesses:-
Otto H. Holmgren
J. George Barry.

Inventor:-
Frederick S. J. Broome
By Brown & Rivard
his Attorneys

THE NORRIS PETERS CO., PHOTO LITHO., WASHINGTON, D. C.

F. S. J. BROOME.

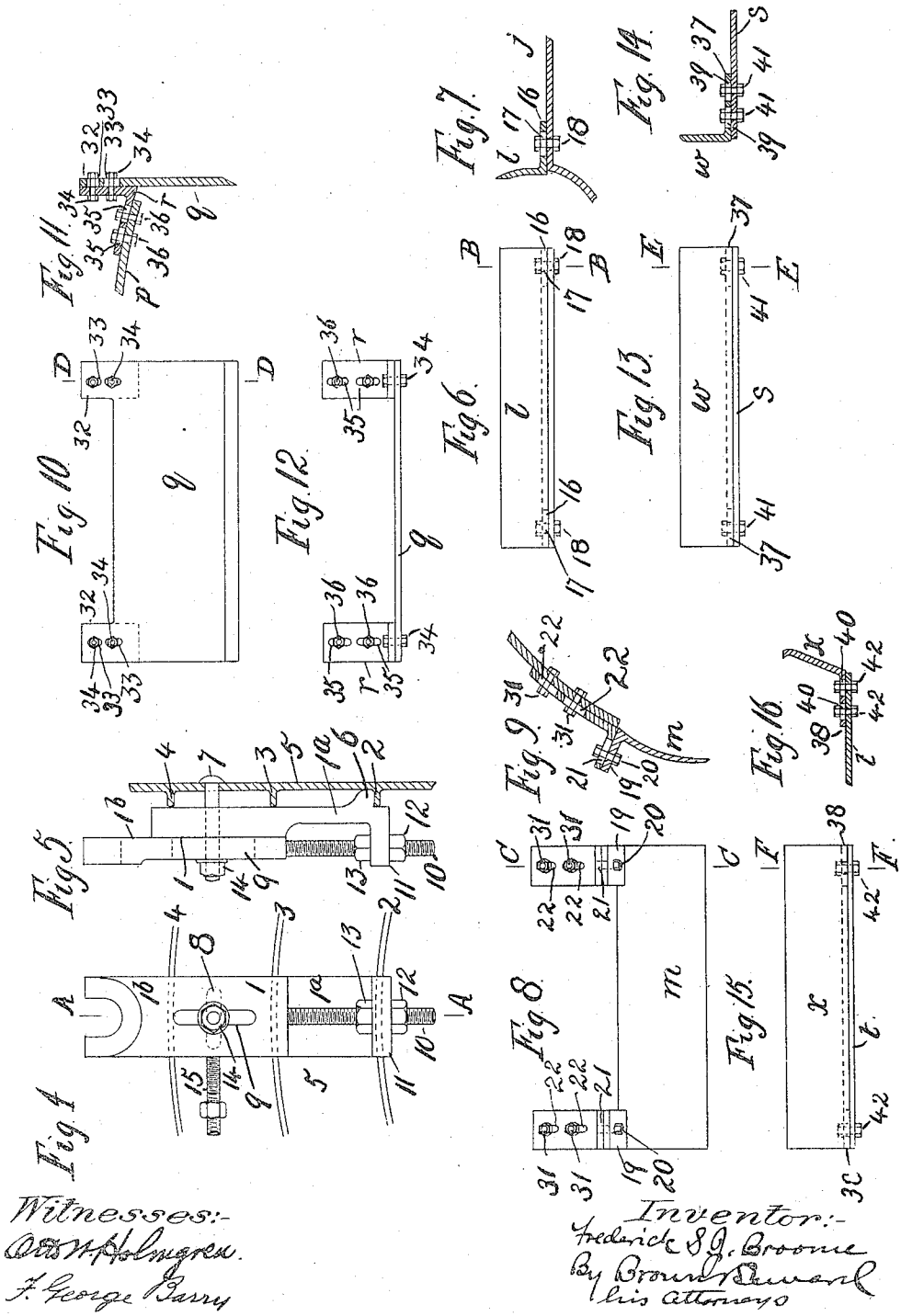
APPARATUS FOR SEPARATING AND GRADING FIBERS.

APPLICATION FILED AUG. 22, 1911.

1,206,408.

Patented Nov. 28, 1916.

3 SHEETS—SHEET 3.



Witnesses:-
Otto M. Holmgren.
F. George Barry

Inventor:-
Frederick S. J. Broome
By Brown & Ewart
his attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FREDERICK SAMUEL JAMES BROOME, OF MATLOCK, ENGLAND.

APPARATUS FOR SEPARATING AND GRADING FIBERS.

1,206,408. Specification of Letters Patent. Patented Nov. 28, 1916.

Application filed August 22, 1911. Serial No. 645,462.

To all whom it may concern:

Be it known that I, FREDERICK SAMUEL JAMES BROOME, spinner, a subject of the King of the United Kingdom of Great Britain and Ireland, and resident of Rockside Hydropathic Establishment, Matlock, in the county of Derby, England, have invented new and useful Improvements in and Apparatus for Separating and Grading Fibers, of which the following is a specification.

This invention relates to apparatus for separating and grading fibers, to be used in the treatment of fibrous materials containing mixtures of strong or coarse and fine fibers or mixtures of fiber of different lengths of staple for the purpose of separating and grading the fibers the strong or coarse from the fine and the fine from the long and longer from shorter fibers or in other ways desirable in different cases, which apparatus makes it possible to separate and grade fibers in the different ways desirable, in a simple, convenient and efficient manner not heretofore attained.

According to this invention the separation and grading of fibers are effected by means of a carding engine which is furnished and used with appliances and auxiliary apparatus hereinafter to be described and set forth in the claims, whereby there is effected a discharge of fiber from the carding engine into an air-current whereby the discharged fibers are conveyed to a place of settlement in which, as the air current loses its velocity the different grades of fibers are deposited at different distances from the carding engine according to their characteristics and according to the degree of fineness or shortness of the fiber, while the doffer and doffing comb of the carding engine remove from the carding engine any fiber not discharged into the air current. To discharge fiber from the carding engine a roller is disposed in such a way and driven at such a speed and in such a manner that it removes the longer, stronger or coarser fibers from the cylinder and by centrifugal action and usually also by the projecting fibers being allowed to strike against the edge of a plate, generally adjustable, discharges the fibers so removed by it through an opening extending in its width across the carding engine throughout the whole length of the roller and provided in the casing of the carding engine in proximity to the roller and to the adjustable plate if used. This opening communicates with a wide trunk which extends across the whole width of the opening and is provided with an opening for the inlet of air and leads to a settling space. A current of air is maintained by appropriate means through the trunk into the settling space and controlled in accordance with the material under treatment as by adjustment of the opening for the inlet of air and the velocity of the means for causing the air current. The fibers as they are discharged by the roller are drawn or carried by the air current through the trunk and into the settling space where they are allowed to settle and the fibers most ready to settle as by being longer or stronger or both settle nearest to the carding engine and those less ready to settle as by being finer or shorter or both are deposited in the settling space at different distances from the carding engine according to their characteristics and the degree of fineness or shortness of the fiber so that fibers may be collected in different grades or sorts from different parts of the settling space. The material remaining in the clothing of the cylinder is removed much in the usual way of carding by means of a doffer and doffing comb and if necessary or desirable may be treated again in like manner either in the same carding engine or another or others until the necessary or desirable degree of separation is attained. The material deposited in any part of the settling space may also be again subjected to treatment in the same carding engine or another or others until the separation of fibers of different kinds has been carried to the degree necessary or desirable.

In the accompanying drawings Figure 1 is a diagrammatic longitudinal vertical section of a carding engine used according to this invention. Fig. 2 is a partial side elevation of one side of the carding engine and the two settling chambers. Fig. 3 is a partial side elevation of the other side of the carding engine. Fig. 4 is a front view drawn on a larger scale, of a roller adjusting device and Fig. 5 is a side view thereof partly in

section on the line A A of Fig. 4. Fig. 6 is a side view and Fig. 7 a vertical section on the line B—B of Fig. 6. Fig. 8 is a side view and Fig. 9 a vertical section on the line C—C of Fig. 8. Fig. 10 is a side view, Fig. 11 a vertical section on the line D—D of Fig. 10 and Fig. 12 a plan of a detail. Fig. 13 is a side elevation of a detail, and Fig. 14 a vertical section on the line E—E of Fig. 13. Fig. 15 is a side view of a detail and Fig. 16 a vertical section on the line F—F of Fig. 15.

In the case illustrated a roller and clearer carding engine is used and the removal of fibers from the cylinder for discharge into air current for separation and grading is effected at two places and the doffer removes from the cylinder the fiber not discharged into air current.

In the drawing, *a* is the cylinder, *b* is the taker-in-roller, *c* is the dirt roller, *d d* are worker rollers, *e e* are clearers, *f* is the doffer and *g g* are calender rollers. Al lthese are mounted and used in the ordinary manner and driven by ordinary means. The card surfaces of the cylinder *a*, dirt roller *c*, worker rollers *d*, clearer rollers *e* and doffer *f*, though represented diagrammatically as formed of straight wires, and the card surface of the taker-in-roller *b* are of ordinary form.

h, *i* are rollers provided for the purpose of this invention, *j*, *k* are trunks adjacent to the openings in the carding engine casing *p* through which the fiber removed from the cylinder *a* by means of the rollers *h*, *i* respectively is to be discharged. The openings adjacent to the rollers *h i* for the discharge of fiber are equal in width to the whole length of the rollers *h*, *i* respectively used with them and the trunks *j k* extend across the whole width of the openings with which they are respectively employed. The trunks *j k* receive the fiber discharged by the rollers *h i* and conduct it to the settling space which may be a space or chamber or spaces or chambers for each trunk or for both and either divided into compartments or otherwise and in connection with an exhaust fan or other means by which a current of air through the trunks into the settling space may be caused. The trunks *j k* are in communication with chambers *z z'* respectively which are in communication by trunks 23, 24 respectively with a trunk 25 leading to an exhaust fan 26. In the case of the chamber *z*, partitions 27, 28, 29 of different height are indicated by dotted lines as provided to divide the lower part of the chamber *z* into compartments. Doors 30 are provided at the ends of the chambers *z*, *z'* to allow of access for the removal of the fiber from the lower parts of the chambers *z*, *z'*. *l*, *m* are plates made adjustable by the provision of slots and bolts and provided to effect or to aid in the removal of fibers from the rollers *h*, *i* respectively. *n* is a clearer roller used with the roller *h*. The directions of revolution of the cylinder *a*, taker-in-roller *b*, dirt roller *c*, workers *d*, clearers *e*, doffer *f*, rollers *h*, *i* and clearer *n* are all clearly indicated by arrows in Fig. 1.

The rollers *h*, *i*, *n* are mounted by means of brackets 1, each formed in two parts 1^a, 1^b. The part 1^a of each bracket 1 is fitted to bear against ribs 2, 3, 4 on the adjacent bend 5 of the carding engine and is provided with a projecting seating 6 to bear on the adjacent rib 2 and is made with a hole to receive a bolt 7 passed through a slot 8 in such bend 5. The part 1^b of each bracket 1 is made with a slot 9 to receive the bolt 7 corresponding to such bracket 1 and is fitted with a screwed shank 10 which passes freely through a projection on the part 1^a and is furnished with nuts 12, 13.

The slots 8 in the bends 5 allow the bolts 7 and brackets 1 to be adjusted for a short distance in a direction around the circumference of the carding engine cylinder *a*. The slots 9 enable the parts 1^b to be adjusted in a direction radial to the axis of the carding engine cylinder *a*. The nuts 12, 13 serve both for effecting and fixing the radial adjustment of the parts 1^b and the nuts 14 of the bolts 7 aid in securing the parts 1^a, 1^b together and secure the parts 1^a, 1^b of the several brackets 1 in position upon the bends 5 of the carding engine.

In the case of the brackets 1 carrying the rollers *h*, *n*, a screw 15 capable of turning in one bracket 1 and engaging screw-threads in the next is provided for adjusting and securing the adjustment relatively to one another of the rollers *h*, *n*.

A band 43 passing over pulleys 44, 45 connected to the rollers *h*, *n* respectively and around a pulley 46 on the shaft 47 of the carding engine cylinder *a* and a band 46 passing over a pulley 49 connected to the roller *i* and around the pulley 46 are provided to drive the rollers *h i n*.

The roller *h* is covered with card wire of ordinary form extending across and disposed so as to work "point to heel" relatively to that of the cylinder *a* and is set with its card surface as close as possible to the card surface of the cylinder *a* but not engaging therewith and is driven at a surface speed greater than that of the cylinder.

The clearer *n* is provided with card wire of ordinary form extending across and disposed so as to work "point to point" relatively to that of the roller *h* and is set so that its card-surface is close to but does not engage the card surface of the roller *h* and just engages the card-surface of the cylinder *a* and is driven so as to have a surface speed less than those of the roller *h* and cylinder *a*.

The roller *i* is covered with card-wire of

ordinary form extending across and disposed so as to work "heel to heel" relatively to and to engage with that of the cylinder *a* and is driven at a surface speed greater than that of the cylinder *a*.

The adjustable plates *l m* used with the rollers *h i* respectively may be mounted in any convenient way so as to be adjustable toward and away from the card-surfaces of the rollers *h i* respectively.

The plate *l* used with the roller *h* is provided with flanges or brackets 16 with slots 17 so that it may be secured by bolts 18 to the lower part of the trunk *j* and may be adjusted relatively to the roller *h*. The plate *m* used with the roller *i* is provided with flanges or brackets 19 secured by bolts 20 to brackets *o* secured by bolts 31 to part of the casing *p* of the upper part of the carding engine. Slots 21 are provided in the brackets *o* to allow the plate *m* to be adjusted relatively to the brackets *o* and slots 22 are provided in the brackets *o* to allow such brackets *o* and the plate *m* to be adjusted relatively to the casing *p* so that the plate *m* may be adjusted in any direction relatively to the roller *i*.

An adjustable plate *q* is provided to extend from the casing *p* nearly to the clearer-roller *n* so as to hinder the clearer roller *n* from throwing fiber carried by it into the trunk *j*. The plate *q* is provided with ears 32 having slots 33 for the passage of bolts 34 passed through holes in brackets *r* provided with slots 35 for the passage of bolts 36 by which they are secured to the casing *p*.

The trunks *j*, *k* may be constructed in any convenient way as for example of sheet metal and be provided with doors or openings, two marked *s*, *t* being shown, at convenient places to enable such trunks *j k* to be cleaned whenever cleaning may be necessary and are each connected at one end to the casing *p* of the carding engine in any convenient way, as for example by being made as to their sides as extensions of the sides of such casing *p*.

Openings *u*, *v* extending throughout the width of the trunks *j k* respectively and adjustable in width by means of plates *w*, *x* with flanges 37, 38 with slots 39, 40 respectively for the passage of bolts 41, 42 respectively connecting them to the hinged parts *s t* of the trunks *j k* respectively are provided in order that air to form the currents along the trunks *j*, *k* may be drawn as much as is readily possible directly from the room in which the carding engine is employed and not from the interior of the casing *p*. The slots 39, 40 and bolts 41, 42 allow of the adjustment of the plates *w*, *x*.

The settling space to which the trunks *j k* are made to lead may be formed in any way convenient whether formed as separate spaces or chambers for each trunk or to serve for use with both and the currents of air through the trunks *j k* may be induced by means of fans for each or one fan for both or in any other way convenient in any case and any provision for access to the settling space or chamber or spaces or chambers either with or without the stoppage of the carding engine and also any provision for the separation of dust or fiber from the air issuing from such settling space or chamber or spaces or chambers may be provided as may be necessary or desirable in any case.

The casing *p* for the upper part of the carding engine is necessarily a little different from that employed in ordinary carding engines but may be of any convenient construction, that in the case illustrated being provided with lids or doors *y*, *z** for allowing access to the workers *d* and clearers *e* and to the dirt roller *c*.

In order that air may be prevented as much as possible from flowing into the trunks *j k* from the interior of the casing *p* at parts other than those at which fiber is to be discharged into such trunks *j k* by the rollers *h i*, the lower sides of the trunks *j k* are made to extend close to the card surface of the cylinder *a* and transverse partitions 1*, 2* are provided in the interior of the casing *p* between the rollers *i*, *n* and the adjacent workers *d* and clearers *v*.

In the working of the apparatus illustrated fiber being supplied to the taker-in-roller *b* as in the ordinary way of carding will be acted upon as in the ordinary way of carding by means of the taker-in-roller *b*, the cylinder *a*, the dirt roller *c* and the first worker *d* and clearer *e*. Then the fiber upon the cylinder *a* being carried in proximity to the roller *h*, the roller *h* will lift from it any fiber lying on or projecting from the surface, chiefly longer or stronger fibers and these except for the portions which extend from the card surface of the roller *h* so far as to be caught by the clearer *n* and thus to be restored to the card surface of the cylinder *a* will be carried by the roller *h* past the clearer *n* and some will be thrown by centrifugal action into the trunk *j* and some will be beaten off by contact with the plate *l* and be carried by the current of air along the trunk *j*. All the fiber entering the trunk *j* will be carried along by the air-current into the settling space or chamber or spaces or chambers with which the trunk *j* is connected and as the velocity of the current becomes reduced in such space or chamber or spaces or chambers the fibers of different characteristics will settle sooner or later according to their greater or less density and their smaller or greater surface in proportion to their weight or other features enabling them to fall more or less easily in air. The fibers carried by the cylinder *a* past the roller *h* will be acted upon

by the workers *d* and clearers *e* at the upper part of the cylinder *a* in the ordinary way of carding and eventually be carried in proximity to the roller *i* whose card surface entering that of the cylinder *a* will brush out therefrom the portion of the fiber lying nearest the surface of the card surface of the cylinder *a* and throw out such portion of fiber into the trunk *k* either by centrifugal action or by bringing it against the plate *m* while the shorter and finer fiber remaining on the cylinder *a* is carried past the roller *i* and removed from the cylinder *a* by the action of the doffer *f* in the ordinary way of carding. As in the case of the fiber thrown or drawn into the trunk *j* so the fiber thrown into the trunk *k* will be carried along by the air current therein into the settling space or chamber or spaces or chambers to which such trunk *k* is connected and as the velocity of the current becomes reduced in such space or chamber or spaces or chambers the fibers of different characteristics will settle therein sooner or later and so at different distances from the carding engine according to their greater or less density and their smaller or greater surface in relation to their weight or other features enabling them to fall more or less easily in air.

The fiber removed from the cylinder *a* by the doffer *f* may be passed again through the carding engine if this be desirable for a further separation of fibers therefrom in a manner similar to that hereinbefore described.

The separation of different kinds of fibers in the settling space or chamber or spaces or chambers connected with the trunks *j k* may be made in any convenient way as by the provision of partitions in the lower parts of such space or chamber or spaces or chambers or by the separate removal of fiber from different larger or smaller parts of such space or chamber or spaces or chambers according to the discretion of operatives removing from time to time the accumulation of fiber from such space or chamber or spaces or chambers.

By changes being made in the position of the plates *l m* and rollers *h i n* and in the relative speeds of the rollers *h i n* as may be found desirable on trial with any particular mixture of fibers the carding engine illustrated may be adjusted in order to obtain any desirable separation of fiber from the mixture of fibers supplied to it.

The doors *y z** and hinged parts *s t* allow of access necessary from time to time to the parts within the casing *p*.

Obviously the casing and other details of a carding engine used for the purpose of this invention may be disposed in different ways as may be desirable in different cases.

In a roller and clearer carding engine the roller for the separation and discharge of fiber according to this invention may be one of the ordinary rollers of the carding engine either a worker roller or the "fancy" roller or a roller provided for the purpose of this invention and used with or without a clearer roller.

The material to be operated upon may be supplied to the cylinder of the carding engine in any convenient way.

It is generally desirable to employ a clearer with the fiber discharging roller in any case in which the material to be operated upon is of a light fluffy nature or contains a large proportion of fine fiber.

The clearer should work preferably "point to point" but may in some cases work "point to heel" relatively to the fiber discharging roller.

The fiber discharging roller is generally made to overrun the cylinder to an extent to be determined in accordance with the nature of the material being operated upon. The fiber discharging roller may work "point to heel" relatively to the cylinder and in this case it should be set as closely as possible to the cylinder but not so as to engage therewith and a clearer should be used or such fiber discharging roller may work "heel to heel" relatively to the cylinder and in that case it should be set so that the points of the wire thereon slightly engage the points of the wire of the cylinder and in that case a clearer may or may not be used. It is preferable to provide means for increasing or reducing the speed of the roller relatively to that of the cylinder.

If a clearer roller be used the fiber discharging roller may in some cases be made to revolve with a surface-speed less than that of the cylinder and in any such case the striking of the fibers against the plate will ordinarily be the only means of removing the strong fibers from such fiber discharging roller.

Air may be forced or drawn through the trunk as may be desirable in any case.

The plate aforesaid which when adjustable may be made to slide or to be adjusted in any other convenient manner, is provided with an edge or angle of suitable character or adapted to be adjusted in inclination as may be desirable in accordance with the material to be treated and the proportion of the material intended to be discharged from the casing of the carding engine by the roller employed for the purpose of this invention.

As may be desirable in different cases a single roller and trunk leading to a settling space or chamber or spaces or chambers or two, as in the case illustrated, or a greater number of rollers working with one trunk or each working in connection with one of two or more trunks and chambers or series

of chambers like that hereinbefore described may be provided at different parts of a carding engine.

The fan or other means for causing a current of air may be made to discharge air from the chamber or chambers provided as aforesaid into or through any suitable device for arresting or effecting the deposition of dust and light fiber or other matter in suspension in the air described.

If desirable in any case two or more rollers provided and employed according to this invention may be made to work in connection with one trunk to convey fibers to a chamber or chambers.

A carding engine with flats fixed or revolving may be employed according to this invention if it be provided with a roller or rollers to work along with a trunk and chamber or chambers in the manner hereinbefore described in discharging fibers through the casing of the cylinder, and in the case of a carding engine with two or more cylinders either one or more or each cylinder may be provided with a roller or rollers working with a trunk and chamber or chambers in the manner hereinbefore described.

Fur may be mentioned as one among other fibrous materials which may be treated according to this invention.

In the application of this invention by means of a carding engine with fixed or revolving flats some pulley or pulleys or other means must be provided for driving the roller or rollers provided for the purpose of this invention.

What I do claim as my invention and desire to secure by Letters Patent is:—

1. Apparatus for separating and grading fibers comprising a carding-engine with a cylinder, means for effecting preliminary carding, and a casing and a roller within the casing in proximity to the cylinder to remove fiber therefrom and an opening in the casing in proximity to the roller extending in width throughout the length of such roller, means for driving the roller, a trunk which extends across the whole width of and is in connection with the said opening and has adjacent to such opening an opening extending across its whole width for the entrance of air from without the carding engine casing, settling space in connection with the said trunk for allowing diminution of the velocity of an air-current entering it and the deposit of different fibers in different parts and means for causing a current of air through the trunk into the settling space independently of the action of the roller, substantially as hereinbefore described.

2. Apparatus for separating and grading fibers comprising a carding engine with a cylinder, means for effecting preliminary carding, and a casing and a roller within the casing in proximity to the cylinder to remove fiber therefrom and an opening in the casing in proximity to the roller extending in width throughout the length of such roller, means for driving the roller, a plate fixed adjacent to such roller and opening, a trunk which extends across the whole width of and is in connection with such opening and has adjacent to such opening an opening extending across its whole width for the entrance of air from without the carding engine casing, settling space in connection with the said trunk for allowing diminution of the velocity of an air current entering it and the deposit of different fibers in different parts and means for causing a current of air through the trunk into the settling space independently of the action of the roller, substantially as hereinbefore described.

3. Apparatus for separating and grading fibers comprising a carding engine with a cylinder, means for effecting preliminary carding, and a casing and a plurality of rollers within the casing in proximity to the cylinder to remove fiber therefrom and an opening in the casing in proximity to each such roller extending in width throughout the length of such roller, means for driving the rollers, a trunk which extends across the whole width of and is in connection with said openings and has adjacent to each such opening an opening extending across its whole width for the entrance of air from without the casing of the carding engine, settling space in connection with the said trunk for allowing diminution of the velocity of an air-current entering it and the deposit of different fibers in different parts and means for causing a current of air through the trunk into the settling space independently of the action of the rollers, substantially as hereinbefore described.

4. Apparatus for separating and grading fibers comprising a carding engine with a cylinder, means for effecting preliminary carding, and a casing and a plurality of rollers within the casing in proximity to the cylinder to remove fiber therefrom and an opening in the casing in proximity to each roller extending throughout the length of such roller, means for driving the rollers, a plurality of trunks each of which extends across the whole width of and is in connection with one of said openings and has adjacent to such opening with which it is in connection an opening extending across its whole width for the entrance of air from without the carding engine casing, settling spaces each in connection with one of the said trunks for allowing diminution of the velocity of an air-current entering it and the deposit of different fibers in different

parts and means for causing a current of air through each trunk into the corresponding settling space independently of the action of the rollers, substantially as hereinbefore described.

5. Apparatus for separating and grading fibers comprising a carding engine with a cylinder, means for effecting preliminary carding, and a casing and a plurality of rollers within the casing in proximity to the cylinder to remove fiber therefrom and an opening in the casing in proximity to each roller and extending in width throughout the length of such roller, means for driving the rollers, plates fixed adjacent to such rollers and the openings adjacent to them, a plurality of trunks each of which extends across the whole width of and is in connection with one of said openings and has adjacent to the opening with which it is connected an opening extending across its whole width for the entrance of air from without the carding engine casing, settling space in connection with the said trunks for allowing diminution of the velocity of air-current entering it and the deposit of different fibers in different parts and means for causing currents of air through the trunks into the settling space independently of the action of the rollers, substantially as hereinbefore described.

6. Apparatus for separating and grading fibers comprising a carding engine with a cylinder, means for effecting preliminary carding, and a casing and a plurality of rollers within the casing in proximity to the cylinder to remove fiber therefrom and an opening in the casing in proximity to each such roller extending in width throughout the length of such roller, means for driving the rollers, a plurality of trunks each of which extends across the whole width of and is in communication with openings in proximity to rollers and has adjacent to each opening in connection with it an opening for the entrance of air from without the carding engine casing, settling space in connection with the said trunks for allowing diminution of the velocity of an air-current entering it and the deposit of different fibers in different parts and means for causing a current of air through each of the trunks into the settling space independently of the action of the rollers, substantially as hereinbefore described.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this eleventh day of August, 1911.

FREDERICK SAMUEL JAMES BROOME.

Witnesses:
HOWARD CHEETHAM,
RUTH M. WILSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."