Dec. 30, 1930. R. A. WEBBER 1,786,973

METHOD OF AND APPARATUS FOR SELECTING FIBER

Filed July 18, 1927 7 Sheets-Sheet 1

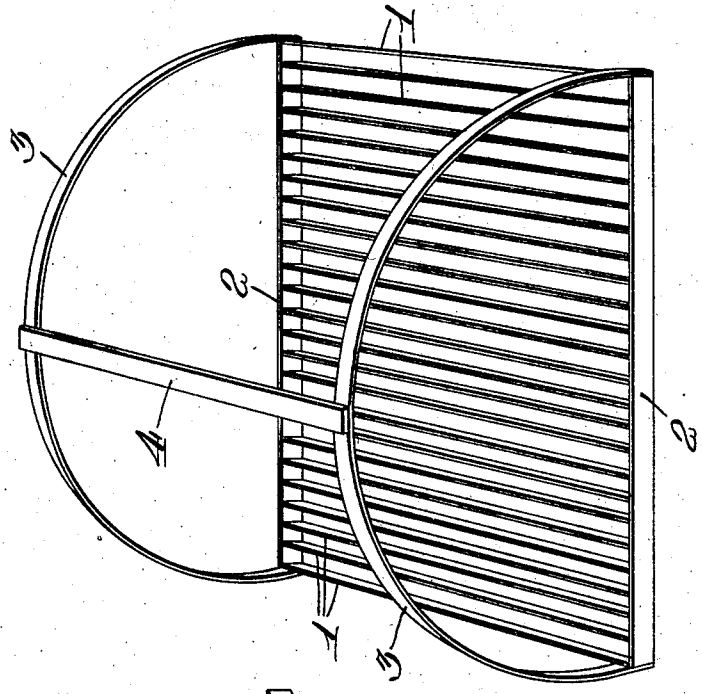


Fig. 1.

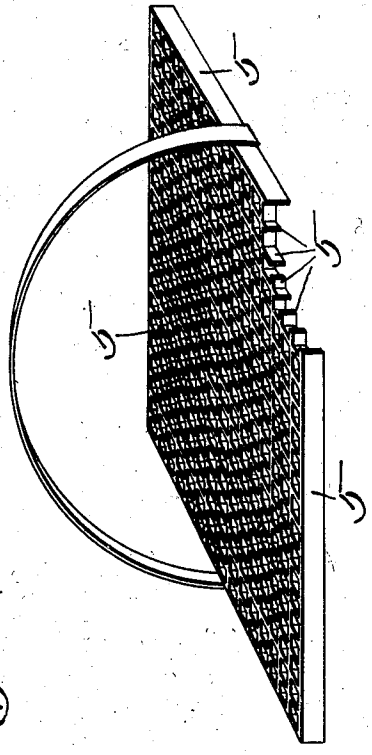


Fig. 2.

Inventor
Robert A. Webber
by Wright, Brown, Quinby & Kay
Attys

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METHOD OF AND APPARATUS FOR SELECTING FIBER

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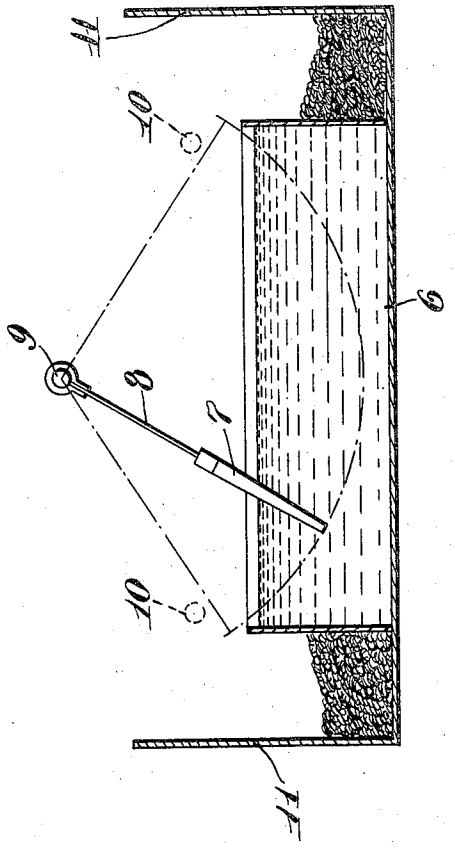


Fig. 3.

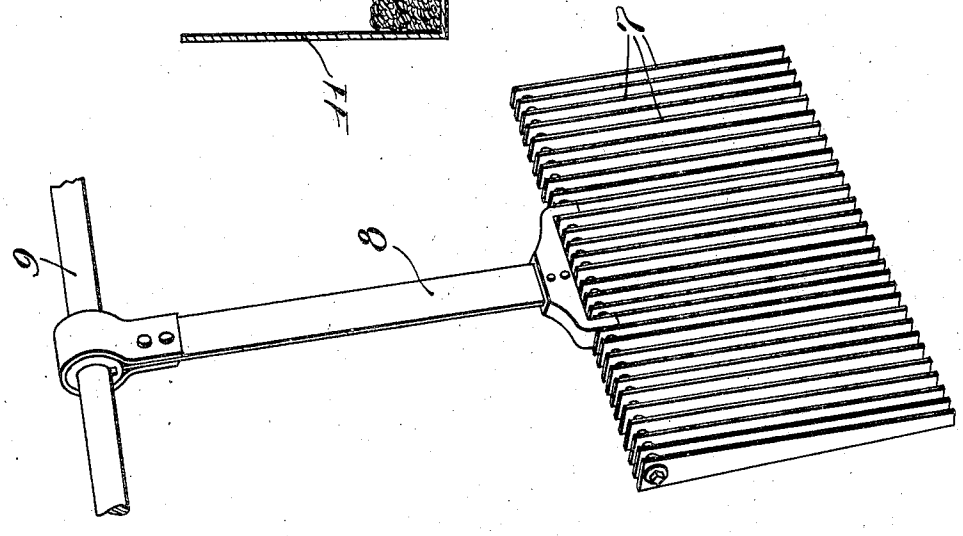


Fig. 4.

Inventor
Robert A. Webber
by Wright, Brown, Quinby & May
Attys

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METHOD OF AND APPARATUS FOR SELECTING FIBER

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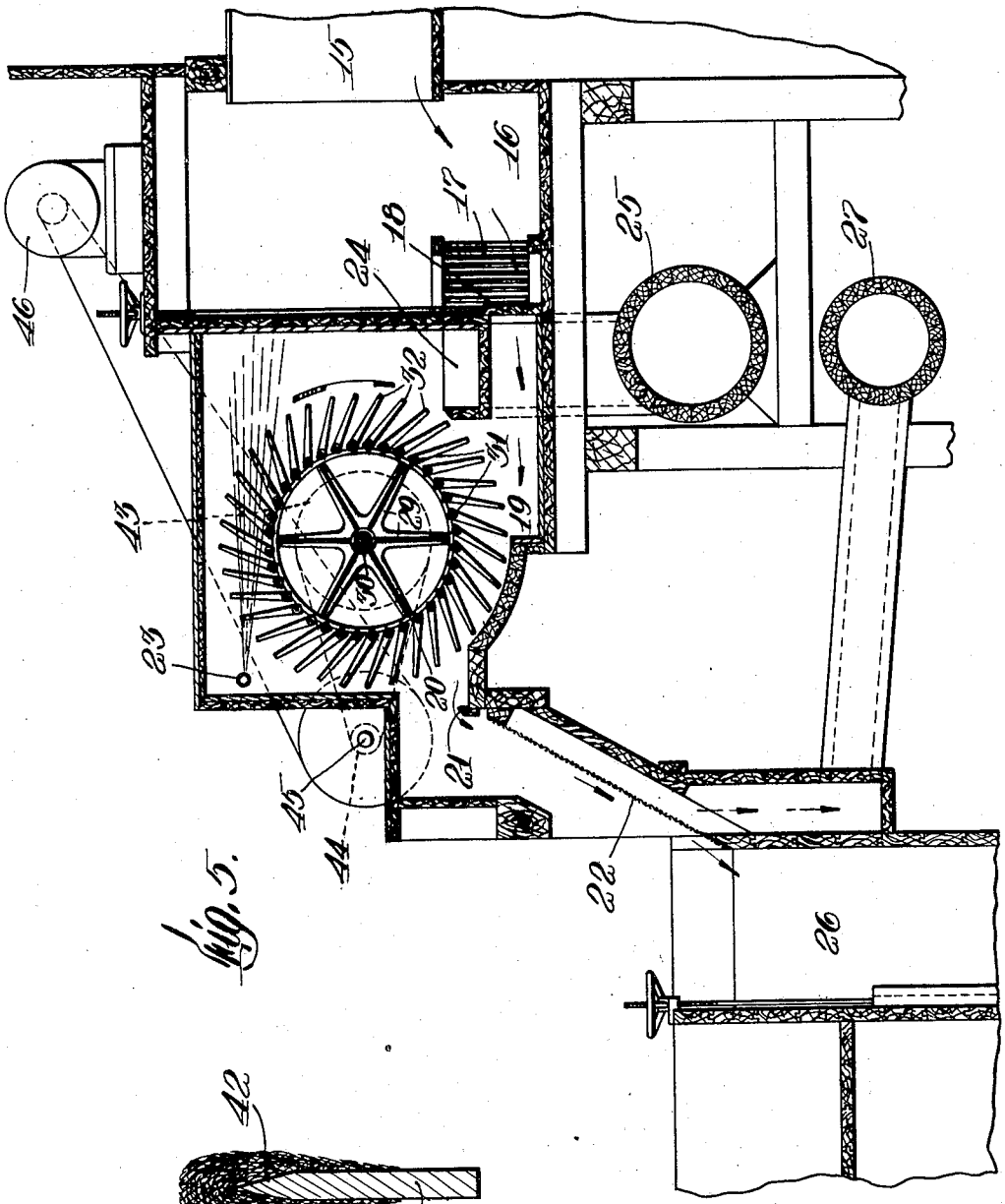


Fig. 5.

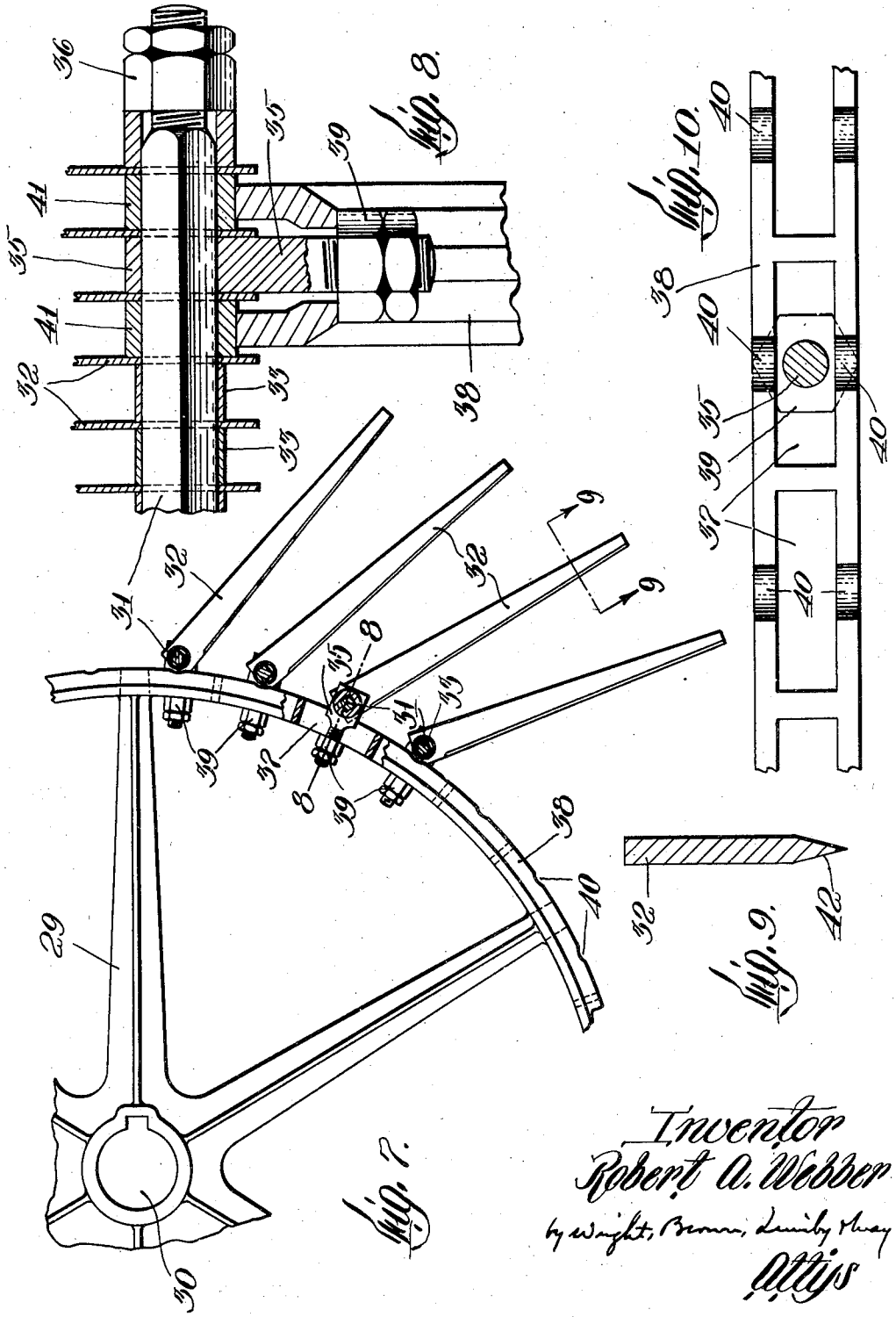
Fig. 6.

Inventor
Robert A. Webber
by Wright, Brown, Quinby & Kay
Attys

Dec. 30, 1930. R. A. WEBBER 1,786,973

METHOD OF AND APPARATUS FOR SELECTING FIBER

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Inventor
Robert A. Webber
by Wright, Brown, Quinby & Way
Attys

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METHOD OF AND APPARATUS FOR SELECTING FIBER

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Fig. 12.

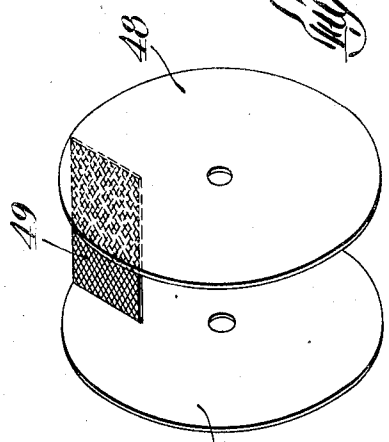
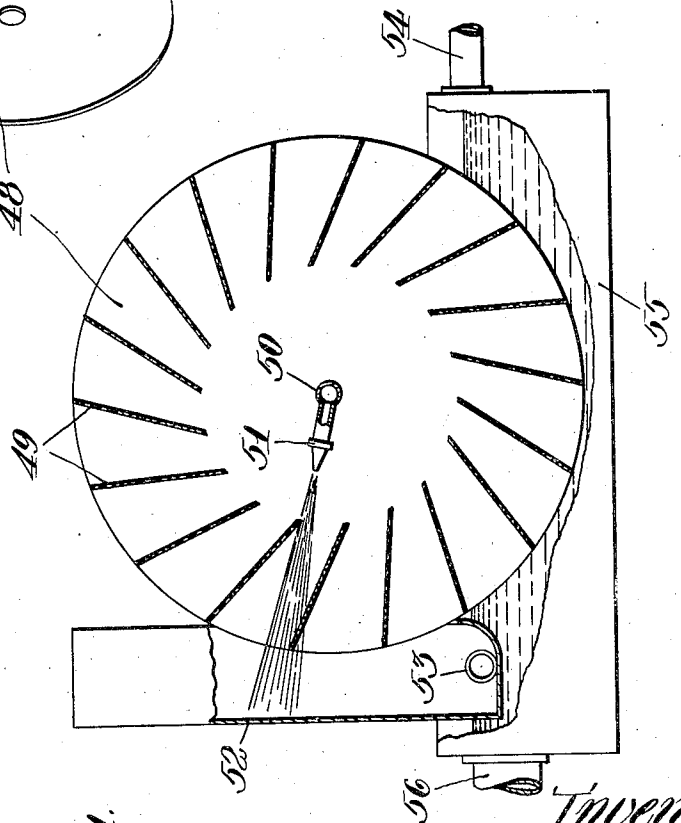


Fig. 11.



Inventor
Robert A. Webber
by Wright, Brown, Quinby & May
Attys

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METHOD OF AND APPARATUS FOR SELECTING FIBER

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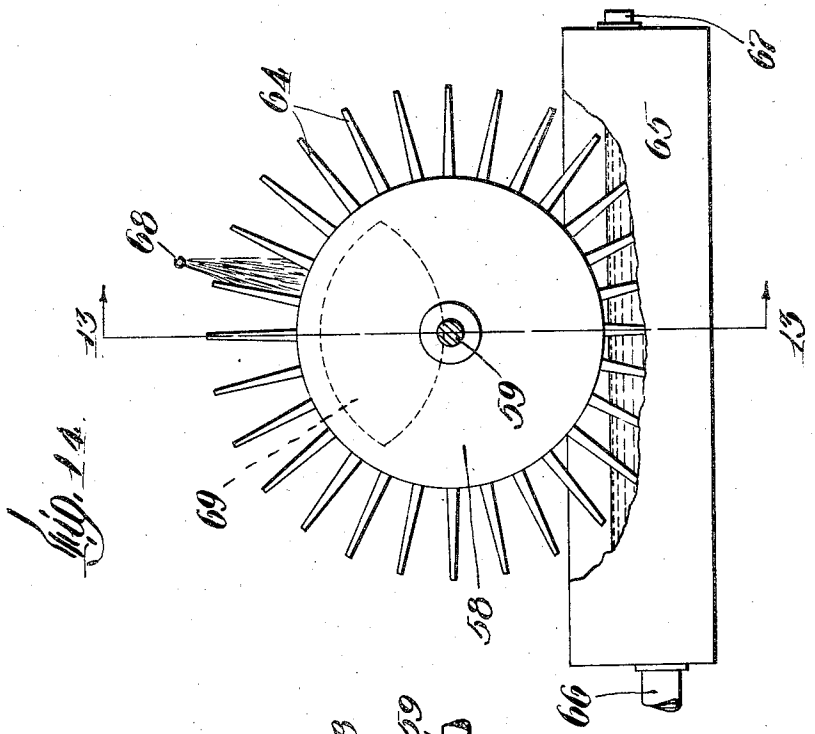


Fig. 14.

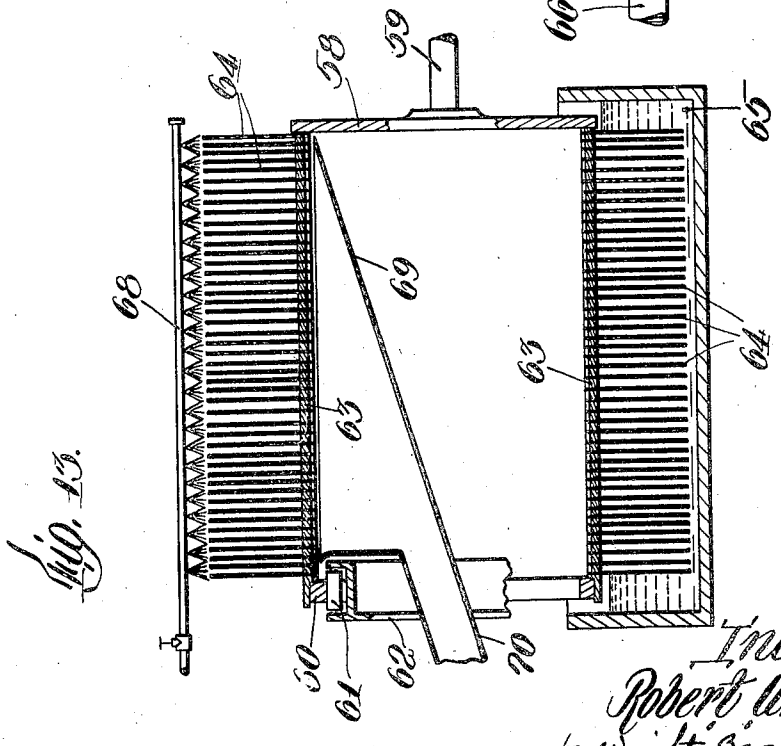


Fig. 15.

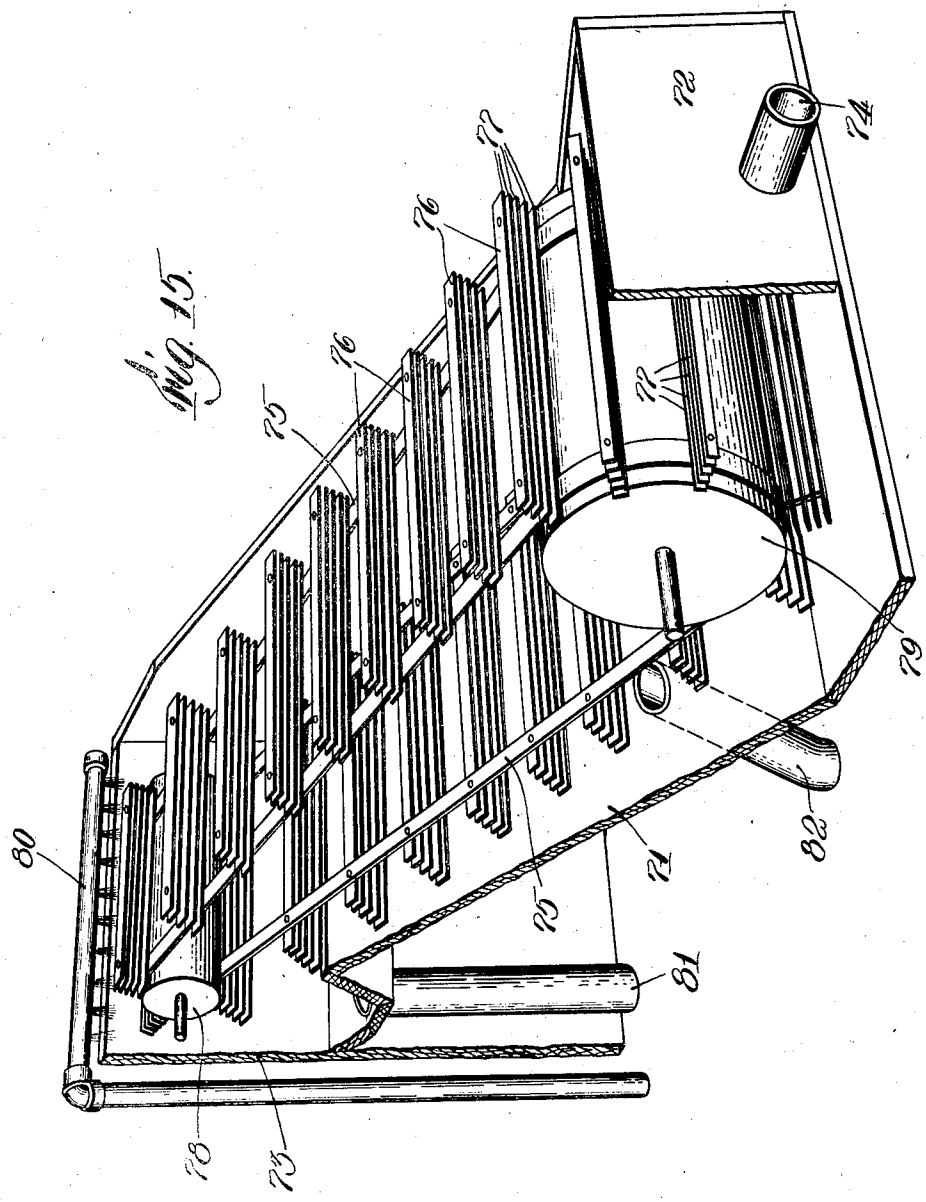
Inventor
Robert A. Webber
by Wright, Brown, Quinby & Finney
Attys

Dec. 30, 1930. R. A. WEBBER 1,786,973

METHOD OF AND APPARATUS FOR SELECTING FIBER

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Fig. 15.



Inventor
Robert R. Webber
by Wright, Brown, Quinby & Kay
Att'ys.

Patented Dec. 30, 1930 1,786,973

UNITED STATES PATENT OFFICE

ROBERT A. WEBBER, OF BERLIN, NEW HAMPSHIRE, ASSIGNOR TO BROWN COMPANY, OF BERLIN, NEW HAMPSHIRE, A CORPORATION OF MAINE

METHOD OF AND APPARATUS FOR SELECTING FIBER

Application filed July 18, 1927. Serial No. 206,477.

Cellulose fiber as found in nature or pulp liberated from various cellulosic materials such as wood, consists of fiber units of widely varying lengths, some being below and some above a certain average fiber length possessed by the pulp as a whole. For many purposes, it is advantageous to employ that portion of a pulp consisting mainly of long fibers, as this portion is superior to the rest of the pulp.

My invention relates to a method of and apparatus for selecting or separating long fibers from pulp. The general method which I employ is to cause relative motion between a pulp suspension and edge-presenting members or "edges" capable of picking up the long fibers, and then removing and recovering the picked up fibers. Either the edges may be moved through the pulp, or the pulp moved past the edges, but, owing to the fact that the second method involves the handling of very large volumes of suspended pulp, the preferable method is one which involves moving the edges through the pulp, as this permits more economical commercial operation.

When edges are moved through a suspended pulp, the long fibers are caught or picked up by being folded over the edges, and the small fibers or fiber fragments slip by. In actual practice, the mechanism of selection is doubtless quite complex. It is thought that probably the edge picks up a layer of fibers upon first entering the stock, and as it moves therethrough continues to pick up more fibers until an accumulation of fibers is produced which after awhile itself constitutes the edge. As the accumulation grows, fiber selectively doubtless varies, and entrainment as well as selection takes place.

A method such as described may be used with great advantage, as it is capable of yielding a product of materially higher fiber length having certain characteristics notably superior to those of the original pulp. For example, the selected fiber will produce a stronger and more stable paper of greater tearing resistance and folding endurance. It is whiter, cleaner, and more absorptive than the original pulp, and possesses a higher total and resistant cellulose content and a lower copper number, these improved characteristics doubtless resulting from its segregation from the coloring, colloidal and other impurities usually present with the short and broken fibers of the original pulp. When selected from wood pulp which has been refined to high alpha cellulose content, it is eminently suitable for the manufacture of high grade papers, such as fine writing, bond, and ledger, for sheeting into absorptive webs to be used as the base for the manufacture of impregnated products such as artificial leather, and for the preparation of high grade cellulose derivatives.

Various types of selectors will be described, but each type involves the use of multiple edges, which may take the form of blades or wires dimensioned so as to be capable of picking up or selecting long fibers when moved through a pulp or fiber suspension. The fibers may then be removed from the edges as by shaking or by spray-washing, the latter method being preferable, as practically all the fiber may thus be recovered. Where wires are employed as the edge-presenting members, they are preferably of non-circular cross-section, for instance, square or triangular, chiefly, because fiber will turn and slip on round wire. Round wire may, however, be satisfactorily used in the form of screening or grilles having relatively large openings, say, one to four meshes to an inch. When thin metallic ribbons are employed as the edge-presenting members, they may be conveniently arranged in the form of a grille.

With these and other features in view, my invention consists in the method, as well as the construction, combination and arrangement of parts hereinafter described in conjunction with the accompanying drawings, wherein

Figure 1 illustrates in perspective a selector of the hand-type.

Figure 2 shows a similar view of a somewhat different type of hand-selector.

Figure 3 represents diagrammaically a selector of the reciprocating type and having only one selector grille.

Figure 4 shows in perspective the selector grille.

Figure 5 represents in side elevation a preferred selector of the rotor type installed in a pulp mill.

Figure 6 shows a detail of fiber formation on a sharp-edge selector blade.

Figure 7 is a side elevation of a portion of the selector shown in Figure 5, illustrating the mounting of the grilles.

Figure 8 is a section on the line 8—8 of Figure 7.

Figure 9 is a section on the line 9—9 of Figure 7.

Figure 10 represents a plan view of a rim portion of a spider on which the grilles are mounted.

Figure 11 illustrates more or less conventionally a side elevation of another type of rotor selector.

Figure 12 shows in perspective the rotor with but one grille attached.

Figure 13 represents a sectional view of still another type of rotor selector.

Figure 14 is a side elevation of the same.

Figure 15 illustrates in perspective another type of selector.

Referring to the drawings, Figure 1 represents one form of hand-grille or selector made up of strips 1 of copper or other sheet metal arranged in spaced parallel relationship and soldered at their ends to similar cross-strips 2. The edges of the strips may be either relatively sharp or else left blunt, as shown, and may correspond to a thickness of about $\frac{1}{16}$ inch. The grille may be provided at its ends with arch-shaped pieces 3 tied together by a cross-piece 4, serving as a handle. In operation, the grille is lowered into the pulp to be subjected to selection, and then quickly drawn up. The grille may then be transferred to a fiber-recovery vat wherein the selected fibers may be thoroughly washed therefrom while held in an edgewise position. In Figure 2 is shown a hand-grille consisting of blades 5 arranged both lengthwise and crosswise. Because of its greater edge length, this type of grille gives a greater yield of fiber per unit of area per dip than that shown in Figure 1.

Hand-type selectors, such as described find utility in the laboratory, giving sufficient yield of selected fiber for such purposes. For obtaining larger yields of selected fiber, it is necessary to provide apparatus capable of selecting fiber automatically. Figure 3 illustrates diagrammatically an apparatus of this type, comprising only one selector grille and intended to reproduce mechanically the operations of hand-selection. As shown, the pulp to be subjected to selection is maintained in a tank 6 into and out of which swings a grille 7 fixed to the lower end of an arm 8. The arm is fixed at its upper end to a rock shaft 9 which causes the grille to move to and fro in an arcuate path through the pulp, and to strike abruptly against stops 10 at both ends of its path and thus cause the wet fibrages to be shed from the grille into collecting troughs 11. While apparatus of this type requires no spray water for the recovery of the selected fiber, the yield is low for economical commercial operation, because only a single grille moves through the stock at a given time, and a certain amount of motion is lost at the end of each movement.

A selector which gives good yields is one consisting of a rotor or other endless carrier on which is mounted an endless succession of grilles, the number of grilles moving through the pulp at a given time being as high as possible. In Figure 5, a preferred selector of this type is shown installed in a pulp mill, and intended to operate upon pulp just as it comes from a riffling or screening mechanism, the pulp thus being in an unbeaten or comparatively free condition. As shown in this figure, the pulp flows from a box 15 into a supply channel 16, and thence through grating 17 past a gate 18 into a vat 19 in which a selector unit 20 operates. The selector rotates in the same direction as the pulp flows and picks up mainly the long fibers, these being removed therefrom by water jets from a water pipe 23, and, falling into a collecting trough 24, gravitate into an outlet spout 25. The rest of the pulp flows over a dam 21, and, if desired, also over an inclined screen 22 of fine-meshed wire or perforated plate, through the openings of which the fibrillæ or fiber fragments and fine impurities pass, the short fiber discharging into a tank 26, and the fines together with the associated white water into a spout 27.

The selector unit comprises spaced spiders 29, fixed to a shaft 30, on which the selector grilles are mounted. Each grille, as best shown in Figure 8, comprises a plurality of blades 32, mounted on a rod 31, preferably of square section, so that the blades are incapable of turning thereon. The blades are maintained fixed in spaced relationship by spacers 33. Each rod is attached, near its end to one of the spiders, by an eye-bolt 35 whose shank passes through a slot 37 in the rim of the spider. The rod is threaded at each end for the reception of a nut 36 serving to maintain the spacers and blades in assembled condition.

The grille is assembled with a spider by passing the eye-bolt through the slot 37 formed in the rim 38 and screwing on the threaded end of the bolt a nut 39 which clamps the rod against the rim. The rim is shown as grooved at 40 near the opening for the reception of the spacers 41 adjacent to the eye-bolt. Grilles are thus assembled in the desired spaced relationship about the entire periphery of the spiders. The blades 32

as shown in Figures 6 and 9 are beveled at their forward edges 42, and as best shown in Figure 7, are arranged at an angle in advance of radial lines passing through their inner ends, this permitting the blades to leave the suspension with their edges more nearly parallel to its surface. The selector may be rotated by a sprocket 43 fixed to one end of the shaft 30 and chain-driven by a sprocket 44 on a countershaft 45 driven from a motor 46.

Figures 11 and 12 show a rotor selector of a somewhat different type, employing wire grilles and equipped with internal spray heads or nozzles. The selector comprises a pair of spaced discs 48, bridged by grilles 49 of coarse mesh wire secured to their inner faces at an angle somewhat in advance of radial lines passing through their outer ends. The discs are mounted for rotation on a hollow shaft 50. A series of nozzles 51 impinge jets of water against the grilles when they have rotated out of a vat 55 in which the selector is mounted to operate. A gland (not shown) may be clamped about the shaft 50 in such way as to permit the shaft to rotate within it, the gland being held in a stationary position as by a weighted arm. To the gland may be attached the nozzle or series of nozzles 51, supplied with water from the hollow shaft which turns in the gland. The selected fiber picked up by the blades or wires is washed into a collecting trough 52, leaving through a discharge pipe 53. The stock to be subjected to selection is fed into the vat 55 from a supply pipe 56, flowing in the direction of the peripheral movement of the selector, and, after being acted upon by the selector, leaves through an outlet pipe 54.

Figures 13 and 14 illustrate still another form of rotor selector. One end of the rotor consists of a disc 58 rigidly affixed to and supported by a shaft 59 by which rotation of the selector as a whole may be effected. The other end consists of a ring 60, revolving over a series of rollers 61 mounted on a stationary channel ring 62 supported in any suitable manner. A series of rods 63 bridging the ring 60 and the disc 58 serve to support rows of radial selector blades 64 in spaced relationship. The rotor operates in a vat 65 supplied with pulp from an inlet pipe 66, the pulp flowing in the direction of rotation of the rotor and leaving through an outlet pipe 67. The blades 64 carry the picked-up or selected fiber until a series of water jets emitted radially from a pipe 68 wash the fibers therefrom into a collecting trough 69, from which the selected pulp passes through a discharge pipe 70.

Another type of selector is that shown in Figure 15, wherein endless belts are employed for carrying the grilles. The selector is shown operating in an inclined tank 71 shown partly broken away to disclose the selector structure therein. The tank has at its lower end a trough 72 wherein the fiber selection takes place, and at its upper end a trough portion 73 wherein the selected fiber is washed off and collected. The stock is fed from an inlet pipe 74 into the lower trough portion 72. Spaced endless belts 75 carry grilles 76 comprising a plurality of blades 77 arranged in spaced parallel relationship through the tank.

Rolls 78 and 79, respectively located in the upper and lower troughs, serve to guide the belts, either roll being driven to cause the movement of the grilles through the tank. As the grilles pass through the pulp in the trough 72, they pick up the long fibers, and then carry them around the roll 79 and thence up to the trough 73, where a series of sprays from a water pipe 80 impinge thereagainst to wash the selected fibers into the trough 73 from which they pass through an outlet pipe 81. The unselected short fiber pulp passes from the trough 72 through an outlet pipe 82.

While blunt-edged grilles may, as stated, be used, it is generally preferable to use the relatively sharp edges, if high selectivity combined with good yield is desired. This is due to the fact that the speed of a blunt-edge member through the pulp must be relatively quite low in order to avoid pushing the stock as a whole ahead of each member and thus lower the relative motion of grille and pulp. At low relative speeds of grille and stock, the selectivity is less than at the high relative speeds at which sharp-blade grilles may be moved through the pulp. But if high selectivity is not desired, that is, if the selected pulp is to be of only slightly higher average fiber length, the blunt-edge selector may be desirable because of the higher yield obtainable.

While selectors of the type described are capable of operating on stocks at various densities, it is generally preferable to have a density of below 1%, say about .2% to .3%, as under these conditions both the yield and selectivity are good. The pulp is preferably fed in the same direction as the movement of the grilles, as otherwise considerable resistance is offered against the grilles. But the pulp flow should be slow, since otherwise little fiber would be picked up, as relative motion is necessary. While it is possible to subject the same pulp to selecting action a number of times, this is generally unnecessary in actual practice, for with a properly designed selector it has been found possible to remove a large proportion, say 50%, of the long fiber, by passing it through a single selecting mechanism. As selection proceeds, the pulp density in the unselected stock gradually decreases from an initial value of, say, 0.3% to 0.2%. As this takes place, the fiber yield drops, this drop being

especially rapid when the density falls below 0.2%. If desired, however, pulp may be subjected to several selections to produce several different grades of selected fiber. Thus, about 50% to 60% of the pulp may be selected into one grade, then 20% to 30% of the remaining fiber into another grade, the fiber being thickened between selections.

A method and apparatus such as herein described thus makes possible the division of a pulp into two or more different grades of different fiber lengths. The longest fiber portion is generally most valuable and may be used for manufacture into products notably superior to those producible from the original pulp. Or it may be desirable to give this valuable portion a special processing, for instance processing to produce a product high in alpha cellulose, where the original pulp is a wood pulp such as sulphite. The short fiber portion may be used for purposes where fiber length is of secondary importance, as in the manufacture of such papers as require an easy beating pulp. It may also be used as a raw material for the manufacture of cellulose derivatives, particularly when the original pulp is of high alpha cellulose content and its content of fine impurities has been removed therefrom.

While in the particular embodiments illustrated I have described the operation of selection as performed on an aqueous pulp suspension, it should be understood that my invention comprehends selection from other mediums or carriers for cellulose fiber, both liquid and gaseous. Thus, cellulose fibers such as those of cotton or wood pulp may be suspended in a current of air or other gas and carried or blown into grille arrangements or selectors such as hereinbefore described, to effect a selection of the portion consisting mainly of long fibers. Fiber recovery may also be effected with an air blast operating in much the same way as the water sprays already mentioned. Hence, by the expressions "pulp" or "pulp suspension" as used in the appended claims, I mean fiber suspended in water, air, or other liquid or gaseous media.

As previously indicated, the method of the present invention may be carried out after the pulp has been subjected to the usual screening operation by which a removal of the coarse impurities, including chips, shives, etc., is effected. These coarse impurities are characterized by their relative inflexibility or inability to become folded over edge-presenting members when relative motion is caused between a pulp suspension and such members, but advantitious entrainment of such impurities in the picked-up fibers is avoided when initial screening of the pulp is effected.

Having thus described certain embodiments of my invention, it is evident to those skilled in the art that various changes might be made therein without departing from the spirit or scope of invention as set forth in the appended claims.

What I claim is:

1. A method which comprises causing relative motion between a comparatively dilute cellulose pulp suspension and edge-presenting members so as to cause a folding of the long fibers over said members, and removing and recovering such long fibers from said members.

2. A method of selecting long fibers from cellulose pulp, which comprises causing relative movement between such pulp comparatively dilute suspension and edge-presenting members so as to cause long, relatively flexible fibers to be picked up on the edges of said members, and washing and recovering such fibers from said members.

3. A method of selecting long fibers from cellulose pulp, which comprises moving edge-presenting members through such pulp, in comparatively dilute suspension, thereby picking up long, relatively flexible fibers on the edges of said members and removing and recovering such long fibers from said members.

4. A method of selecting long fibers from cellulose pulp, which comprises moving edge-presenting members through such pulp in comparatively dilute suspension, thereby folding the long fibers over said members, and washing and recovering the fibers from such members.

5. A method of selecting long fibers from cellulose pulp, which comprises moving edge-presenting members through a pulp suspension flowing in the same direction but at lower speed than said members, and removing and recovering the pulp picked up by said members.

6. A method which comprises moving edge-presenting members through pulp thereby picking up long, relatively flexible fibers on the edges of said members, washing and recovering such long fibers from said members, and removing fine impurities from the rest of the pulp.

7. A method which comprises passing an endless succession of grilles capable of picking up long cellulose fibers through cellulose pulp, and removing and recovering the fibers picked up thereby when such grilles emerge from the pulp.

8. A method which comprises passing an endless succession of grilles capable of picking up long cellulose fibers through a cellulose pulp suspension moving at lower speed in the same direction as the grilles, and washing and recovering picked-up fiber from the grilles after they have emerged from the pulp.

9. Apparatus of the class described, com-

prising edge-presenting members capable of picking up long, relatively flexible fibers from cellulose pulp, and means for moving said members into and out of the pulp.

10. Apparatus of the class described, comprising edge-presenting members capable of picking up long fibers from cellulose pulp, means for moving said members into and out of the pulp, and means for removing the picked-up fibers from said members.

11. Apparatus of the class described, comprising a plurality of edge-presenting members capable of picking up long fibers from cellulose pulp, means for moving said members into and out of the pulp, and means for spraying water against said members after emergence from the pulp, to remove the fibers therefrom.

12. Apparatus of the class described, comprising edge-presenting members capable of picking up long fibers from cellulose pulp, means for moving said members into and out of pulp, means for spraying water against said members to wash the long fibers therefrom after they have emerged from said pulp, and means for recovering the fibers washed from said members.

13. In combination, a vat for containing cellulose pulp, an endless succession of edge-presenting members capable of picking up long fibers from such pulp, and means for causing the movement of said members through such pulp.

14. In combination, a vat for containing cellulose pulp, an endless carrier in said vat, a succession of grilles mounted on said carrier and capable of picking up long fibers from such pulp, means for causing the movement of said carrier through such pulp, and means for removing the picked-up fibers from said grilles.

15. In combination, a vat for containing cellulose pulp, an endless carrier partially submerged in such pulp, a succession of grilles mounted on said carrier and capable of picking up long fibers when moved through such pulp, means for causing the movement of said carrier through such pulp, and means for washing and recovering the picked-up fibers from said grilles.

16. Apparatus of the class described, comprising a shaft, spiders arranged in spaced relation on said shaft, and a plurality of grilles secured around the periphery of said spiders and capable of picking up long fibers from cellulose pulp.

17. Apparatus of the class described, comprising a shaft, spiders arranged in spaced relation on said shaft, a plurality of grilles secured around the periphery of said shaft, and capable of picking up long fibers from pulp, means for rotating said shaft, and means for washing and recovering the picked-up fiber from the grilles.

18. Apparatus of the class described, comprising a shaft, spaced spiders on said shaft, rods extending from spider to spider, and sharp-edge blades arranged in spaced relation on said rods.

19. A method which comprises causing relative motion between an unbeaten cellulose pulp suspension and edge-presenting members so as to cause a folding of the long fibers over said members, and removing and recovering such long fibers from said members.

20. A method which comprises causing relative motion between a cellulose pulp suspension of about 0.2% to 0.3% and edge-presenting members so as to cause long, relatively flexible fibers to be picked up by such members, and removing and recovering such long fibers from said members.

21. A method which comprises causing relative motion between a cellulose pulp suspension of about 0.2% to 0.3% and edge-presenting members so as to cause long, relatively flexible fibers to be picked up by such members, and washing and recovering such fibers from said members.

22. In combination, a channel through which a stream of cellulose pulp suspension may continuously flow, a rotor, an endless succession of edge-presenting members carried by said rotor and progressively dipping into and issuing from said suspension during the operation of said rotor, and means for removing and recovering the fibers picked up from said suspension by said members as they progressively issue from the suspension.

23. In combination, a channel through which a stream of cellulose pulp suspension may continuously flow, a rotor, an endless succession of edge-presenting members carried by said rotor and progressively dipping into and issuing from said suspension during the operation of said rotor, and means for washing and recovering the fibers picked up from said suspension.

24. A method of treating wood pulp which comprises removing coarse impurities therefrom, bringing the resulting pulp in contact with edge-presenting members to cause a folding of the long fibers over said members, and removing and recovering such long fibers from said members.

In testimony whereof I have affixed my signature.

ROBERT A. WEBBER.