

No. 847,371.

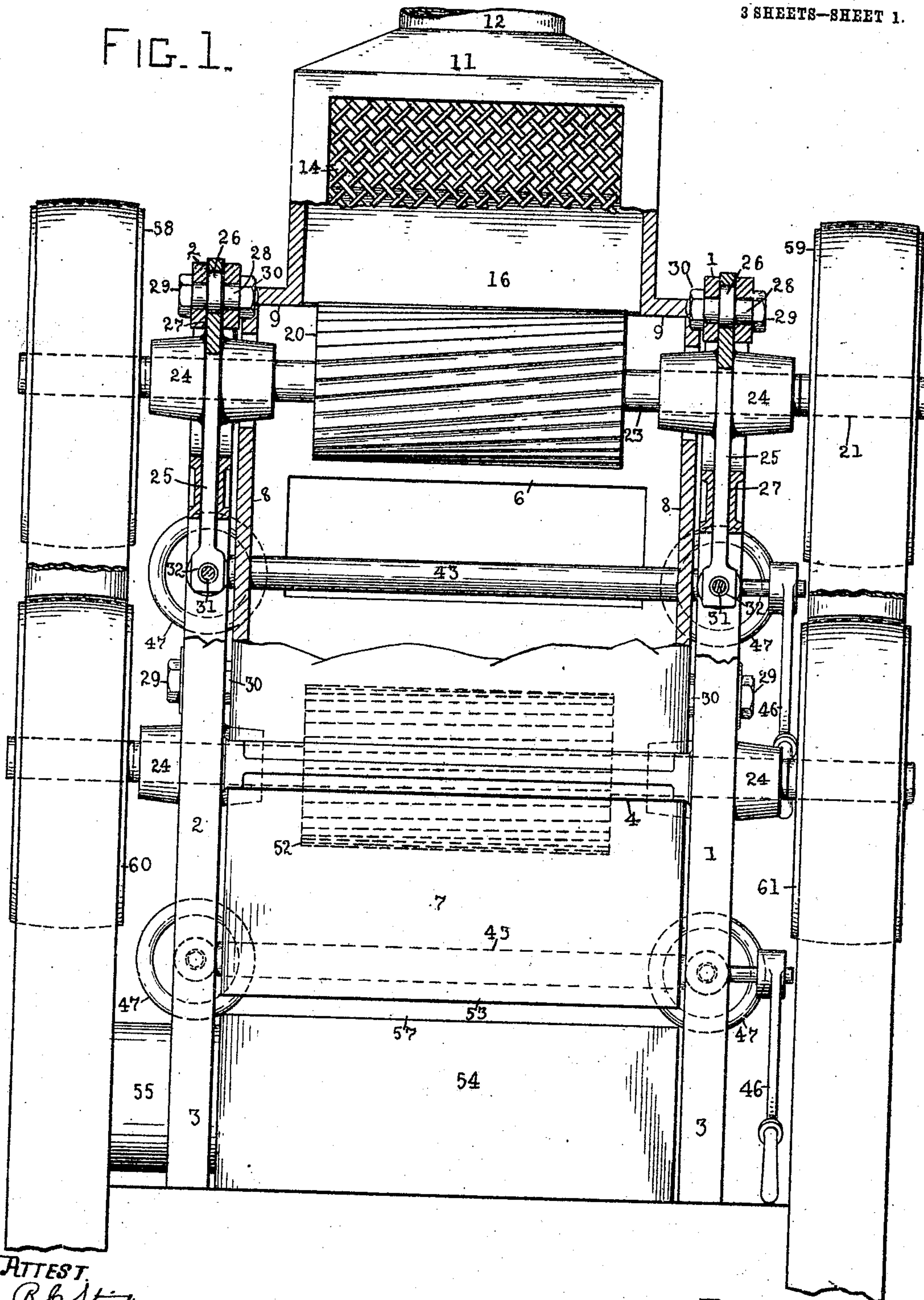
PATENTED MAR. 19, 1907.

W. H. ROBINSON.
APPARATUS FOR CONVERTING FEATHERS INTO DOWN.

APPLICATION FILED FEB. 17, 1902.

3 SHEETS—SHEET 1.

FIG. 1.



ATTEST.
B. B. Stickney
L. A. Johnson

INVENTOR
By William H. Robinson
Thomas H. Robinson HIS
ATTY.

No. 847,371.

PATENTED MAR. 19, 1907.

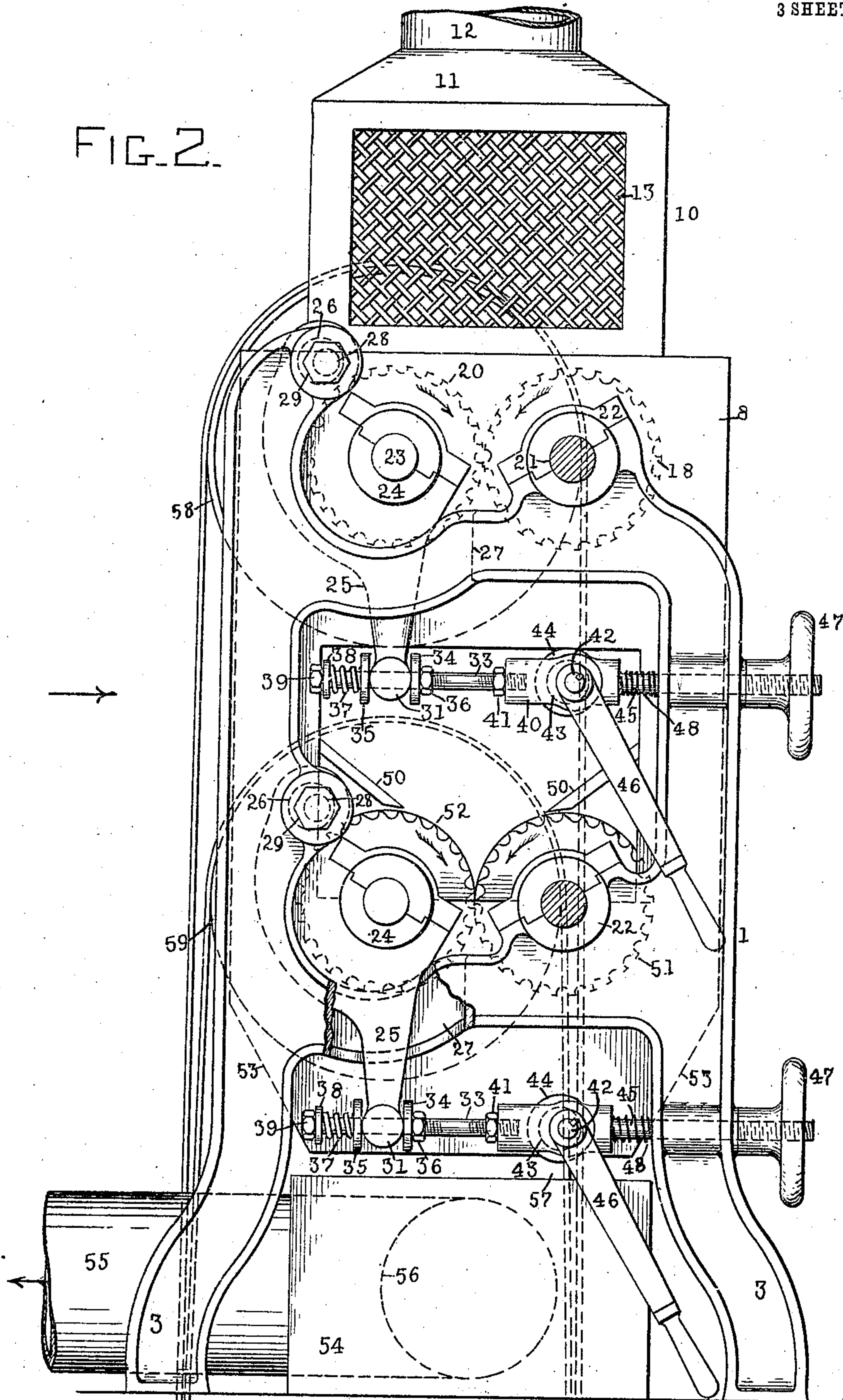
W. H. ROBINSON.

APPARATUS FOR CONVERTING FEATHERS INTO DOWN.

APPLICATION FILED FEB. 17, 1902.

3 SHEETS—SHEET 2.

FIG. 2.



WITNESSES.

B. B. Stickney
L. A. Schmitt

INVENTOR

William H. Robinson
By *Thomas H. Patterson*
HIS ATTORNEY

No. 847,371.

PATENTED MAR. 19, 1907.

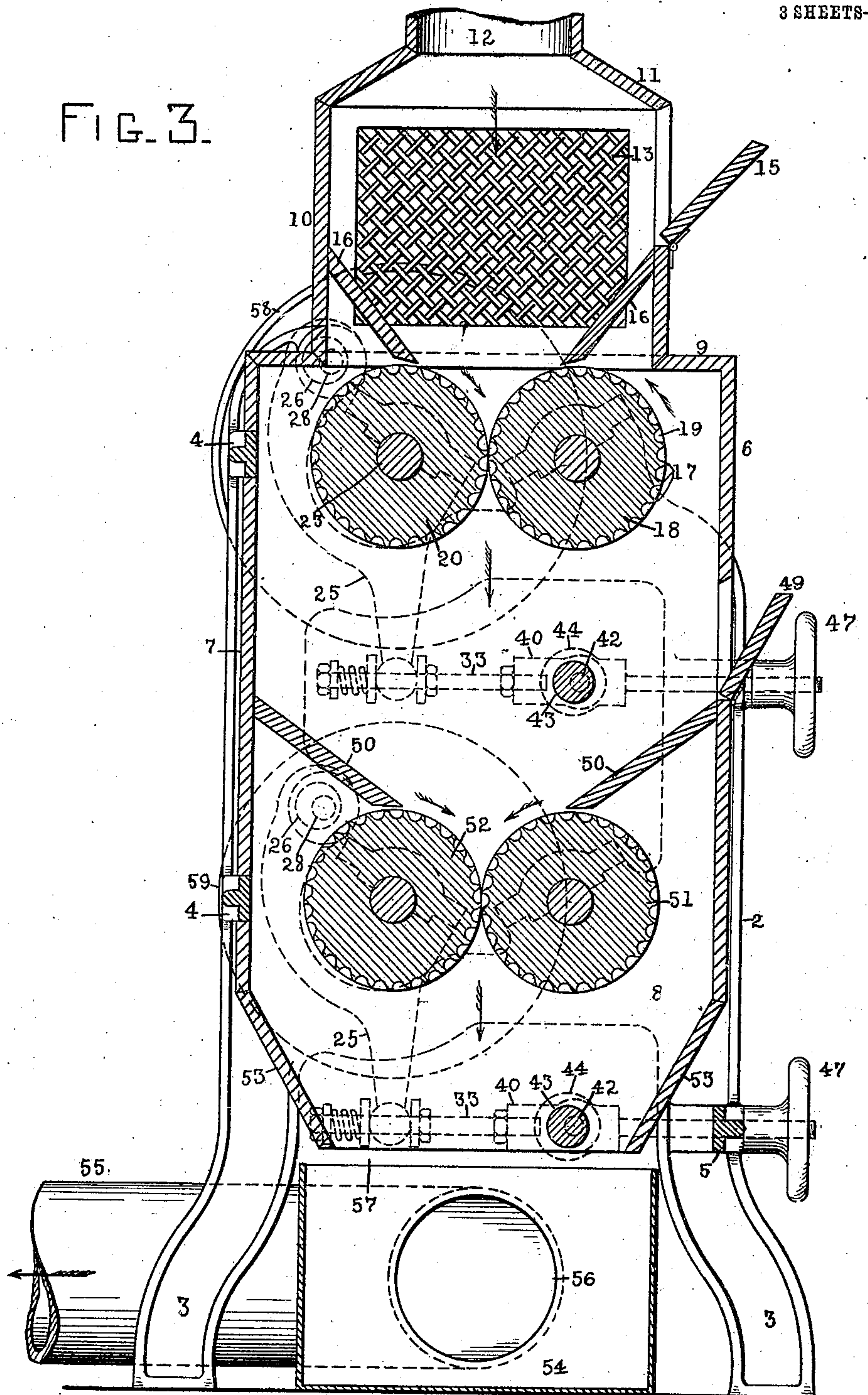
W. H. ROBINSON.

APPARATUS FOR CONVERTING FEATHERS INTO DOWN.

APPLICATION FILED FEB. 17, 1902.

3 SHEETS—SHEET 3.

FIG. 3.



ATTEST
B. B. Stickney
L. A. Schmale

INVENTOR
William H. Robinson
By Thomas L. Patterson
His Atty

UNITED STATES PATENT OFFICE.

WILLIAM H. ROBINSON, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO HIMSELF, AND W. M. HANES, OF WINSTON SALEM, NORTH CAROLINA.

APPARATUS FOR CONVERTING FEATHERS INTO DOWN.

No. 847,371.

Specification of Letters Patent.

Patented March 19, 1907.

Application filed February 17, 1902. Serial No. 94,557.

To all whom it may concern:

Be it known that I, WILLIAM H. ROBINSON, a subject of the Queen of Great Britain, and a resident of Steinway, borough of Queens, city of New York, and State of New York, have invented a certain new and useful Apparatus for Converting Feathers into Down, of which the following is a specification.

This application relates to a novel method of and apparatus for converting contour-feathers taken from common fowls into down for stuffing pillows, quilts, &c.

In practicing my invention the lighter vane or web portions of the feathers are separated from the denser stem or quill and shaft portions and so treated as to form a material or mass having the desirable characteristics of the down plucked from the breasts of fowls—such as lightness, resiliency, &c—while the stems and any other dense portions of the features are reduced to a substance which may be termed a “coarse” grade of down.

In the accompanying drawings, Figure 1 is a rear elevation of my novel apparatus. Fig. 2 is a side elevation thereof. Fig. 3 is a sectional side elevation.

Throughout the several views similar parts will be found designated by similar numerals of reference.

Certain portions of the apparatus are broken away in some of the views, so as to more clearly disclose the invention.

The apparatus illustrated in said drawings comprises a metallic framework, a box-like casing or chamber arranged within the framework, cylinders working within the chamber, and other parts.

The framework comprises a pair of side frames, (designated, respectively, as 1 and 2 and formed with legs 3,) said frames being connected by two rear horizontal bars 4 and one front horizontal bar 5. Upon this framework is supported the mechanism hereinafter described. The chamber or casing has front and rear walls 6 and 7, end walls 8, and cover 9, the whole being surmounted by a hopper-box 10, having a roof 11, which communicates with a tubular chute 12, through which the feathers are discharged into the apparatus by means of an air-blast. Said

hopper-box has latticed or open-work ends, as indicated at 13, and is also latticed upon its rear side, as at 14. The lattice-work affords the operator a view of the contents of the hopper-box and also permits the exhaust of the air-blast, while retaining the feathers. The front wall of the hopper-box is formed with a hinged lid 15, which may be let down, so as to afford access to the contents of the hopper or to permit the introduction of feathers, if desired. The converging sides of the hopper proper are designated as 16 and are arranged within the box 10.

The feathers descending through the hopper are received into the bite of a pair of contiguous parallel chilled-steel rotary cylinders, each about eighteen inches in length, extending horizontally across the upper portion of the main chamber, with their upper faces nearly touching the mouth of the hopper. A series of similar peripheral ridges or teeth 17 is formed upon the forward cylinder 18, each tooth extending the full length of the cylinder and the series extending entirely around the cylinder. The teeth extend in either a left-hand or a right-hand spiral direction, but are, however, nearly parallel with the axis of the cylinder, the variation from such parallelism being only about one inch for each twelve inches in length of the tooth or spiral, or, in other words, one inch to the running foot. The diameter of the cylinder is about nine inches, so that the pitch of the spiral is about twenty-eight feet. The spiral grooves, which are designated as 19, are cut at such intervals as to leave the teeth blunt. Preferably, however, the corners of the teeth are sharp. The advancing corners of the teeth are preferably either square or cut at an acute angle to the circumference of the cylinder, while the following corners of the teeth are cut upon an obtuse angle with the circumference. This cylinder may have about two hundred and thirty-four of these teeth or blades, and the grooves are preferably about one-sixteenth of an inch in depth. The set of revolving teeth may be otherwise supported than upon a solid cylindrical body, and the specification given in this description may be varied within the scope of the invention. The rear cylinder of the pair (designated as 20) is arranged upon about the same level as

the cylinder just described and is preferably similar thereto in all respects. These cylinders are set close together and rotate in opposite directions toward each other, the rear cylinder at Fig. 3 turning to the right and the forward cylinder turning to the left. It will be seen that the advancing or leading corners of the teeth upon the rear cylinder are obtuse, while their following corners are either square or acute. This cylinder is intended to rotate at about twice the surface speed of the forward cylinder, and hence it will be seen that the obtuse corners of the teeth upon the rear cylinder advance or impinge upon the obtuse corners of the teeth of the forward cylinder. It will also be understood that the teeth upon the contiguous or adjoining faces or sides of the cylinders incline in opposite directions from a horizontal plane—that is, said teeth extend in crosswise directions relatively to one another—and since one tooth is moving faster than the opposing tooth their relative movements may be said to roughly resemble in one respect the opening movement of a pair of ordinary shears, there being also present, however, an additional rolling movement or touch-and-go contact of the corners of the opposing teeth, owing to the rotation of said teeth upon their respective cylinder-axes.

The object of forming and operating the opposing sets of teeth in the described manner is to cause a rasping or scraping and tearing action, whereby the feathers are chewed and mutilated, one part of each feather being held temporarily as in a vise, while another part thereof is torn off by the action of the teeth, so that the feather falls from the rollers in a mutilated condition, a quantity of the barbs (which form the vanes of the feather) being torn from its stem, and in many instances only one or two considerable fragments or tatters being left of the original feather. The limper barbs forming the inner webs of the feather pass through the cylinders uninjured, except that they may be torn into shorter lengths, while the stiffer barbs, forming the outer webs of the feather, are to some extent limbered up by the pressure to which they are subjected in passing between the cylinders. The shafts and quills of the feathers are broken up or coarsely shredded. Thus it will be seen that the feathers are broken up and mutilated in preparation for the final reduction thereof to a downy mass, although it will be understood, of course, that a considerable portion of the vanes of the feathers is practically reduced to down in passing through the above-described cylinders by being torn from the stems and more or less shredded.

The forward-cylinder shaft 21 is journaled at its ends in fixed bearings 22, provided upon the side frames 1 and 2 of the apparatus, while the shaft 23 of the rear cylinder is

mounted in bearings 24, provided upon a pair of swinging arms or levers 25, which are pivoted at their upper ends at 26 and work in vertical slots 27, formed in the side frames. The pivots 26 are keyed or otherwise fastened eccentrically upon trunnions 28, which are provided with outer bolt-heads 29, whereby the eccentrics may be turned, together with the trunnions, so as to adjust the arms 26 independently up or down. The adjustment is preserved by means of lock-nuts 30, tapped upon the inner ends of the bolts or trunnions. By means of these adjusting devices the rear cylinder may be tipped in either direction from the horizontal or toward the horizontal, as the case may be, so as to bring it into parallelism with the forward or companion cylinder.

The lower portion of each of the levers or arms 25 terminates in a boss 31, which is horizontally and radially perforated at 32. A short horizontal rod 33 passes loosely through this perforation, and collars 34 and 35 are placed upon the rod, so that the boss 31 is confined between them. The forward collar 34 is held in position by a nut 36, threaded upon the rod, while the rear collar 35 is pressed against the boss 31 by a compression-spring 37, the rear end whereof bears against a small collar 38, secured upon the rear end of the rod by a nut 39. It will be seen that this spring presses the movable cylinder toward its companion fixed cylinder.

Upon the forward end of the rod 33 a link 40 is threaded, a lock-nut 41 being employed to retain the link in position. The forward end of the latter is pivoted upon an eccentric-pin 42, which projects horizontally from the end of a transverse shaft 43. Said shaft is journaled in a pair of eyes 44, formed or fixed upon the rear ends of a pair of horizontal rearwardly-extending rods 45, arranged in sockets bored in the forward portions of the side frames 1 2 and directly in line with the rods 33. Upon the pin 42, which is extended for the purpose, is keyed a lever 46, whereby the shaft 44 may be rotated so as to move rearwardly the eccentric-pins 42, carried at each end thereof, and hence to push back simultaneously the rods 33 and the bosses 31, to which they are connected, whereby the arms 25 are simultaneously swung rearwardly upon their pivots, and the rear cylinder is hence carried out of cooperative relation with its companion cylinder 18. Upon the forward end of each rod 45 is tapped a hand-wheel 47, whereby the working position of the cylinder 20 may be nicely adjusted, a revolution of said wheel to the right drawing the coupled rods 45 and 33 forwardly, together with the arms 25 and cylinder 20, thus drawing the latter closer at this end to the forward cylinder. A revolution of said wheel to the left permits an opposite movement of said parts under the reaction of a

compression-spring 48, arranged upon the rod 45 between the hub of the eye 44 and the inner face of the side frame. As said wheels may be operated independently, it will be
 5 seen that the arms 25 may be independently swung upon their pivots and independently adjusted, whereby either end of the cylinder may be moved closer to the forward cylinder. The spring 37, while weak enough to permit
 10 the cylinder 20 to spring away from the cylinder 18 when the feathers become clogged and jammed, so as to avoid injury to the mechanism, is still strong enough to hold the cylinder up to its work, it being understood,
 15 of course, that one of these springs is provided at each end of the cylinder and that in general the parts just described in detail are duplicated at the cylinder ends. The said lever 46 is preferably, however, arranged
 20 only at the left-hand side of the machine, although it may, if desired, be arranged at the opposite side, or a lever may be provided at each end of the cylinder.

In the forward part of the casing, below the
 25 level of said cylinders, is hinged a lid 49, and within the casing, below said lid, are arranged oppositely-inclined shelves 50, which converge at their lower ends, so as to form a hopper for directing the mutilated feathers into
 30 the bite of a second pair of opposing cylinders, of which the forward one is designated as 51 and is mounted in stationary bearings, while the rear cylinder is designated as 52 and is mounted in swinging arms. In structure, arrangement, adjustability, and other
 35 respects this pair of cylinders is similar to the upper pair, except that they should be placed closer together and provided with finer teeth, the number of said teeth being preferably
 40 three hundred and thirty-four. Although it is not essential, each of these cylinders may be rotated somewhat more rapidly than the corresponding upper cylinder.

By the lower pair of cylinders the barbs
 45 which have been detached from their stems by the upper cylinders are torn into shorter lengths, the stiffer barbs are rendered more pliable by being subjected to pressure, the larger fragments are torn to pieces, and the
 50 quills and shafts are finely shredded and rendered pliable, and all the shreds are more or less curled.

The material falling from the lower pair of cylinders is directed by the converging lower
 55 ends 53 of the casing 8 into a box or bin 54, arranged upon the flooring. Some of the material, including the shredded stems and such few remnants of the stiff outer webs as may still remain attached to stem portions, fall
 60 at once to the bottom of the bin, while the fluffy or downy detached barbs or webs float about and are drawn off by an air-current through a suction-pipe or conductor 55, which communicates with an opening of
 65 large diameter 56 at the end of the bin and

from which the air is exhausted by suitable apparatus, (not shown,) whereby the current above mentioned is induced. A slight opening 57 is left between the bin and the casing
 70 8, so as to permit entrance of outside air into the box to replace that which is drawn into the pipe.

In operation, the rear cylinders in each set having first been adjusted to the right level by means of the eccentrics upon which their
 75 supporting-arms are respectively hung, the throw-off levers 46 are moved down to the positions shown at Fig. 2, thus bringing the opposing cylinders together. The air-blast is then turned on, and the feathers, which have
 80 previously been renovated, are blown into the hopper-box through the pipe 12, whence they descend into the bite of the first pair of cylinders. These cylinders are rotated by means of suitable belt-pulleys 58 and 59, the
 85 former being arranged at the left of Fig. 1 upon the extended shaft of the rear cylinder 20 and the latter being shown at the right of said figure as arranged upon the extended
 90 shaft 21 of the forward cylinder. Said forward cylinder should make about two hundred and fifty-four revolutions, and said rear cylinder should rotate at about twice the speed, or, say, four hundred and forty-seven
 95 revolutions per minute. The operator may inspect the feathers as they enter the hopper, and should they become packed and threaten to injure the cylinders or the teeth or blades thereon he may instantly throw the cylinders out of coöperative relation by swinging
 100 up the upper lever 46. Subsequently he may stop the machinery and then may pass his hand into the opening in the hopper-box and loosen the pack of feathers. It will be perceived also that if the feathers should
 105 become packed in the chute he may reach in and loosen them, so that they may continue to discharge into the hopper. In passing between said cylinders the feathers are chewed or mutilated in the manner already described.
 110 The operator may inspect the mutilated feathers from time to time and, if required, may turn either or both of the adjusting-wheels 47 so as to bring either or both ends of the rear cylinder closer to the forward cylinder,
 115 thereby securing a more thorough mutilation of the feathers, or said wheels may be unscrewed more or less, so as to permit more separation of the cylinders in case it becomes evident in any way, as by heating of
 120 the cylinders, that too much work is being put upon the same. The lid 49 affords access to the internal portions of the apparatus for purposes of cleaning, as well as to the feathers which may collect or pack in the bite
 125 of the second pair of cylinders, so that the operator may loosen them if required, which is, however, seldom the case.

The lower cylinders 51 and 52 are driven, respectively, by pulleys 58 and 59, the for-
 130

ward cylinder 51 at about the same number of revolutions as cylinder 18 and cylinder 52 at about twice the speed, although this lower set may run faster. The rear cylinder
 5 may be moved or adjusted at any time in the same manner as already described with reference to the upper rear cylinder, and is preferably set closer to its mate than is the case with the upper rear cylinder so that
 10 the mutilated feathers upon entering the bite of these lower cylinders may be reduced thereby to such downy fineness as will render them substantially equal to down plucked from the breast of fowls for general com-
 15 mercial purposes. This portion of the product of the apparatus is collected and wafted out by the air-current in the above-described manner through the conductor 55 and deposited in any suitable receptacle or bin.
 20 The residue, composed principally of shredded quills and stems, may be removed from the bottom of the bin 54 at intervals.

It will thus be seen that by means of simple operations performed quickly and cheaply
 25 in an inexpensive apparatus the ordinary feathers of commerce may be converted into down of fine quality. Moreover, the fibrous by-product which settles at the bottom of the bin 54, which may be defined as a "coarse
 30 grade of down," is suitable for use in stuffing cushions, &c., or it may be mixed in suitable proportions with the light and fine down that is collected by the air-current, thus adding to the bulk and weight of the latter without de-
 35 tracting appreciably from its downy qualities. Being composed principally of the shredded stems of feathers, this by-product is resilient and not liable to pack unduly.

Wide variations may be made from the
 40 details of construction and operation above described within the scope of the invention. For instance, the feathers may be introduced otherwise than by an air-blast and the down may be collected and removed otherwise
 45 than by suction. If desired, small and light feathers may be run directly through the lower set of cylinders or revolving blades without being first mutilated by the upper sets of blades, or a single set of opposing
 50 blades or cylinders may be used for the entire process, the feathers being first passed through them to become broken up and mutilated in the described manner and then passed through them a second and perhaps a
 55 third time, said cylinders being adjusted more closely together at each step in the process and operated at higher speeds, if necessary. It is not essential that the teeth or blades be formed integrally upon the pe-
 60 ripheries of cylinders. Where in the claims I employ the term "cylinder" I mean to include any and all rotary devices, whether of cylindrical or other form, upon which is carried a set of blades or teeth for the pur-
 65 pose specified. It is not essential that the

cylinders in each pair be of equal diameters, although I prefer the illustrated construction.

In the following claims the term "feather-mutilating cylinders" or "feather-shredding
 70 cylinders" is meant to signify the kind of cylinders whose construction and operation is herein particularly described, and the distinction between which and leather-macerating, shuck-hackling, quill-grinding, fiber-
 75 smoothing, cornstalk-shelling, pith-chopping, corn-grinding, quill-softening, and scissoring-cylinders and devices is herein clearly made out.

What I claim as new, and desire to secure
 80 by Letters Patent, is as follows:

1. An apparatus for converting feathers into down, comprising a pair of feather-mutilating cylinders having peripheral teeth and mounted close together, and means for
 85 running them in opposite directions at unequal surface speeds; one of said cylinders being yieldingly mounted.

2. An apparatus for converting feathers into down, comprising two cylinders, means
 90 for revolving them at unequal surface speeds, each cylinder having upon its periphery spirally-cut feather mutilating or shredding teeth extending longitudinally thereof, one cylinder being mounted so as to have a yield-
 95 ing action, and means for effecting relative adjustment between the cylinders.

3. An apparatus for converting feathers into down, comprising two cylinders and means for revolving them in opposite direc-
 100 tions at unequal surface speeds, each cylinder having upon its periphery spirally-cut feather mutilating or shredding teeth extending longitudinally thereof, said teeth being cut out either left hand or right hand upon both
 105 cylinders; and the leading or advance corners of the teeth upon the fast cylinder being obtuse, and the following or back corners of the teeth being sharp.

4. In an apparatus for converting feathers
 110 into down, a pair of cylinders journaled side by side, each cylinder having upon its periphery a set of longitudinally-extending feather mutilating or shredding teeth, said teeth being cut spirally upon an inclination
 115 of about one inch to the running foot, and the advance or leading corners of said teeth upon the fast cylinder being obtuse, and means for revolving said cylinders in opposite directions at unequal speeds.
 120

5. In an apparatus for converting feathers into down, a blade revolving upon an axis and extending in a spiral direction longitudinally of said axis, and an opposing spiral
 125 blade crossed by the first blade, one of said blades having an obtuse leading or advance corner and a sharp following or back corner, and means for rasping or scraping one blade along the other.

6. An apparatus for converting feathers
 130

into down, comprising a pair of cylinders, means for revolving them at unequal surface speeds, a set of spiral peripheral teeth extending longitudinally upon each cylinder, each tooth upon the fast cylinder having an obtuse leading or advance corner and a sharp following or back corner, said cylinders being set close together, and the teeth upon adjoining sides of the cylinders crossing.

7. An apparatus for converting feathers into down, comprising a pair of cylinders, means for revolving them in opposite directions at unequal surface speeds, and a set of spiral peripheral teeth extending longitudinally upon each cylinder; each tooth upon the fast cylinder having an obtuse leading or advance corner, the spirals upon both cylinders being formed either right hand or left hand, and said cylinders being set close together.

8. An apparatus for converting feathers into down, comprising two cylinders, means for revolving them at unequal surface speeds, each cylinder having upon its periphery spirally-cut feather mutilating or shredding teeth extending longitudinally thereof, and means for effecting fine adjustments of one of said cylinders bodily toward or away from the other.

9. An apparatus for converting feathers into down, comprising two cylinders, means for revolving them at unequal surface speeds, each cylinder having upon its periphery spirally-cut feather mutilating or shredding teeth extending longitudinally thereof, and means for effecting fine adjustments of one of said cylinders bodily toward or away from the other, and means for adjusting the axis of one of said cylinders into parallelism with the axis of the other cylinder.

10. An apparatus for converting feathers into down, comprising two cylinders, means for revolving them at unequal surface speeds, each cylinder having upon its periphery spirally-cut feather mutilating or shredding teeth extending longitudinally thereof, and means for effecting fine adjustments of one of said cylinders bodily toward or away from the other, and means for adjusting the axis of one of said cylinders into parallelism with the axis of the other cylinder, and means for adjusting one of said cylinders bodily away from the other.

11. An apparatus for converting feathers into down, comprising opposing cylinders each provided with feather mutilating or shredding teeth, at least one of said cylinders being mounted for a yielding action, and means for revolving said cylinders in opposite directions at unequal speeds; said teeth being blunt and extending along the cylinders in spiral direction, and all either left hand or right hand upon both cylinders.

12. An apparatus for converting feathers into down, comprising opposing cylinders

each provided with feather mutilating or shredding teeth, means for enabling a bodily movement of one cylinder toward and away from the other, a spring for pressing said movable cylinder toward its mate, and means for revolving said cylinders at unequal speeds; said teeth being blunt and extending along the cylinders in spiral direction, and all either left hand or right hand upon both cylinders.

13. An apparatus for converting feathers into down, comprising opposing feather mutilating or shredding cylinders, each having peripheral feather-shredding teeth, and at least one thereof being mounted for bodily movement toward and away from the other, a spring for pressing said movable cylinder toward the opposing cylinder, and means for adjusting said movable cylinder toward or away from the other; said teeth being blunt and extending along the cylinder in spiral direction, and all either left hand or right hand upon both cylinders.

14. An apparatus for converting feathers into down, comprising a cylinder provided with longitudinally-extending feather shredding or mutilating teeth, swinging arms whereon said cylinder is journaled, and a cylinder having cooperating feather-shredding teeth; said teeth being blunt and extending along the cylinders in spiral direction, and all either left hand or right hand upon both cylinders.

15. An apparatus for converting feathers into down, comprising opposing cylinders each having feather-mutilating teeth, means for rotating said cylinders at unequal speeds in opposite directions, a lever or handle, and means connected to said lever for throwing said cylinders out of cooperative relation; said teeth being blunt and extending along the cylinders in spiral direction, and all either left hand or right hand upon both cylinders.

16. An apparatus for converting feathers into down, comprising opposing cylinders each provided with longitudinal feather-shredding teeth, one of said cylinders being journaled upon the framework, movable arms upon which the other cylinder is journaled, and a lever for controlling said arms; said teeth being blunt and extending along the cylinders in spiral direction, and all either left hand or right hand upon both cylinders.

17. A feather-mutilating cylinder having a shaft, a pair of pivoted arms in which said shaft is journaled, means for adjusting the pivot of one arm independently of the pivot of the other arm, means for adjusting the arms upon their pivots, and means for throwing said arms and cylinder together bodily out of operative position.

18. In an apparatus for converting feathers into down, the combination of feather-mutilating or shredding cylinders, 18 and 20, arms 25, pivoted upon eccentrics, rods 33, 130

springs 37, eccentric device 42, 44, lever 46, rods 45, and adjusting-wheels 47.

19. In an apparatus for converting feathers into down, a cylinder having feather-mutilating teeth a pair of arms in which said cylinder is journaled, an opposing cylinder having corresponding teeth, and a transverse shaft connected to both arms and provided with means for moving said arms on their bearings; said teeth being blunt and extending along the cylinders in spiral direction, and all either left hand or right hand upon both cylinders.

20. In an apparatus for converting feathers into down, the combination of feather mutilating or shredding cylinders 18 and 20, arms 25, rods 33, springs 37, eccentric device 42, 44, lever 46, rods 45, adjusting-wheels 47, and springs 48.

21. An apparatus for converting feathers into down, comprising two sets of rotary feather mutilating or shredding cylinders having peripheral teeth, and so related that the mutilated feathers from one set may pass between the cylinders in the other set, and means for revolving the cylinders in each set at unequal surface speeds; the teeth upon each cylinder extending spirally and those upon the fast cylinder having obtuse advance or leading corners, and both cylinders in each set having either right-hand or left-hand teeth.

22. An apparatus for converting feathers into down, comprising two sets of feather mutilating or shredding cylinders having peripheral teeth, the teeth in the second set being finer or closer than the teeth in the first set, and the cylinders in each set being arranged close together, and means for revolving the cylinders in each set at unequal surface speeds.

23. An apparatus for converting feathers into down, comprising two sets of feather mutilating or shredding cylinders, and means for throwing the cylinders in each set out of coöperative relation to each other.

24. An apparatus for converting feathers into down, comprising two sets of feather mutilating or shredding cylinders, at least one cylinder in each set being yieldingly supported, and means for revolving the cylinders in each set at unequal surface speeds.

25. An apparatus for converting feathers into down, comprising two sets of feather mutilating or shredding cylinders, and means for revolving the cylinders in each set at unequal surface speeds, one cylinder in each set being journaled upon swinging arms.

26. In an apparatus for converting feathers into down, the combination of means for shredding the feathers, a bin or box to receive the shredded feathers, and a suction-pipe communicating with said bin or box.

27. An apparatus for converting feathers into down, comprising a casing, a pair of

feather-mutilating cylinders arranged in the upper part thereof, a pair of feather mutilating or shredding cylinders arranged in the lower part thereof, a box beneath said cylinders, and an opening in said box through which the descending shreds may be wafted.

28. In an apparatus for converting feathers into down, a pair of cylinders journaled side by side, each cylinder having upon its periphery a set of longitudinally-extending feather mutilating or shredding teeth, said teeth being cut spirally upon an inclination of about one inch to the running foot, and all the teeth upon both cylinders being either right hand or left hand, and means for revolving said cylinders in opposite directions at unequal speeds.

29. In an apparatus for converting feathers into down, a blade revolving upon an axis and extending in a spiral direction longitudinally of said axis, an opposing spiral blade crossed by the first blade, and means for revolving said blade in opposite directions at uneven surface speeds.

30. An apparatus for converting feathers into down, comprising a pair of cylinders, means for revolving them in opposite directions at unequal surface speeds, a set of blunt spiral peripheral teeth extending longitudinally upon each cylinder, said cylinders being set close together and the teeth upon the adjoining sides of the cylinders crossing.

31. An apparatus for converting feathers into down, comprising a pair of cylinders, means for revolving them in opposite directions at unequal surface speeds, a set of blunt spiral teeth extending longitudinally upon each cylinder, the spirals upon both cylinders being formed either all right hand or all left hand, and said cylinders being set close together.

32. An apparatus for converting feathers into down, comprising a pair of cylinders, means for revolving them in opposite directions at unequal surface speeds, and a set of spiral teeth extending longitudinally upon each cylinder, the spirals upon both cylinders being formed either all right hand or all left hand, the teeth upon the fast cylinder having obtuse leading or advance corners and sharp back or following corners, and the teeth upon the slow cylinder having sharp leading or advance corners and obtuse back or following corners.

33. An apparatus for converting feathers into down, comprising a casing, a chute in the upper part of the casing, through which the feathers may be blown into the casing, the latter having openings to permit exhaust of the blast which introduces the feathers into the casing, a pair of cylinders within the casing provided with revolving means and coöperating to shred the feathers introduced by the blast, a receptacle beneath the cylinders into which the heavier portions of the

shredded feathers may fall and accumulate, and an air and down duct below said cylinder and above said receptacle, for drawing off the lighter portions of the shredded feathers as they fall from the rolls, so as to separate the lighter from the heavier products of the rolls.

34. An apparatus for converting feathers into down, comprising a casing, a receiving-chute in the upper part of the casing, the latter having exhaust-openings for the blast which enters with the feathers through the chute, a pair of cylinders within the casing and provided with revolving means and co-operating to shred the feathers introduced by the blast, a second pair of cylinders below the first pair and provided with revolving means and constructed to shred more finely the product of the first pair of cylinders, and a duct below the second pair of cylinders for drawing off by an air-current the lighter portions of the product of the second cylinders as it falls therefrom, so that said lighter portions are segregated from the portions of said product which are too heavy to be drawn off by the air-current and which settle below said duct.

35. An apparatus for converting feathers into down, comprising a casing, a pair of cylinders within the casing and provided with revolving means and coöperating to shred the feathers received thereby, a second pair of cylinders below the first and provided with revolving means and coöperating to shred more finely the product of the first pair of cylinders, and means for segregating the lighter from the heavier portions of the product of the second pair of cylinders, as such product drops therefrom.

36. An apparatus for converting feathers into down, comprising a casing having an opening for the admission of feathers, a pair of cylinders within the casing and provided with revolving means and coöperating to shred the feathers, and means for segregating the lighter from the heavier portions of the product of the cylinders as it drops therefrom.

37. An apparatus for converting feathers into down, comprising a pair of cylinders co-operating to shred the feathers, a hopper for said cylinders, a casing in which the cylinders are confined, means for revolving the cylinders at unequal speeds in opposite directions, said cylinders having peripheral teeth so formed that the teeth on one cylinder cross those on the other along the line where the cylinders meet, a second pair of cylinders and means for guiding thereto the

product of the first pair, the cylinders in the second pair having peripheral teeth so formed that the teeth on one cylinder cross those on the other along the line where the cylinders meet, but the teeth on the second pair being finer than those on the first pair, and means for revolving the second cylinders at unequal speeds but both faster than the cylinders in the first pair.

38. An apparatus for converting feathers into down, comprising a pair of cylinders, having peripheral teeth so formed that the teeth on one cylinder cross those on the other along the line where the cylinders meet, means for revolving the cylinders at unequal speeds, a second pair of cylinders placed to receive the product of the first pair, the cylinders in the second pair having peripheral teeth so formed that the teeth on one cylinder cross those on the other along the line where the cylinders meet, and means for revolving the second cylinders at unequal speeds but both faster than the cylinders in the first pair.

39. An apparatus for converting feathers into down, comprising a pair of cylinders having peripheral teeth so formed that the teeth on one cylinder cross those on the other along the line where the cylinders meet, means for revolving the cylinders at unequal speeds, a second pair of cylinders placed to receive the product of the first pair, the cylinders in the second pair having peripheral teeth so formed that the teeth on one cylinder cross those on the other along the line where the cylinders meet, means for revolving the second cylinders at unequal speeds but both faster than the cylinders in the first pair, and means for effecting segregation of the lighter from the heavier products of the second cylinders as said products fall from said cylinders.

40. In an apparatus for converting feathers into down, the combination with a feather-shredding mechanism, of a second feather-shredding mechanism placed to receive the product of the first and constructed and operating to shred said product more finely, and means for effecting segregation of the lighter from the heavier portions of the product of the second mechanism, as said product falls therefrom.

Signed at New York, in the State of New York, this 8th day of January, A. D. 1901.

WILLIAM H. ROBINSON.

Witnesses:

JOSEPH WEILL,

THOMAS C. PATTERSON.