

(No Model.)

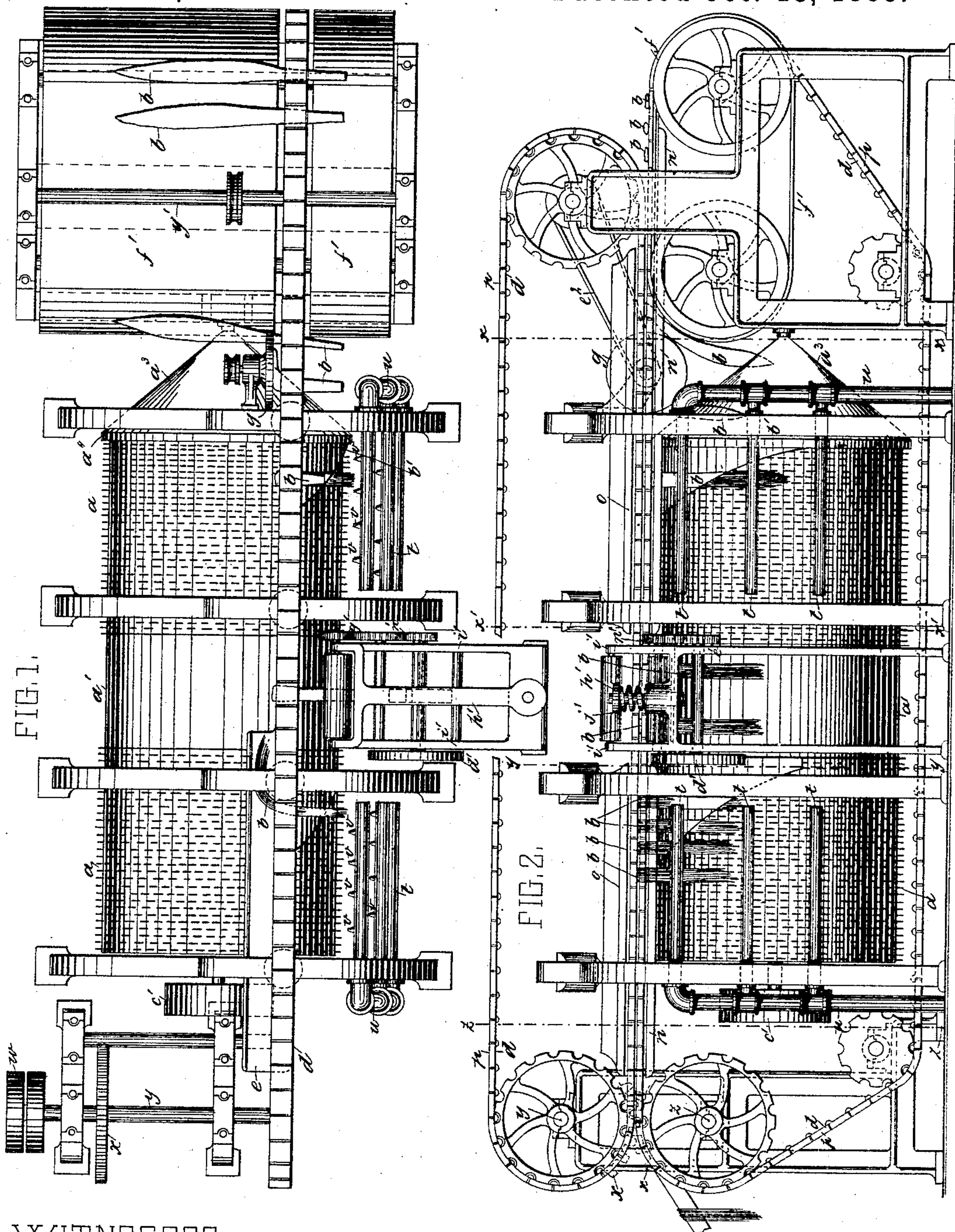
2 Sheets—Sheet 1.

J. G. STEPHENS.

MACHINERY FOR CLEANING AND SEPARATING THE PULPY MATTERS
FROM FIBERS OF LEAVES, &c.

No. 328,357.

Patented Oct. 13, 1885.



WITNESSES:

Henry H. Hays
Chas. Morgan

INVENTOR

John Geo. Stephens
By A. P. Thayer,
att'y

(No Model.)

2 Sheets—Sheet 2.

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FIG. 7.

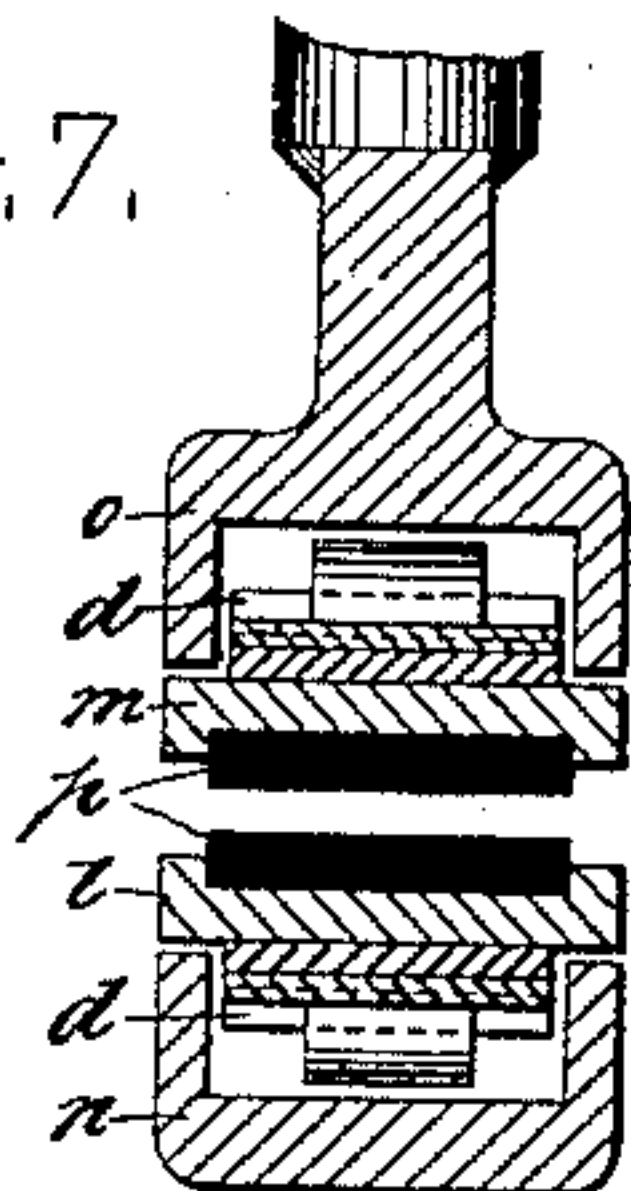


FIG. 8.

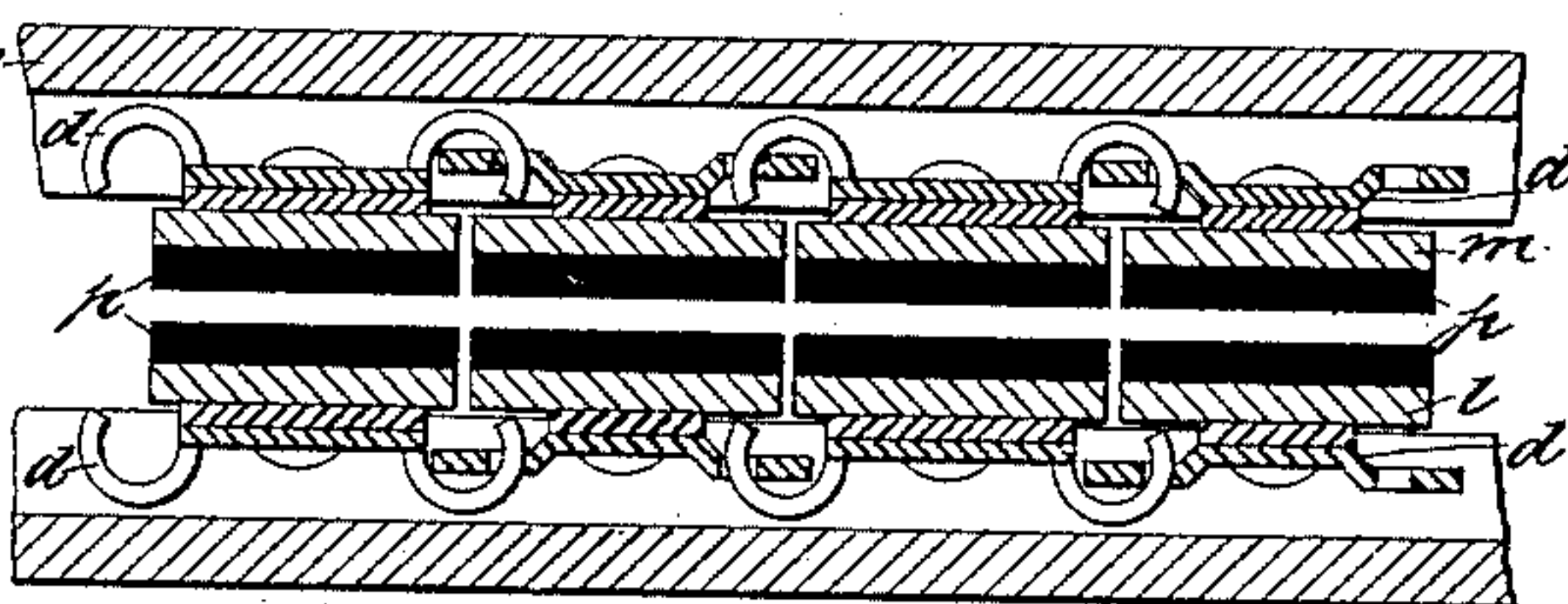


FIG. 9.

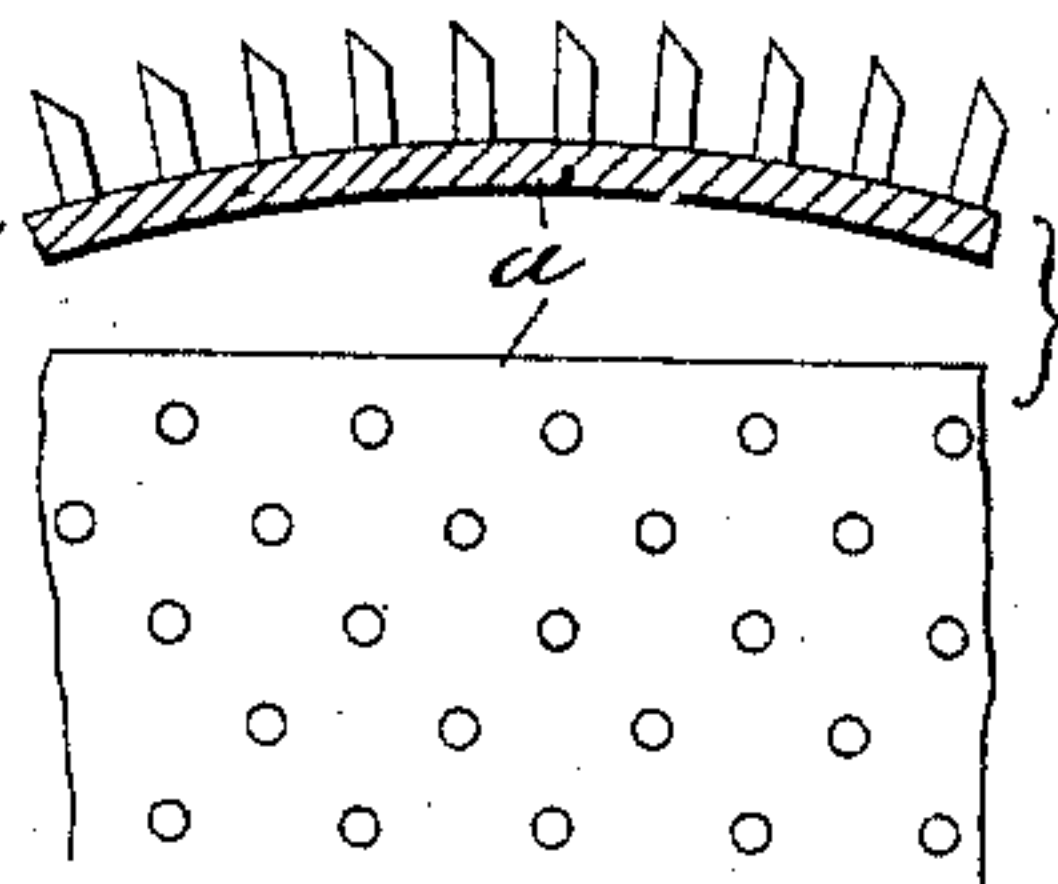


FIG. 5.

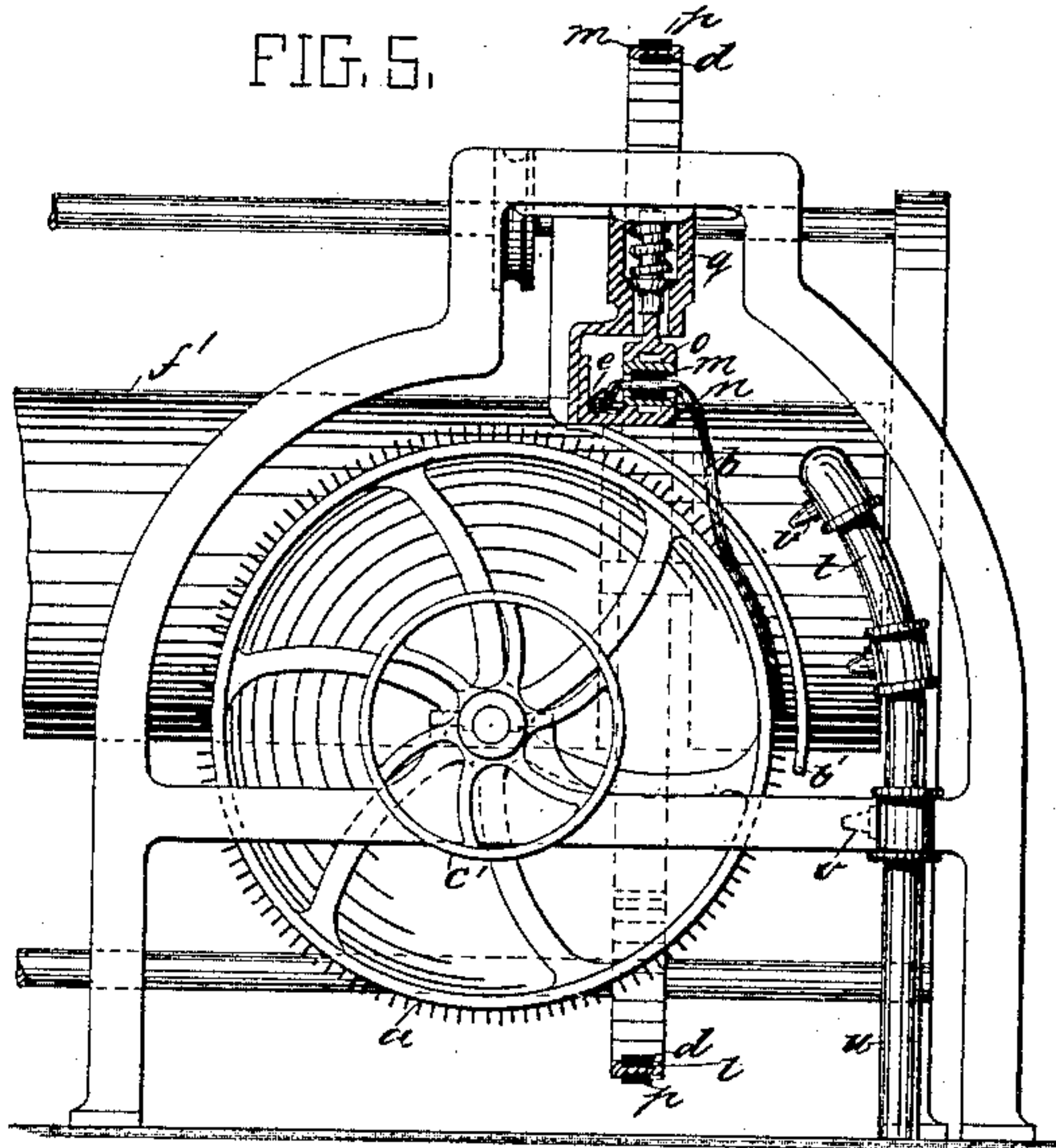


FIG. 3.

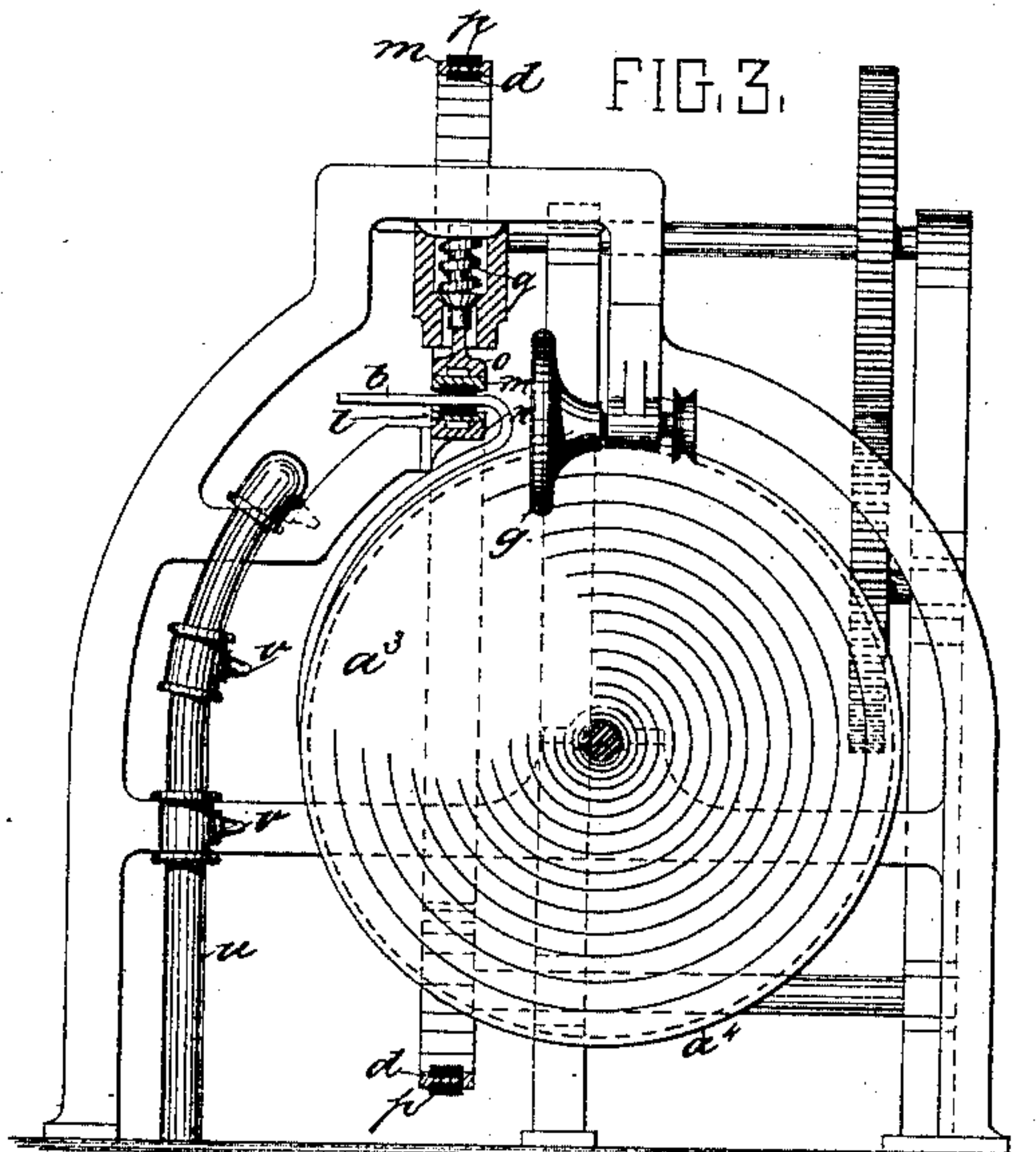


FIG. 4.

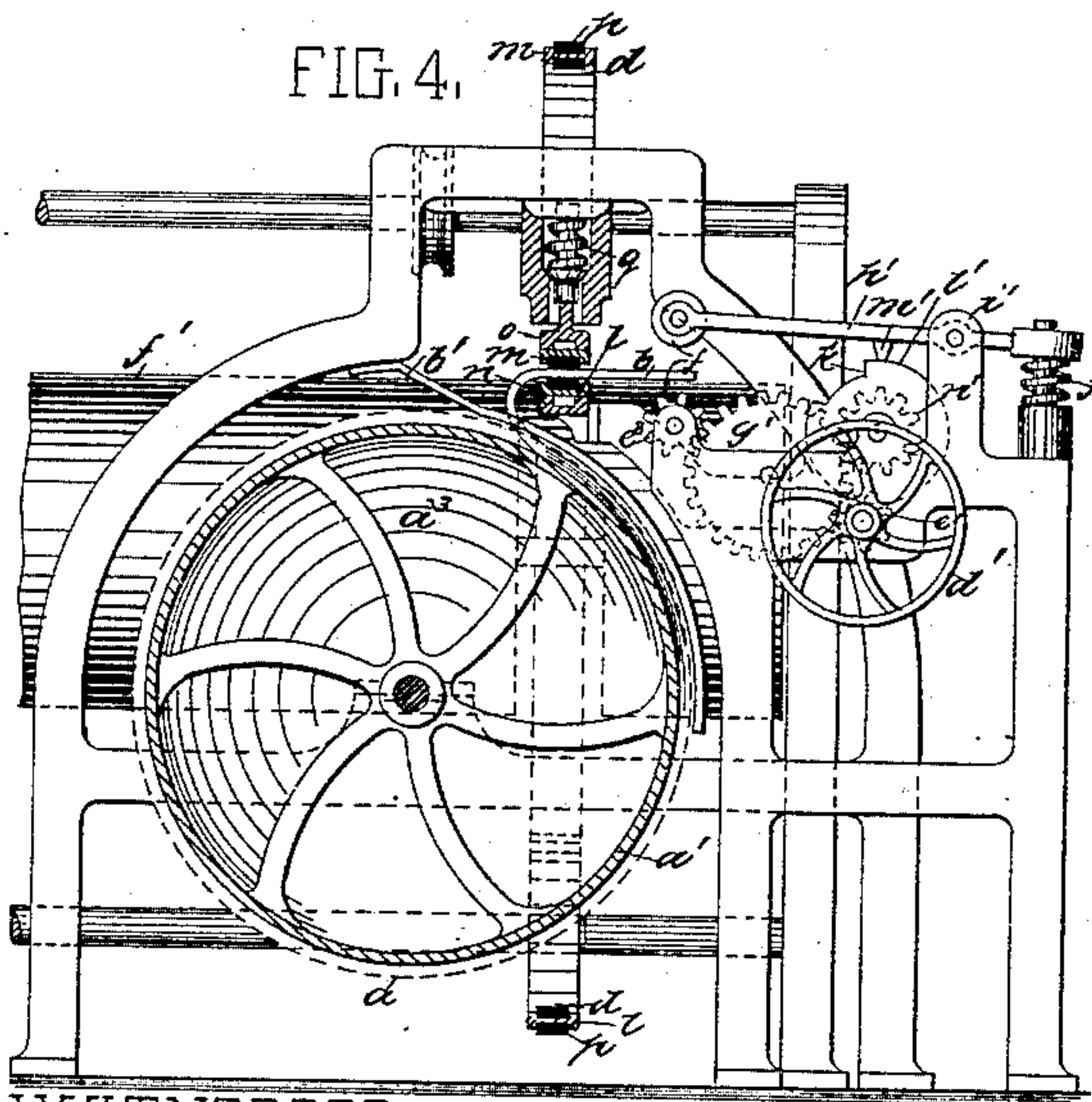
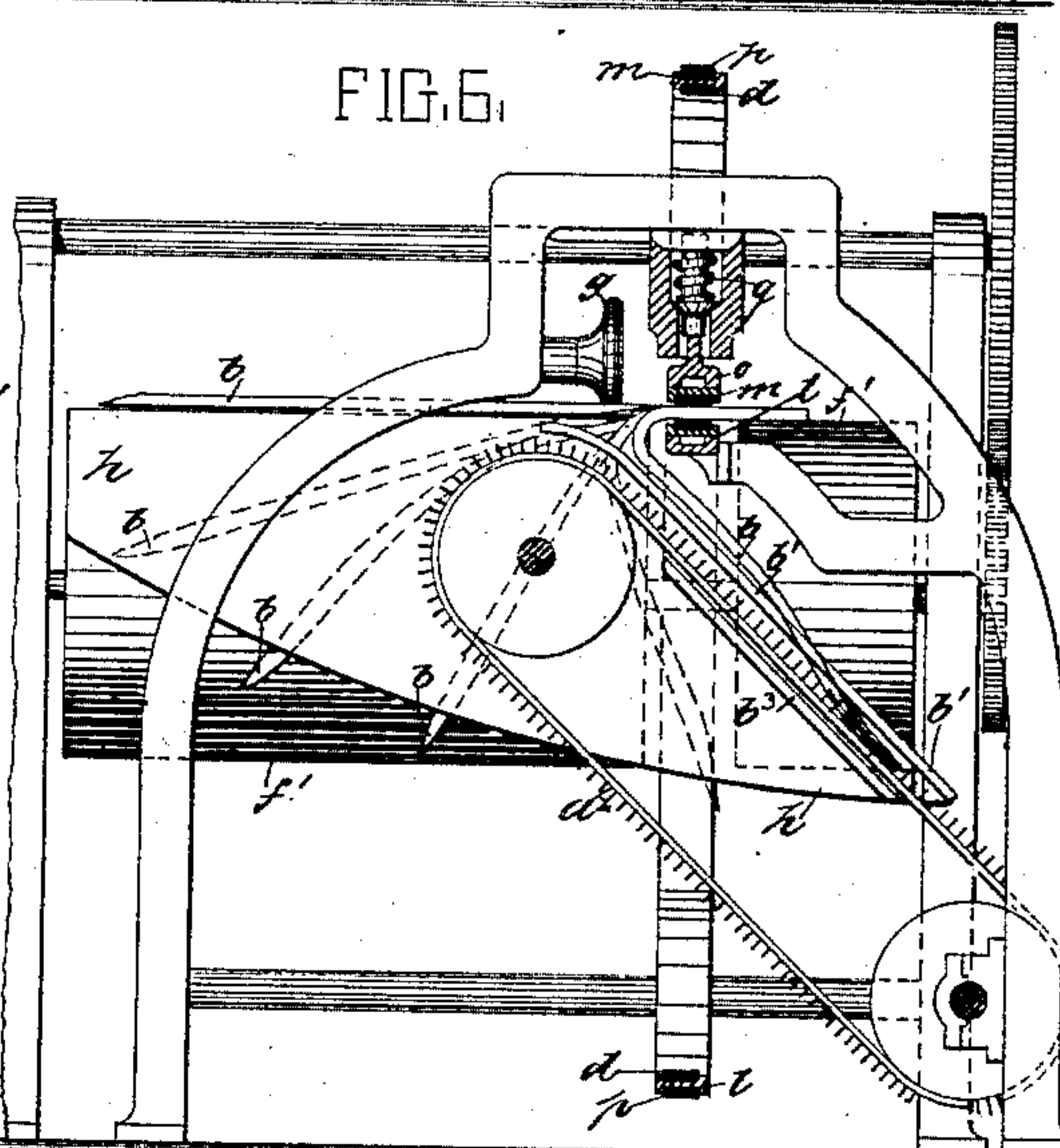


FIG. 6.



WITNESSES:

Henry H. Lee
W. J. Morgan.

INVENTOR:

John Geo. Stephens.
By A. P. Thayer, atty.

UNITED STATES PATENT OFFICE.

JOHN GEORGE STEPHENS, OF BROOKLYN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO DELPHIN E. THEBAUD, OF NEW YORK, N. Y.

MACHINERY FOR CLEANING AND SEPARATING THE PULPY MATTERS FROM FIBERS OF LEAVES, &c.

SPECIFICATION forming part of Letters Patent No. 328,357, dated October 13, 1885.

Application filed June 10, 1885. Serial No. 168,240. (No model.)

To all whom it may concern:

Be it known that I, JOHN GEORGE STEPHENS, of Brooklyn, Kings county, New York, have invented new and useful Improvements in Apparatus or Machinery for Cleaning and Separating the Pulpy Matters from the Fibers of Leaves and Plants, of which the following is a specification.

My invention consists of improved apparatus or machinery for removing the pulpy or fleshy matters of the stalks and leaves of fiber-producing plants—such as henequin or sisal, istle or tampico, pita, hemp, and others of like character—by which the said fibers can be cleaned separated, and prepared with great rapidity, and at the same time be more thoroughly cleaned and be left in a better natural condition for industrial purposes and with less waste of the fibers than as heretofore prepared.

The method of operation consists in suspending the leaves, stalks, or other fiber-bearing substance in front of a rapidly-moving combing or carding cylinder or belt clothed or armed with fine sharp teeth, pins, or studs of an approved form adapted for carding or combing, as distinguished from scraping, and running downward along the fiber-bearing substance, which is suspended in such manner that the teeth of the card or comb are made to run lightly against the same, and rapidly cut and comb away the pulp therefrom, preferably beginning at the lower end and gradually working upward along the whole range of the suspended part, so as to cause but little stress and no crushing, breaking, or tearing effect whatever on the fiber, as when scraped; and the essential feature of the mechanism employed consists of said carding cylinder or belt adapted for thus carding or combing away the pulpy matters, and provided with contrivances for conducting the fiber-bearing leaves, stalks, or other objects to and sidewise along the combing or carding device and away therefrom in a manner to enable the work to be accomplished rapidly, all as hereinafter described, reference being made to the accompanying drawings, in which—

Figure 1 is a plan view of a machine suit-

ably contrived for carrying out the said method of cleaning and separating fibers, with leaves and fibers in the machine as in the process of being cleaned, to illustrate the operation. Fig. 2 is a side elevation of the same. Fig. 3 is a transverse section at xx , Figs. 1 and 2. Fig. 4 is a transverse section at yy . Fig. 5 is a transverse section at zz . Fig. 6 is a transverse section at $x'x'$, with an endless belt of card-clothing such as I propose to substitute for the cylinder for treating pita and other leaves of greater length than can be well treated on a cylinder of moderate size. Fig. 7 is a detail of the chains and the guides in cross section and on an enlarged scale. Fig. 8 is a detail of the same in longitudinal section, also on an enlarged scale; and Fig. 9 represents a small section of the card-clothing in side and front views, and on an enlarged scale, to illustrate the contrivance of the teeth or pins more clearly; but it is to be understood that the form or shape and dimensions of the teeth may be varied, if desired.

The method now in use of disintegrating fiber-bearing leaves and plants, and cleaning the pulpy matters away from the fibers, consists of first crushing the pulpy substance, then scraping away the pulp as much as it can be removed in that manner, and, finally or simultaneously, washing the fiber to remove the rest of what may be sufficiently disintegrated by the crushing and scraping to be so removed; but the scraping is not as effectual as is desirable, in that the pulpy matters lying between the fibers cannot be scraped away, and it is also objectionable because many of the fibers are cut or broken apart by the edges of the scrapers and wasted with the pulp, and those fibers that are naturally round, and particularly the round and tubular fibers, such as are obtained from the henequin plant, are materially injured by the crushing and flattening effect of the scrapers. The scraping process is also slow, and demands excessive power; hence I have contrived the method of combing or carding the pulpy matters by means of teeth or pins of sufficient fineness to work into the pulpy mat-

ters and between the fibers in a much easier, more effectual, and less injurious manner, as follows:

For cutting away the pulp, I prefer to employ an ordinary carding-cylinder, *a*, except that I prefer to have the pins or teeth of larger dimensions and stronger capacity than are used in cotton or wool machinery; but for very long fibers I may use an endless toothed belt, *a*², of card-clothing or similar material, as represented in Fig. 6, or in any equivalent form, and I suspend the leaves or stalks *b* containing the fiber in front of that side of the cylinder or belt that runs downward, and move them sidewise along the same, suitably for combing away the pulp from the fibers, which remain suspended, so that the teeth of the card or comb run freely between the fibers and thoroughly cut and carry away the pulp and clean the fibers effectually without pulling and straining, tearing, or crushing them, the leaves or stalks being free to be forced away from the points of the teeth and escape the tensile strain by the lateral thrusts of the teeth in case the resistance of the pulp is too great for the strength of the fibers.

For the purpose of causing the carding-teeth to begin at the lower ends and gradually work upward along the leaves or stalks as the fibers are freed from the pulp below the point or points of action of the teeth on the pulp to prevent clogging and straining the fibers, and thus enable the teeth to work freely in the pulp, and also to facilitate the application of the leaves to and removal of them from the card, I cause the leaves to move sidewise along in front of the cylinder, and employ a shielding-apron, *b*¹, between the hanging leaves and a portion of the cylinder, and being so shaped that it fends off the leaves, except at the lower end at first, and allows them to gradually touch higher up the card as they move along, until the leaves are dressed nearly to the grip-clutch by which they are suspended and carried.

To begin with, the leaves or stalks are clutched in the carrying-chains *d*, a suitable distance from the ends of, preferably, the stems or butts to be suspended in front of the card *a* suitably to be combed, but so that the stems or butts and some portion of the leaves or stalks will be carried above the reach of the card, and, consequently, will not be dressed. For dressing these portions, I cause them, by means of rolls *f*, or it may be other suitable contrivance, to be shifted lengthwise between the clamps of the grip-chains, while the pressure of the grip is temporarily relaxed, so that they drop in front of the cylinder suitably for being carded or combed same as the rest, while the previously-combed fibers are carried clear of the cylinder along the trough or way *e*, thus completely removing the pulp the whole length of the leaves or plants, and leaving the fibers clear from end to end. The fibers are then discharged from between the

carrying-chains down the inclined way *s*, on which the bunches, or hanks, so to speak, *s*¹, of the respective leaves fall in loops suitably to be conducted to any receptacle. I prefer to denude the cylinder of a portion of its clothing at *a*¹, along where the shifting of the leaves takes place, and may, perhaps, make the cylinder a little smaller in this part to facilitate the drawing up of the cleaned fiber; but this is not essential.

Thus it will be seen that the pulp is combed and cut away from the fibers in a manner almost wholly relieving them from tensile strain, and therefore avoiding the severe strains to which they are subject by a stripping process, and wholly avoiding the crushing effect to which they are subject in the common method of first crushing the pulp and then scraping it from the fibers; hence I economize largely in the yield of fiber by not breaking and carrying portions away with the pulp, and I have the much greater advantage of getting the fiber out in its natural round or nearly round shape, in which condition its utility for industrial purposes is far greater both in strength and form than when flattened by the crushing, rubbing, and scraping process.

This method of combing away the pulp from the leaves suspended in front or at the side of the card-cylinder is also highly advantageous in respect of the more economical expenditure of power required to do the work, which results from the more natural action and consequently easier operation of the mechanism.

It will also be seen that by rapid action of the card cylinders or belts the pulp is cut away in very fine particles with but slight stress upon the fibers, enabling the work to be done so quickly that the limit of speed at which the machine may run is not dependent upon the effect on the fibers as much as on the capacity of the mechanism for high speed, from which it results that the rate of progress is vastly greater by this method than by any other known method. Practically it is governed, mainly, by the ability of the attendant to supply the leaves or stalks to the machine.

For supplying the leaves or stalks to the grip-chains *d*, by which they are fed along the cylinder *a* or belt *a*², I arrange a horizontal endless feeding-apron, *f*¹, on the table level with the upper surface of the lower feeding-chain *d*, suitably to receive the leaves or stalks on it from the attendant, and carry them so that the stems or butts will pass along over that portion of said lower chain that extends beyond the upper one, as shown in Figs. 1 and 2, and will pass between and be gripped by the two chains, to be held thereby and be carried along the card-cylinder. The feeding-apron *f*¹ may consist of two parts, as here shown—one on each side of the chains *d*—or it may have only one part and be located on the side along which the main body of the leaf

or stalk is placed, as shown. Said apron terminates a little beyond where the leaves enter between the two chains, to allow the leaves or stalks to drop and hang vertically from the chains, and a depressing-wheel, *g*, is located at a suitable position for pressing them down in case they are naturally too stiff to drop, or become so by drying. If the leaves are too rigid to be thus bent downward, they may be crushed by passing them through crushing-rolls of any approved kind—as, for instance, such as are used for crushing sugar-cane previous to being supplied to the feeding mechanism; but the feeding-chains may be contrived to receive the leaves vertically, and so that the leaves will hang naturally, whether stiff or not. The crushing-rolls may be fluted or corrugated, if desired.

The chains are located more or less back of the extreme front of the card-cylinder, according as the length of the leaves or stalks or other conditions require for the length of the range of the card-teeth along them, and the cylinder is constructed with a conical end, *a*³, to conduct or guide the dependent portions of the leaves around to the front of the cylinder and onto guard *b'*, that graduates the contact of the card-teeth and the leaves. The leaves are then carried along the front of the cylinder and sufficiently beyond the guard to be dressed from the lower ends upward as high as the range of the cylinder. The projecting stems of the partly-dressed leaves then pass between rolls *f* and are gripped and pulled forward by the descent of the upper roll when let fall by the cam *l* and by the rotation of said rolls, by which the leaves are so shifted in the grip-chains that the stem portions fall in front of the card-cylinder after passing from between said rolls and are combed or carded clear as they are carried further along the cylinder or belt, as the case may be. The grip of the chains is relaxed during the shifting of the leaves, this being effected by the construction of the guides in which the chains run so as not to press the chains quite so close together along where the shifting-rolls are.

In practice I propose to graduate the teeth or pins of the carding-cylinder by arranging coarser or stronger ones for the earlier and grosser portions of the work, and finer and closer teeth along the cylinder in the direction the material passes them.

For enabling the feeding-chains to grip the leaves or stalks and hold them securely against the pull of the card-teeth, I attach to or construct the chains with a series of clutches consisting of gripping jaws or blocks *l m*, suitably for working together in pairs by closing coincidentally on the stems, the clutches being confined between grooved guides *n o*, along which they run to maintain the grip, and to enable the chains to resist the pull of the card-teeth on the leaves or fibers. The upper guide, *o*, is pressed down by springs *q*, which enable the grip-chains to work uniformly on the

leaves of different thicknesses, and where the pressure is to be relieved for shifting the leaves by the rolls *f*, the upper guide may be dispensed with for a short distance, as shown in Fig. 2, or one or both of said guides may be reduced in thickness to have less pressure on the chains and allow them to run slack; but therefrom the guides must be arranged closer, as the chains must run closer together to grip the fiber.

The gripping-faces of the jaws may be variously shaped and otherwise fitted for adapting them to hold the different kinds and forms of leaves, stems, and other parts of the fiber-bearing substances to be treated. For instance, the lower jaws, *l*, may be grooved transversely, in concave or V shape, and the upper jaws may be flat or convex, or similar to the form of the lower jaw, and the surfaces may be plain or roughened, or may have leather, rubber, or other approved lining or facing, *p*, adapted to hold more firmly than the metallic surfaces of the jaws, or the jaws may be made wholly of other material.

For securely holding the dressed fibers, the jaw-faces should have the elastic cushions or pads of rubber *p*, specially adapted as to their elasticity to bind the individual fibers so that none will fail of being securely held.

Other means of feeding the leaves along the cylinder may be employed, if preferred, and I do not limit myself to the particular feeding mechanism herein represented; nor do I limit myself to the employment of a contrivance for shifting the leaves and the extension of the cylinder or belt for dressing the stems or butts, because by contriving the apparatus so as to dress the leaves and stalks close up to the ends of the stems or butts the undressed portions may be cut off and thrown away, or they may be dressed off by subsequently running the partly-dressed leaves or stalks again along the same apparatus employed for the first dressing, the leaves or stalks being in this case presented to the feeding mechanism in reverse of their first position, so as to be gripped this time on the clean fibers the same as herein represented after being shifted by the rolls *f*; but it is best of course to employ the extension-cylinder or belt and the shifting feeding mechanism substantially as herein shown.

When the leaves, stalks, or other parts of plants are dry and hard, it may sometimes be desirable to lubricate the card-teeth with water, for which I arrange one or more pipes, *t*, having numerous jet orifices or nozzles, *v*, suitable for the purpose along the front of the cylinder or belt, as the case may be, and having a suitable supply-pipe, *u*, for discharging fine jets on the cylinder or belt and the leaves while the work is in progress.

The power may be applied to the feeding-chains in any approved way for working them; but in this case I have represented the fast and loose pulleys *w* for the driving-belt, fitted

on the shaft z of the lower chain d , which is geared by the pinions x with the shaft y of the upper feeding-chain, and the lower chain d drives apron f' . The cylinder is driven by a belt running on the pulley c' . The shifting-rolls f' are driven by a belt running on the pulley d' , which gears by the pinion e' with the intermediate wheel, g' , with which the lower roll gears by a pinion, e^3 , on it, said roll being mounted in fixed bearings and driving the upper one by friction when pressed down on the leaves by the lever h' , in which it is mounted. The lever is pivoted in supports i' , and has a spring, j' , to thrust the upper roll down when the notch k' of the cam l' passes the bearer m' , said cam being geared by a pinion, n' , with the intermediate wheel, g' . The cam is to be so "timed" with relation to the feed-chains that the shifting-rolls will act consecutively with sections or length of the chains, carrying as many of the leaves as may be well gripped between the rolls at once, say three or four, according to the length of the rolls.

The contrivance of the rolls, cam, and lever mechanism may be modified or changed as may be preferred, and any other means of mechanism that will effect the shifting of the leaves may be employed in lieu of the same. The depressing-roller g is turned by a belt, e^2 , from a pulley on shaft y' .

When it is preferred to employ endless carding-belts, instead of the ordinary carding-cylinder, they may be arranged in an inclined position, as in Fig. 6, or be placed vertically, if preferred. In either case a support, b^b , will be placed behind or under the belt to prevent it from sagging or being crowded away from the work. With the belt a curved guide, h , may be employed to guide the leaves from where they are pressed down by wheel g around the edge of the belt onto the shield b' , and such a guide may also be used with the cylinder; but I prefer to construct the cylinder with the conical end, which serves the same purpose, making the base a^4 of the cone a little larger than the rim of the cylinder to form a ledge with which the edge of the shield b' will set flush, so that the leaves will pass smoothly from the cone onto the shield.

It is to be noted that the teeth or pins of the carding cylinder or belt give lateral movement to the portions of the leaves and fibers having contact therewith, and move them along even with the parts carried in the chains by the side push which the pins give the fibers while running rapidly along and between them, and from where the pins enter between the fibers they run along the whole of the rest of their length and pass from between them at the ends, carrying away all detached particles of matter and keeping the fibers straight and separate from or parallel with each other.

Although I have represented and described the application of the leaves or plants so that the point or upper ends as they grow are

dressed first, I do not mean to be limited in this respect, as it is only the preferable way. The stems or butts may be dressed first, if desired.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination, with a carding or combing cylinder or belt having combing or carding teeth or pins, of mechanism, substantially as herein described, to hold and suspend the leaves, stalks, and other parts of vegetable fiber-bearing substances in front of and so as to hang in contact with the descending side of the cylinder or belt, to be carded or combed thereby, as specified.

2. The combination, with a carding or combing cylinder or belt having combing or carding teeth or pins, of mechanism to hold and suspend the leaves, stalks, or other parts of vegetable fiber-bearing substances in front of the descending side of the cylinder or belt, also to feed the leaves or other vegetable substances along the cylinder or belt in said suspended condition, substantially as described.

3. The combination, with a carding or combing cylinder or belt having combing or carding teeth or pins, of mechanism to hold and suspend the leaves, stalks, or other parts of vegetable fiber-bearing substances in front of the descending side of the cylinder or belt, also to feed the same along the cylinder, and also the guard contrived to cause the leaves or other parts to touch the card first at their points, and to gradually increase the range of the contact from the points of the leaves along said leaves or other parts, and the cylinder or belt, substantially as described.

4. The combination of feeding-chains d , having clutches $l m$, and grooved guides $n o$, with the card-cylinder a or belt a^2 , having combing or carding teeth or pins, substantially as described.

5. The combination of feeding-chains d , having clutches $l m$, and grooved guides $n o$, with carding or combing cylinder a or belt a^2 , having the shield b' , substantially as described.

6. The combination of the feeding-chains d , having clutches $l m$, and grooved guides $n o$, with the cylinder a or belt a^2 , having the cone or a curved guide, h , to guide the leaves onto the shield b' , substantially as described.

7. The combination of the feeding-apron f' , feeding-chains d , and depressing-roller g with the card-cylinder a or belt a^2 , having combing or carding teeth or pins, substantially as described.

8. The combination, with the carding-cylinder a or belt a^2 , having combing or carding teeth or pins, of the feeding-chains d , adapted to suspend and carry the leaves or plants along the same, and the shifting-rolls f , adapted to grip and shift the leaves or plants in the carrying-chains and with relation to the cylinder or belt, substantially as described.

9. The combination of chains d , having

clutches *l m*, and grooved guides *n o*, one of which is adjustable with the carding-cylinder *a* or belt *a*², substantially as described.

10. The combination of a card cylinder or
5 belt, leaf or stalk carrying and suspending chains adapted to carry the leaves laterally along the cylinder or belt, and water-sprinklers or jet apparatus adapted to lubricate and wash the cards or combs and the fibers while

the carding or combing is in progress, substantially as described.

In witness whereof I, the said JOHN GEORGE STEPHENS, have hereunto set my hand this 6th day of May, 1885.

JOHN GEORGE STEPHENS.

Witnesses:

W. J. MORGAN,

S. H. MORGAN.