No. 847,611. PATENTED MAR. 19, 1907

R. SCHOFIELD.

MACHINE FOR TREATING FLAX.

APPLICATION FILED FEB. 29, 1904.

3 SHEETS—SHEET 1

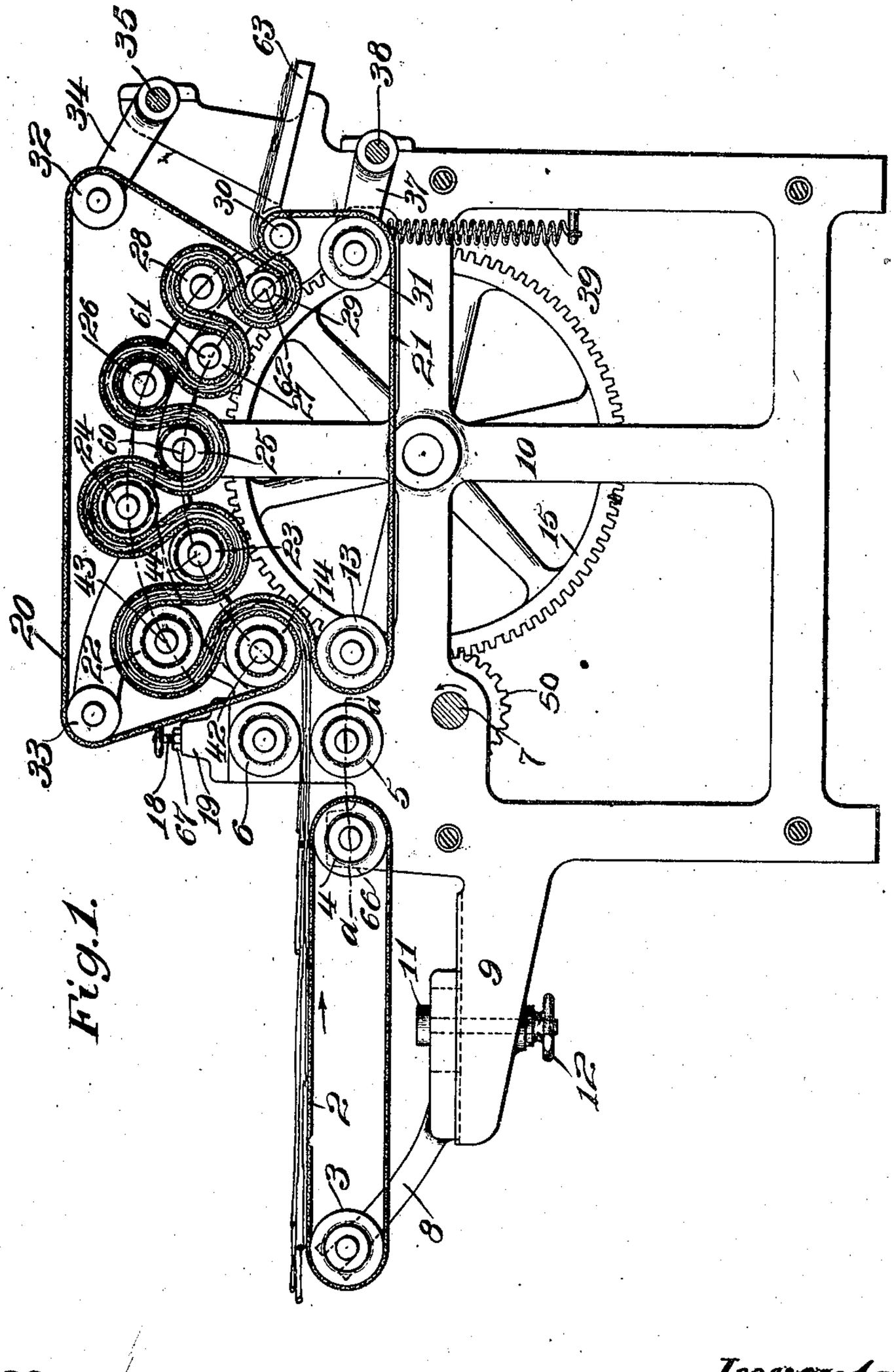

Fig. 1.

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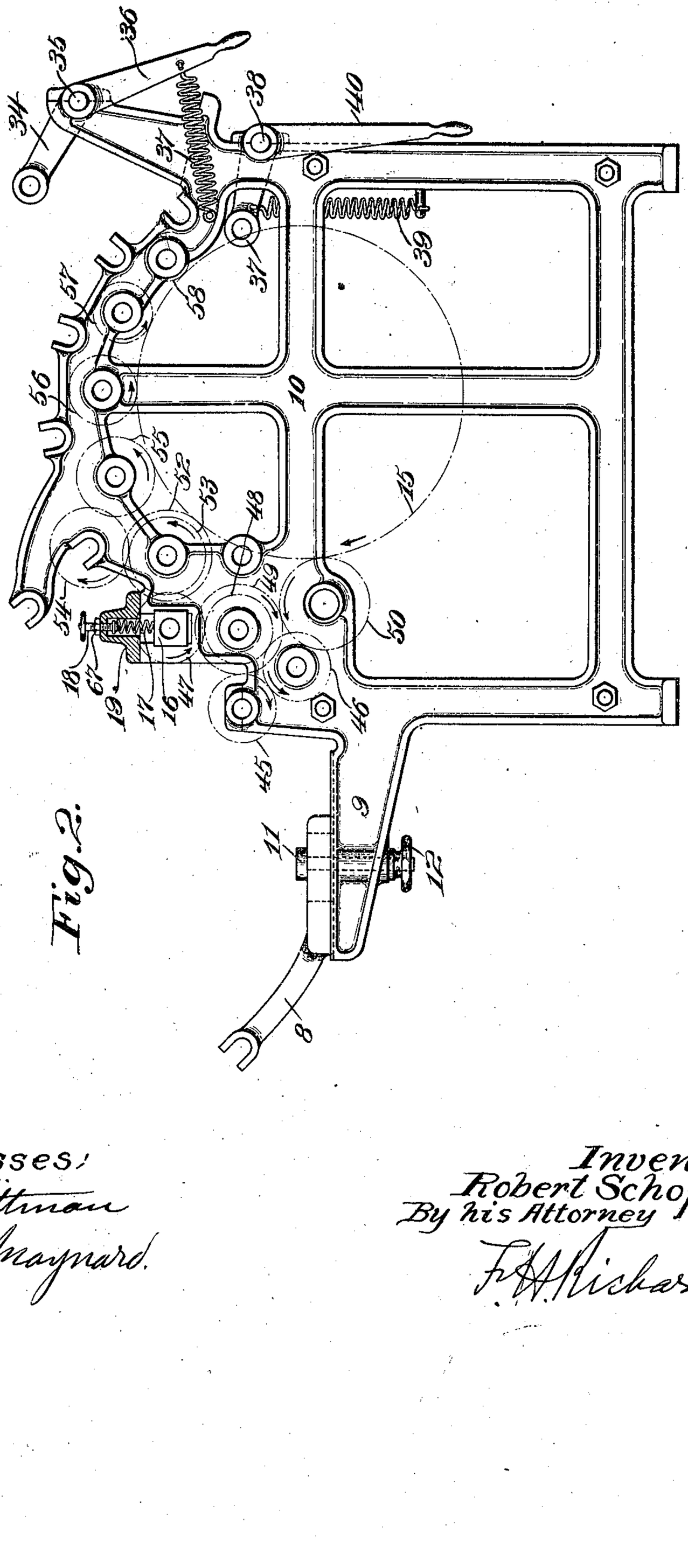

Fig. 2.

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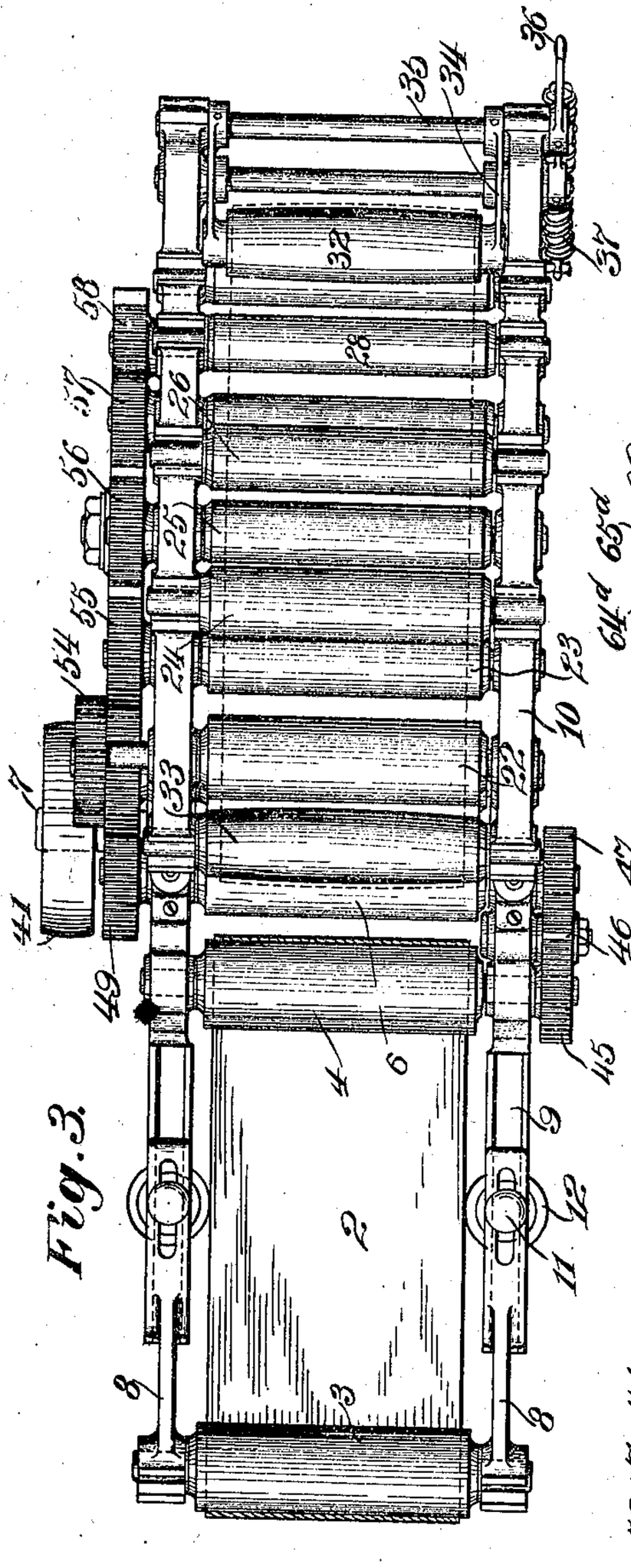

Fig. 3.

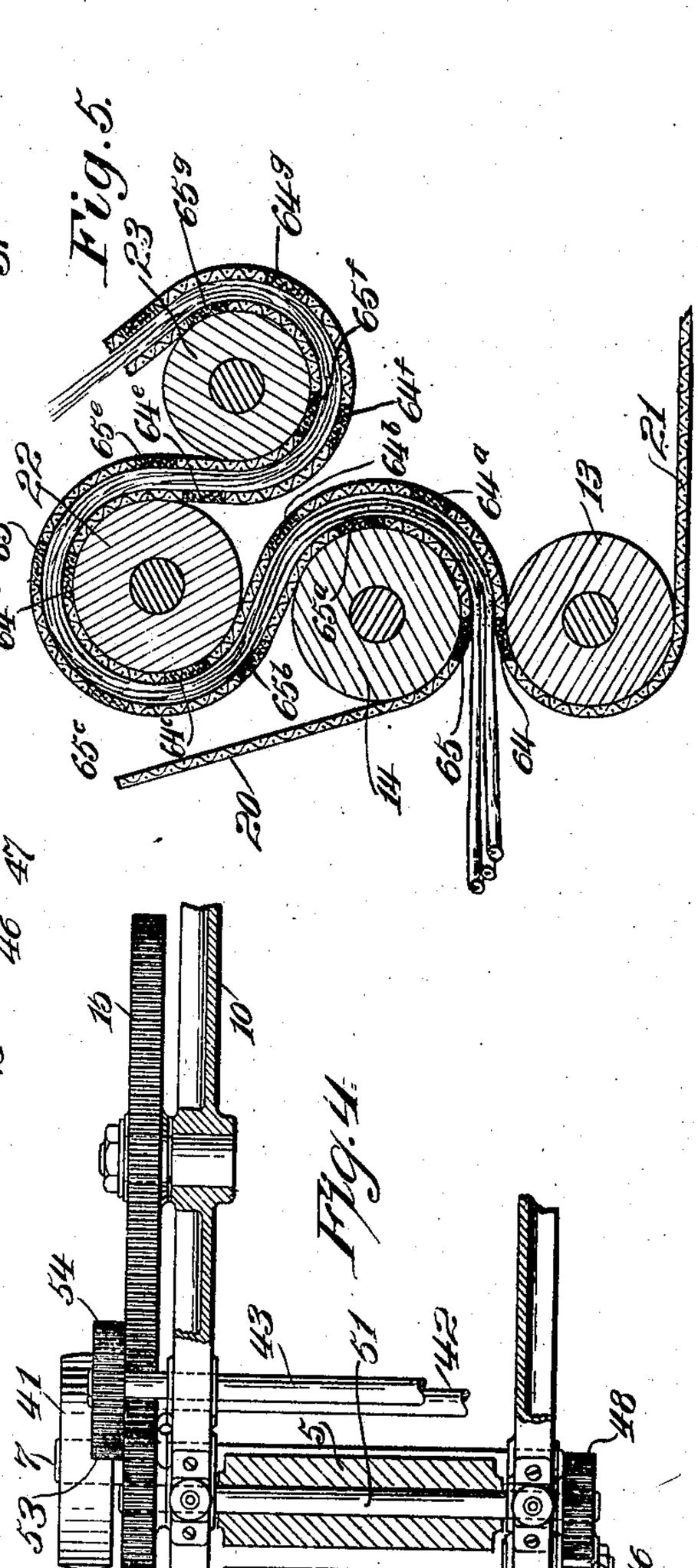

Fig. 5.

Fig. 4.

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UNITED STATES PATENT OFFICE.

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MACHINE FOR TREATING FLAX.

No. 847,611. Specification of Letters Patent. Patented March 19, 1907.

Application filed February 29, 1904. Serial No. 195,716.

To all whom it may concern:

Be it known that I, ROBERT SCHOFIELD, a citizen of the United States, residing in New Bedford, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements in Machines for Treating Flax, of which the following is a specification.

This improvement relates to fiber-treating machines, and more particularly to that class of such machines as automatically manipulate fiber plants, especially flax, with the object to separate the fiber from the woody or shive portions thereof. This object has heretofore been partially accomplished by various means—as, for instance, crushing-rollers, intermeshing toothed wheels, or combing mechanism, or by these devices used in combination or succession—but by these and other means as heretofore used the waste and breakage of fiber has been excessive.

One object of my improvement is to furnish means adapted for operating on the material in a progressive manner and with increasing mechanical intensity and more or less governed by the quality and quantity of the stock being treated, so that a relatively large quantity and a relatively high quality of fiber is preserved with a relatively small loss by waste and breakage.

With these objects in view I have provided an improved machine embodying my present invention, which machine in the form illustrated in the accompanying drawings comprises a series of pulleys or rolls preferably decreasing in diameter from the supply end of the machine toward the delivery end thereof and so arranged and actuated that a pair of conveying members comprising continuous coacting fiber-conveying belts may be caused to travel around and between said rolls in alternate bends in opposite directions, respectively, in such manner that the flax-stalks or other material fed between said belts will be bent successively in opposite directions and with increasing sharpness of bends, and at the same time said stalks will be caused to move locally lengthwise in relation to one another, and thereby abrade the partially and increasingly broken and loosened shives from the fibrous portions of one another. This simultaneous bending and rubbing action subjects the fiber to a compound treatment of peculiar and complex character, operating with unusual efficiency for the separation of the shives from the fiber of the flax and for breaking up the shive thoroughly before it is passed out to the point where the shive fragments will be shaken out or otherwise disposed of. The freed shive fragments will then act as abrasives on the remaining partly-deshived fiber.

One feature of the present improvement relates to crushing-rolls for seizing and passing the stalks and fiber to the disintegrating-belts, the rolls crushing the stalks and fiber preparatory to the subsequent treatment and feeding the crushed material directly to the belts. In this way the action upon the fiber by the belts and coacting rollers will be made more uniform, since the larger stalks will be crushed relatively more than the smaller stalks.

In the drawings accompanying and forming a part of this specification, Figure 1 is a side elevation with the side frame removed of a machine illustrating one form, and which may be the preferred form, of my improvement. Fig. 2 is a side elevation of the side frame, illustrating partially in diagram an arrangement of framing, gearing, and tension devices suitable for mounting and driving operative parts embodying my improvement. Fig. 3 is a plan view with some parts broken away and some omitted of the machine illustrated in Fig. 1. Fig. 4 is a plan view, partly in section, illustrating more in detail a portion of the machine. The section through the rolls in said figure is taken on line *a a* of Fig. 1. Fig. 5 is a vertical cross-section, on an enlarged scale, of a portion of the running members or belts and their supporting-rolls and illustrating the manner in which said belts are accelerated and retarded in relation to one another.

Similar characters of reference indicate similar parts throughout the drawings.

A feed-apron 2, preferably in the form of an endless belt, is suitably supported on rolls 3 and 4, and the upper ply of said belt is caused to travel in the direction of the arrow adjacent thereto toward the main portion of the machine by means of suitable gearing hereinafter more fully described. Roll 3 is mounted for free rotation on a shaft in brackets 8, which brackets are slidably mounted

on rearwardly-extending portions 9 of side frames 10. Said brackets 8 may be held rigidly in position on extensions 9 by means of clamp-screws 11 and hand-nuts 12. Roll 3 may be adjusted to maintain apron 2 in suitable tension by means of said shiftable brackets 8, clamp-screws 11, and hand-nuts 12. Roll 4 may be mounted for rotation in bearings, as 66, in side frames 10.

Suitably mounted for rotation one above the other contiguous to the delivery end of the apron is a pair of oppositely-disposed crushing-rolls 5 and 6. By means of gearing connecting them with the driving-shaft 7 these rolls are caused to revolve at a surface speed preferably somewhat in excess of the surface speed of apron 2. The bearings of the upper roll 6 are mounted in vertically-slidable boxes 16, and said upper roll 6 may be impelled toward lower roll 5 by springs 17. The pressure exerted by said springs may be varied by means of adjusting-screws 18, threaded into the upper wall of box-caps 19 and detained from turning by suitable check-nuts 67.

A pair of rolls 13 14 is suitably mounted for rotation in side frames 10. Either or both of said rolls I preferably drive by gearing from driving-shaft 7. Under said roll 14 I pass in the direction of the rotation of said roll an upper disintegrating-belt 20 and over roll 13 and in a similar direction a lower disintegrating-belt 21. I then pass these belts in conjunction with one another upwardly around roll 14 and then over roll 22, thence downwardly under roll 23, and so on together over and under successive rolls, respectively, until roll 29 is passed. The zone of coaction of said belts 20 and 21 thus extends through an intricate and circuitous path from their point of meeting in passing under roll 14 to their point of separation in passing under roll 29. From this point belts 20 21 are separated, the upper belt being passed over tension-roll 32 and thence over idler-roll 33 back to its starting-place under roll 14, thus forming an endless circuit. Belt 21 after leaving roll 29 is passed over idler-roll 30 and thence over tension-roll 31 back to its starting-place over roll 13, thus forming a continuous circuit. The rolls 13 and 33 and tension-rolls 31 and 32 are preferably crowned, Fig. 3, so as to preserve the direction of travel of belts 20 and 21.

Rolls 22 to 30 I preferably decrease in size from roll 22 downwardly and gear a part or all of them to large gear 15. Such of the rolls as are geared to large gear 15 may be timed so as to all have the same surface speed; but I preferably gear them so that their surface speed may be slightly increased successively, respectively. Rolls 13 14 are preferably so situated in advance of rolls 5 and 6 that the latter will deliver without special assistance the partially-crushed stalks into the mouth-like opening between belts 20 21 as said belts run inwardly face to face over rolls 13 14.

Some suitable tension devices for belts 20 and 21 may be used, and that herein illustrated comprises for upper belt 20 a roll 32 revolubly mounted in swinging arms 34 fixed to rock-shaft 35, suitably supported in portions of frames 10. Fixed to and depending from shaft 35 is a hand-lever 36, which is connected for tension by spring 39 to a part of one of frames 10. Lower belt 21 may be held taut in a similar manner by roll 31, revolubly mounted in swinging arms 37, fixed to rock-shaft 38, mounted in frames 10. A spring 39, attached by one end thereof to one of arms 37 and by the other end thereof to adjacent frames 10, exerts tension on said arms 37. A hand-lever 40, fixed to shaft 38, is provided to facilitate manipulating the device.

In their preferred form running members 20 21 comprise woven belts and preferably composed of flax, so that in the treatment of flax this fiber will be subjected to the mechanical action of its own kind of material, so that in a sense the flax being treated will be subjected to the attrition of its own fiber.

A table, as 63, is provided at the delivery end of the machine to receive the material as delivered by belts 20 21.

Power-shaft 7 may be operated from any suitable source of power by ordinary means—as, for instance, a belt (not shown) connecting with pulley 41 on said shaft. The gear-trains which drive several rolls will best be understood by reference to Fig. 2 of the drawings, in which the various gears are illustrated in diagrammatic form. Gear 50 on power-shaft 7 meshes with and drives gear 49 at the rearward end of shaft 51, on which roll 5 is secured. On the forward end of said shaft 51 is secured gear 48, which meshes with gear 47 of roll 6 and also through intermediate gear 46 drives gear 45 of apron-roll 4. Gear 50 also meshes with and drives large gear 15, which in turn meshes with and drives the gears on several of the endless-belt rolls arranged above said gear 15. The first gear driven directly by gear 15 is gear 52 on shaft 42, to which shaft is fixed roll 14. Adjacent to gear 52 and fixed to the same shaft therewith is gear 53, which meshes with and drives gear 54 on shaft 43, to which shaft is fixed roll 22. Gears 55, 56, 57, and 58, meshing with and driven by gear 15, are fast to shafts 44, 60, 61, and 62, respectively, and through said shafts actuate rolls 23, 25, 27, and 29, respectively, fixed thereon. Rolls 24, 26, 28, and 30 are illustrated as idler-rolls, being driven by the belts contacting with them. The directions of rotation of the various gears are indicated by arrows thereon, respectively.

The operation of my improved machine is

as follows: Power being applied to rotate shaft 7 in an anticlockwise direction, the various rolls and belts of the machine are put in motion by the means already described, the flax-stalks or other material to be operated upon are laid on the traveling apron 2, and with their lengths approximately in the direction of the (toward the right hand in Fig. 1) travel of said belt they are fed forward into engagement with the oppositely-disposed rolls 5 and 6. Springs 17 having been previously adjusted to exert the desired amount of pressure on roll 6, the stalks will be sufficiently crushed in passing between said rolls. From thence by the continued revolution of said rolls crushed stalks are fed forward into the grip of the opposing disintegrating-belts 20 21. The stalks tend to separate these belts somewhat, thereby increasing the tension of said belts, which thereupon tend to grip more firmly the stalks between them. The stalks are bent upwardly by the belts around roll 14 and thence upwardly and in a reversed bend over roll 22, then downwardly under roll 23, which last roll not only again reverses the bend of the belts and the stalks between them, but said roll 23, being smaller in diameter than roll 22, also bends the stalks in a sharper bend, thereby acting upon some shive portions not acted upon in their transit between the belts about rolls 14 and 22 and increasing the bending action on such shive portions as were somewhat bent in their previous travel. Coincident with the bending action on the stalks the peculiar path of the belts 20 21 about said rolls causes opposite coacting portions of the faces of said belts to be alternately accelerated and retarded with relation to one another. This action is particularly illustrated in Fig. 5, wherein the edges of said belts are shown with equidistant portions, as 64 64^a 64^b, &c., as to belt 21 and 65 65^a 65^b, &c., as to belt 20, shaded darker than the main portions of such edges. Portions 64 65 are illustrated as opposite one another, and at 64^a 65^a is shown the manner in which belt 20 in contact with roll 14 travels on a circle of shorter radius than that traversed by belt 21, which is separated from said roll by the thickness of belt 20 and by whatever material may be between said belts. Belt 20 therefore moves more rapidly, measured in degrees, about the axis of roll 14 than belt 21 and leads it in their travel toward roll 22. The amount of this lead continues to increase to positions 64^b 65^b, where it about reaches its maximum. Then the influence of roll 22 tends to reverse the relative motions of said belts, and at positions 64^c 65^c belt 21 has regained a part of the motion which it lost and at 64^d 65^d is again in the same relative position to belt 20 as at 64 65. Said belts, continuing their onward movement, at 64^e 65^e belt 21 is in the lead of belt 20, and as the belts in passing about roll 23 again reverse their turning portions 64^f 65^f come opposite one another, and so on. I thus obtain a constantly alternative lengthwise abrading action of the belts upon the stalks between them and also a constant abrading action of the stalks one upon another as they pass onward between the belts. In this way the entire mass of material being treated is subjected to a kind of attrition action, and during this process the freed broken and granulated shive portions of the stalks operate as a grinding or abrading means for the further treatment of the material not yet disintegrated. The stalks then continue in alternately-opposite directions between the belts around succeeding rolls 24 25, &c., each roll being of less diameter than its immediate predecessor, and thereby bending the flax-stalks with increasing sharpness of bends. These combined bending and abrading actions in successively-increasing intensity are continued until roll 29 is reached, when upper belt 20 passes upwardly over tension-roll 32 and lower belt 21 passes over roll 30 and downwardly over tension-roll 31. Just after lower belt 21 passes over roll 30 the disintegrated fibrous mass is delivered to table 63, and the freed shives and woody portions may be blown out or otherwise removed from the fibrous portions in any convenient or well-known manner.

By reference to Fig. 1 it will be seen that the rolls are arranged in two sets or series. The axes of the outer series of rolls—namely, 22, 24, 26, and 28—are arranged in the arc of a circle, and the inner series of rolls, comprising rolls 14, 23, 25, 27, and 29, have their axes arranged in the arc of a circle. In the present illustration the rolls are of gradually-decreasing diameter, and the arcs in which the axes are arranged are eccentric one to the other. Were the rolls of each series uniform in diameter such arcs could be concentric. In the illustration the rolls 14 and 22 are of substantially the same diameter, so are the rolls 23 and 26, and so on through the entire series of rolls. It will also be observed by reference to such view that the innermost points on the perimeters on the outer series of rolls are arranged in the arc of a circle and that the outermost points of the perimeters of the rolls of the inner series are arranged in the same arc, the arrangement between the respective series being staggered. This arrangement will bring the rolls of the inner series closer together than the rolls of the outer series, so that the belts and material being treated in their passage about the rolls will be wrapped about the outer rolls to a greater extent than they will be wrapped about the inner rolls. In the present instance the wrapping about each of the rolls 22, 24, 26, and 28 comprises about three-quarters of a circle, and the wrapping about

each of the rolls 23, 25, 27, and 29 comprises more than two-thirds, so that in any instance the wrapping is more than a half-circle in each roll. This excessive bending will, since it is alternately in opposite directions, greatly facilitate the operations of the machine in its treatment upon the fibrous plants, as above referred to.

I claim—

1. In a fiber-treating machine the combination with a pair of coacting belts, of rolls for successively bending said belts in opposite directions in their zone of coaction and tension devices for closing the coacting belts alternately about alternate rolls onto the fiber during the successive bendings of said belts and the fiber between them in alternate directions, and means for actuating the rolls at successively-increasing surface speeds respectively.

2. In a fiber-treating machine the combination with coacting running members, of means for successively bending said running members in opposite directions and in increasing sharpness of bends, and for closing the running members alternately about the bending means onto the fiber during the successive bendings of the running members and fiber between them in alternate directions.

3. In a fiber-treating machine a combined conveyer and disintegrator comprising a plurality of running members in combination with means for actuating and controlling said members for bending the fiber in alternate directions and in increasing sharpness of bends and subjecting the same to disintegration, substantially as described.

4. In a fiber-treating machine the combination with a pair of coacting endless belts, of means comprising successive rolls of successively-decreasing diameter for alternately supporting at successive points each of said coacting endless belts respectively, each of said belts being supported at intervening points by its coacting belt, and means to actuate the rolls.

5. In a fiber-treating machine the combination with a pair of coacting running members, of means comprising successive rolls of successively-decreasing diameter for alternately supporting at successive points each of said coacting running members respectively, each of said running members being supported at intervening points by its coacting running member, and means for actuating the successive rolls at successively-increasing surface speeds respectively.

6. In a fiber-treating machine the combination with two coacting endless belts, of means for guiding and driving said belts in successive oppositely-disposed bends of successively-increasing sharpness, in their zone of coaction.

7. In a fiber-treating machine the combination with two coacting endless belts, of means comprising a series of rolls, said rolls being of successively-decreasing diameter respectively, for guiding and driving said belts in successive oppositely-disposed bends in their zone of coaction, and means for actuating the rolls.

8. In a fiber-treating machine the combination with two coacting endless belts, of means comprising a series of rolls, said rolls being of successively-decreasing diameter respectively for guiding and driving said belts in successive oppositely-disposed bends in their zone of coaction, and means for actuating each of the series of rolls at successively-increasing surface speeds respectively.

9. In a fiber-treating machine the combination of a plurality of coacting crushing-rolls, with oppositely-disposed conveying-belts mounted and adapted for bending and abrading in successively-increasing intensity fiber supplied thereto, and means for actuating the rolls and the belts.

10. In a fiber-treating machine the combination of a plurality of coacting crushing-rolls, with oppositely-disposed combined conveying bending and abrading continuous belts, mounted and adapted for treating fiber in successively-increasing intensity and means for directing said belts in successive oppositely-disposed bends, and means for actuating the rolls and the belts.

11. A machine for treating fibrous material embodying belts for carrying between them the material under treatment, and a series of rolls disposed alternately upon opposite sides of an arc of a circle in staggered arrangement and about which rolls the belts pass, making a turn of more than a half-circle about each roll.

12. In a fiber-treating machine the combination with an outer series of rolls arranged with the innermost points of their perimeters in an arc of a circle, of an inner series of rolls arranged with the outermost points of their perimeters in the same arc, the rolls of the respective series being in relatively staggered positions, and a pair of belts passing alternately about the rolls of the respective series.

13. In a fiber-treating machine the combination with an outer series of rolls arranged with the innermost points of their perimeters in an arc of a circle, of an inner series of rolls arranged with the outermost points of the r perimeters in the same arc, the rolls of the respective series being respectively staggered, and a pair of belts passing alternately about the rolls of the respective series, the belts and material carried between them in passing about the said inner rolls describing about two-thirds of a circle, and when passing about the outer rolls about three-fourths of a circle.

14. In a fiber-treating machine the combination with an outer series of rolls arranged with the innermost points of their perimeters in an arc of a circle, of an inner series of rolls arranged with the outermost points of their perimeters in the same arc, the rolls of the respective series being relatively staggered, and a pair of belts passing alternately about the rolls of the respective series, one belt contacting with the rolls of one series and the other belt with the rolls of the other series, the distance between the inner rolls being sufficient for permitting the passing of the plies of the belts while carrying material under treatment between them, the belts and material carried between them in passing about the said inner rolls describing about two-thirds of a circle, and when passing about the outer rolls about three-fourths of a circle.

15. In a fiber-treating apparatus, the combination with two series of rolls arranged in staggered relation, and a pair of belts passing alternately about the rolls of the respective series, the belts and the material carried between these in passing about the said rolls describing more than a half-circle, and the belts having a local relative movement.

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