No. 673,199. Patented Apr. 30, 1901.

E. J. DE COURCY & R. CRAWFORD.

MACHINE FOR BREAKING FLAX.

(Application filed July 31, 1900.)

(No Model.) 4 Sheets—Sheet 1.

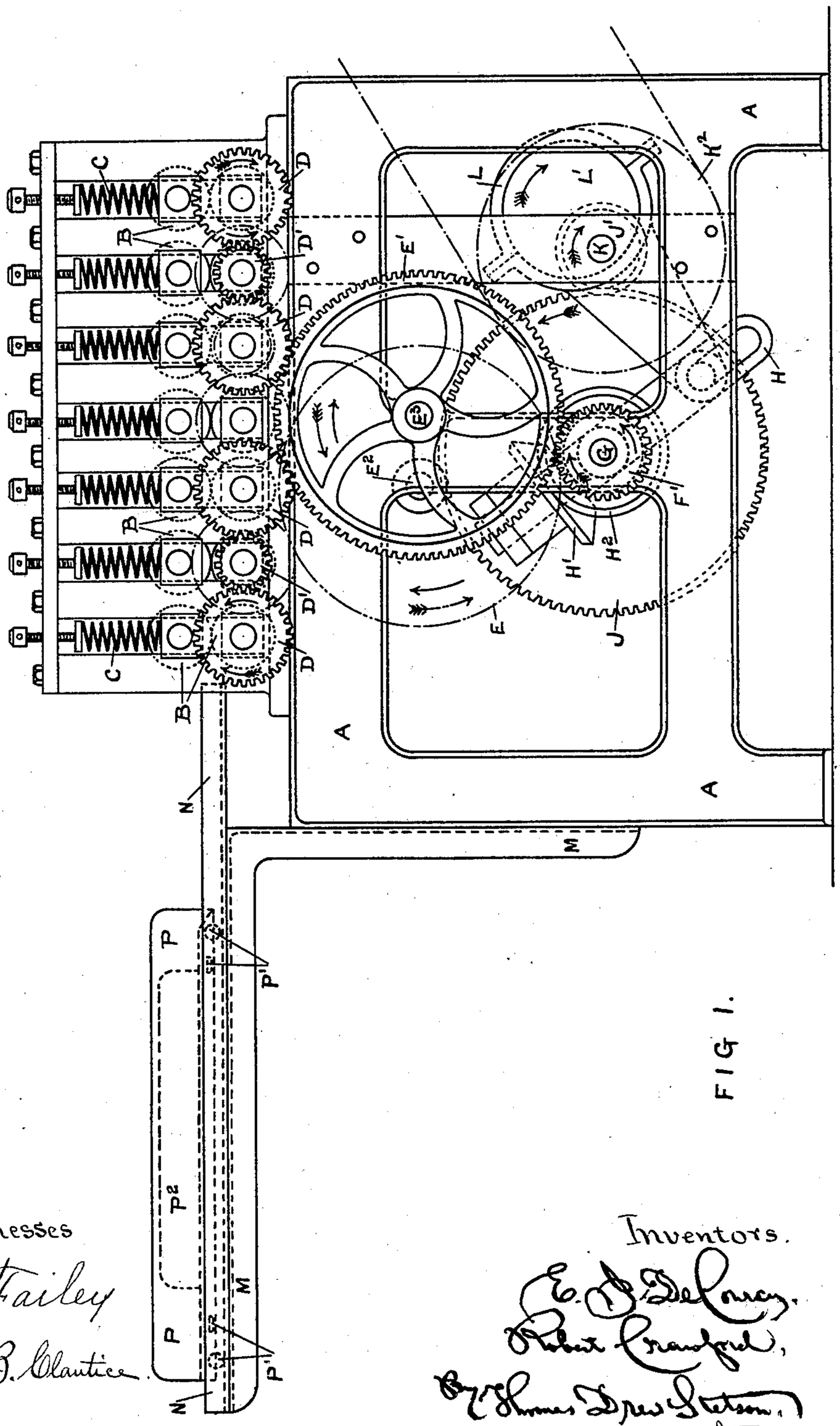

FIG 1.

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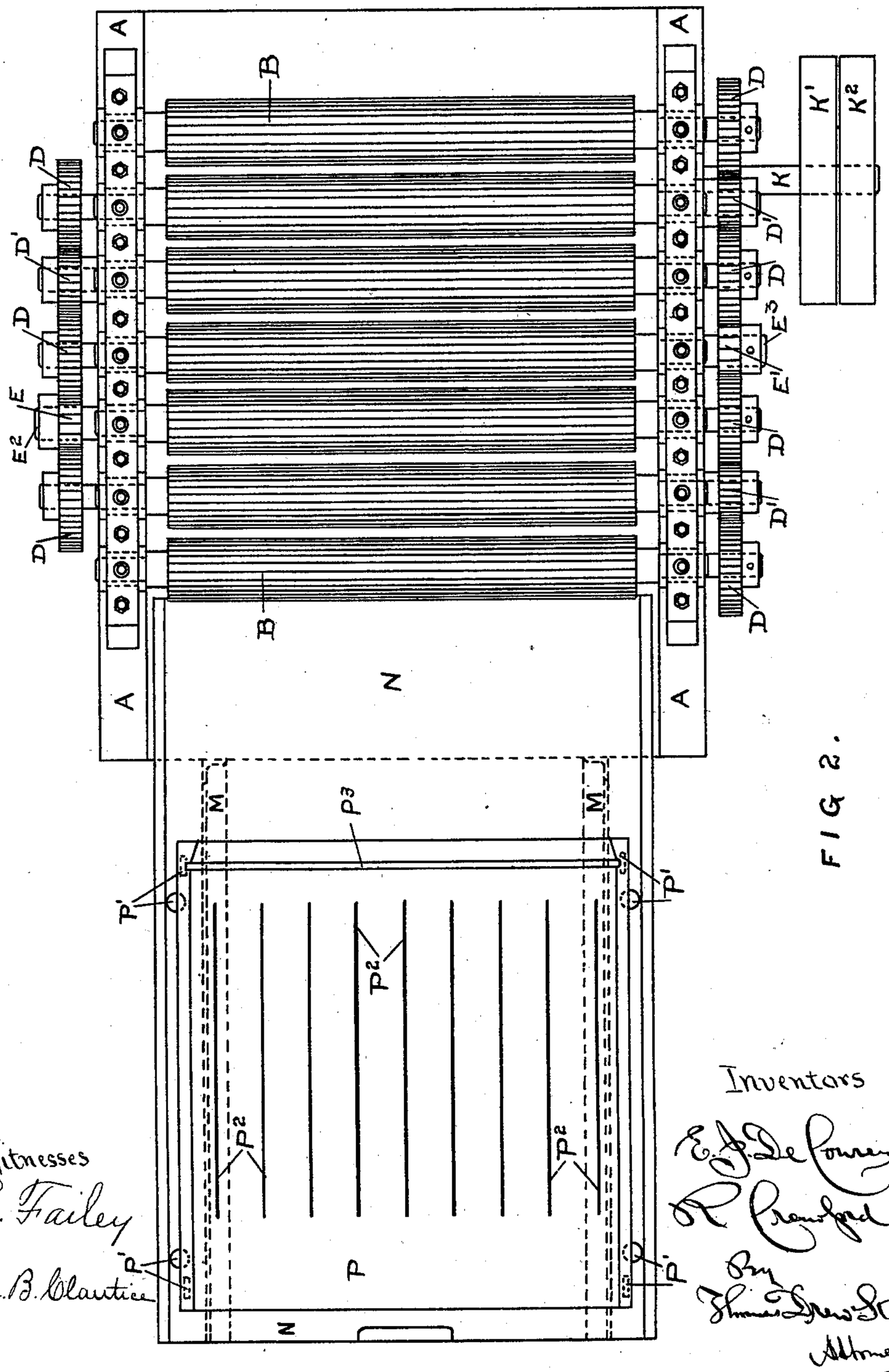

FIG 2.

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FIG 5.

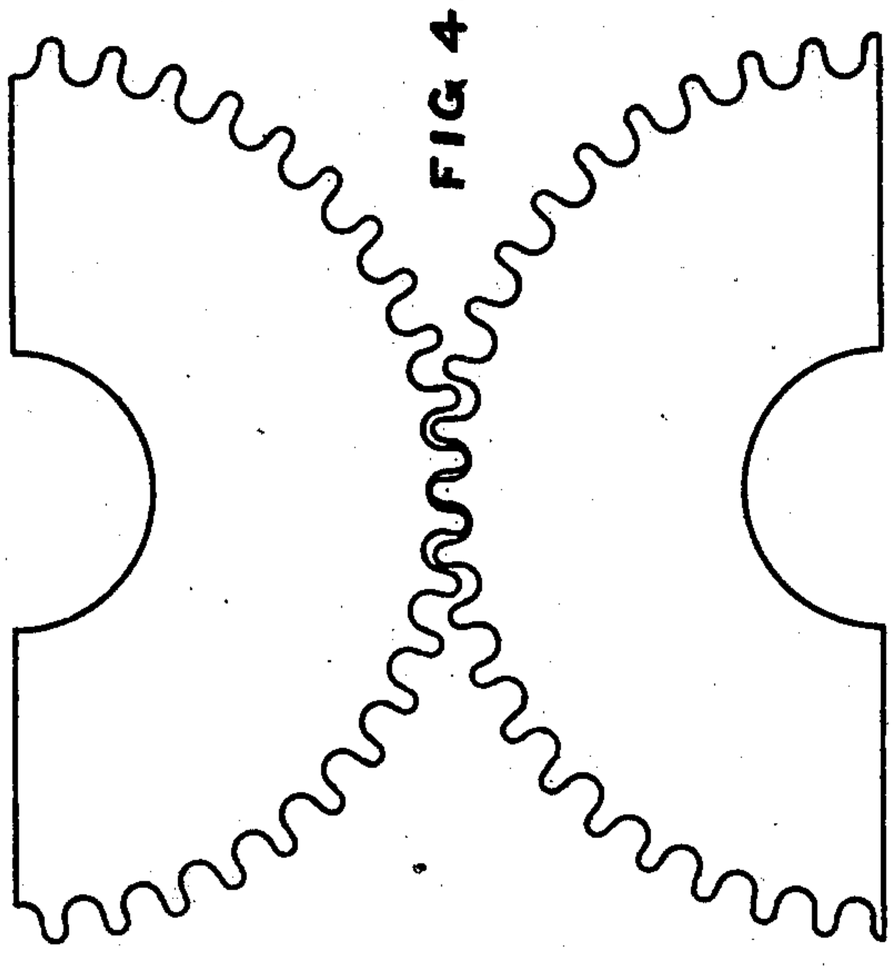

FIG 4.

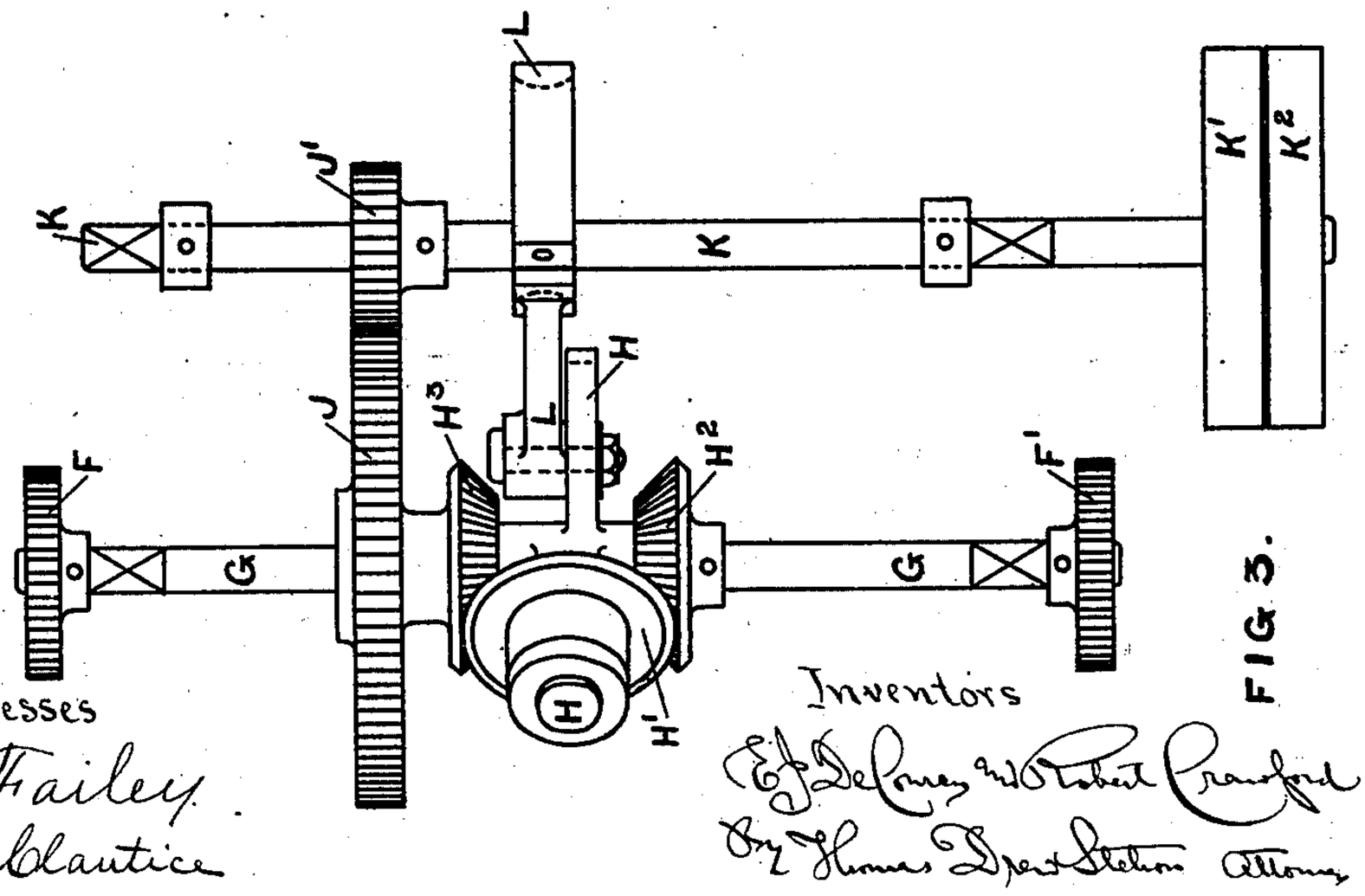

FIG 3.

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No. 673,199. Patented Apr. 30, 1901.

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MACHINE FOR BREAKING FLAX.

(Application filed July 31, 1900.)

(No Model.) 4 Sheets—Sheet 4.

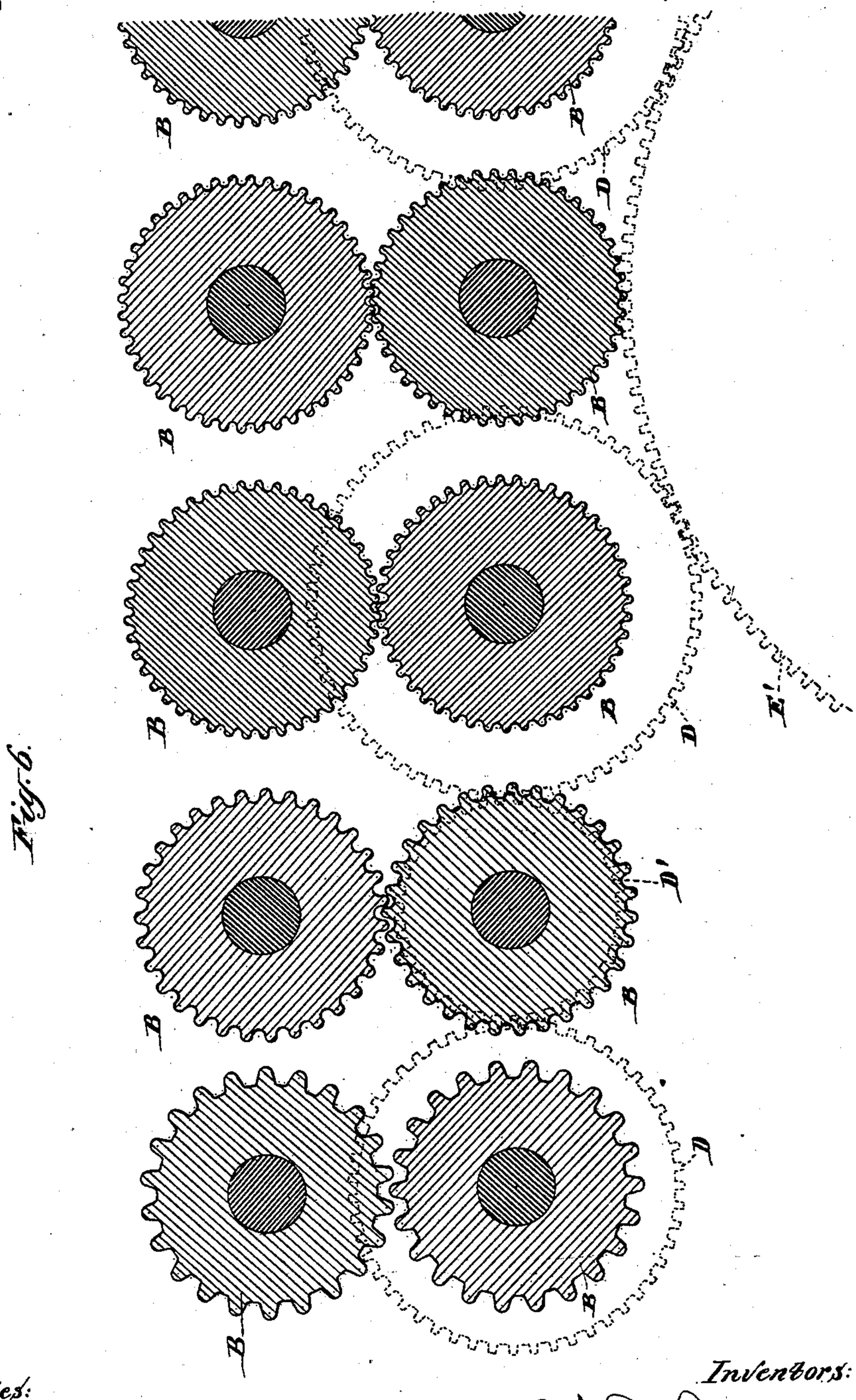

Fig. 6.

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UNITED STATES PATENT OFFICE.

EDWARD JOSEPH DE COURCY AND ROBERT CRAWFORD, OF BELFAST, IRELAND.

MACHINE FOR BREAKING FLAX.

SPECIFICATION forming part of Letters Patent No. 673,199, dated April 30, 1901.

Application filed July 31, 1900. Serial No. 25,478. (No model.)

To all whom it may concern:

Be it known that we, EDWARD JOSEPH DE COURCY and ROBERT CRAWFORD, subjects of the Queen of Great Britain and Ireland, and residents of Belfast, in the county Antrim, Ireland, have invented certain new and useful Machinery for Breaking Flax, (for which we have obtained provisional protection in the United Kingdom of Great Britain and Ireland, dated June 8, 1900, and numbered 10,450;) and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

The invention has reference to new or improved machinery for breaking flax in an economical, expeditious, and efficient manner and without wasting or injuring the fiber.

According to the present practice of treating flax considerable difficulty is experienced in the process of removing the straw and bark without wasting the fiber, and various mechanical attempts have been made to overcome this difficulty with but partial success. Our invention, however, is designed not only to accomplish the end in view in a satisfactory manner, but to produce a fiber of a softer and silkier finish, superior in all respects to any hitherto produced by the machinery available.

In carrying out our invention we mount a series of fluted rollers transversely in pairs in a horizontal plane and in suitable framework. The flutes on these rollers are of a special formation, and the pitch of certain pairs varies, likewise the speed, as hereinafter more fully described. The opposite ends of the rollers are provided with a train of spur-gear whereby a reciprocating rotary motion is communicated throughout the series, this reciprocating motion being imparted by suitable mechanism so arranged and operating that the forward motion of the rollers will exceed the reverse motion, the object of this stepwise action being to effect the delivery of the fiber at the terminal end of the machine. As thus constructed the flax upon being fed between the rollers and carried forward and backward by their reciprocating rotary motion is subjected to a thorough and efficient breaking process, and owing to the formation of the flutes the straw is broken into extremely short lengths and is effectually separated from the fiber without breaking or injuring the same, while the rolling friction produced by the flutes effects the glossy or silky appearance above referred to.

The flax is fed to our improved machine by a movable tray arranged to slide horizontally over a fixed platform and to deliver the flax at a proper level on reaching the feed-rollers. This feed arrangement enables the attendants to place the flax in properly-distributed layers before presenting to the machine and also insures the supply being carried on in a practically continuous manner.

In order that our said invention may be more readily understood and carried into practice, we will describe the accompanying drawings.

Figure 1 is a side elevation of a complete machine constructed according to our invention. Fig. 2 is a plan view. Fig. 3 is a detail view of the "epicyclic" train or mechanism for imparting the unequal alternate motion to the rollers, as hereinafter more fully described. Fig. 4 illustrates segments of the fluted rollers of fine pitch, showing the special formation of the flutes. Fig. 5 illustrates the rollers of coarse pitch. Fig. 6 is on a larger scale. The strong lines give a central vertical section across all the crushing-rolls. Dotted lines show the driving-gears on the side of the machine nearest the eye.

Similar letters of reference indicate corresponding parts in each of the views.

A indicates the frame of the machine; B, the fluted rollers arranged in pairs, the lower series being journaled in fixed bearings and the upper series in movable bearings pressed down by springs C. The gearing for communicating motion to the series of rollers consists of spur-wheels D D, keyed on opposite ends of each alternate lower roller B, and intermediate pinions D′ D′, running loosely on the other alternate ends. These trains of spur-gearing are actuated by intermediate

spur-wheels E and E′, mounted on opposite sides, respectively, of the machine on transverse shafts E^2 and E^3 and actuated by pinions F and F′, keyed on the shaft G, on which latter is mounted the epicyclic train, as shown in detail in Fig. 3. It will be perceived that the intermediate spur-wheel E engages two rollers on the off side of the machine, while the intermediate spur-wheel E′ engages two rollers on the near side. This train of mechanism consists of a rocking shaft H, carrying a bevel gear-wheel H′, turning loosely thereon, bevel H^2, which is keyed to the shaft G, and bevel H^3, which forms part of spur-wheel J and turns loosely on shaft G. Spur-wheel J engages pinion J′, keyed on the shaft K, which latter is provided with fast and loose pulleys K′ K^2 and constitutes the driving-shaft of the machine. To the lower end of the rocking lever H is pivotally connected the strap-arm L of the eccentric L′.

The action of the mechanism is as follows: As shown in the drawings, the gear is in position to start the forward movement of the rollers B. The driving-shaft K, and consequently the pinion J′ and spur-wheel J, is driven continuously in the direction indicated by the feathered arrow. The eccentric in starting will push the rocking lever H and turn it until the throw of the eccentric is complete. During this movement bevel gear-wheel H′ tends to revolve both bevels H^2 and H^3 in the same direction. If the bevel H^3 is held nearly stationary, the effect will be to rotate H^2 in the opposite direction, and as H^2 is keyed to shaft G the latter (shaft G) will transmit motion through the pinions F and F′ and intermediate spur-wheels E and E′ to the rollers B, thus producing a forward movement, as indicated by the feathered arrow. This forward motion will be increased by the fact that the bevel gear-wheel H^3 is not absolutely stationary, but is slowly turned by the constant rotation of the gears J′ J. Continuing the revolution of the eccentric, the motion of the rocking lever H is reversed, and since wheel J always revolves in the one direction bevel H′, acting, as before, as a kind of bridge between H^2 and H^3, partially revolves in the reverse direction, thus reversing the direction of H^2, and consequently reversing the rotation of the shaft G, during the return stroke of the rocking lever H or during a great part of the same. This backward rotation of shaft G is transmitted through the spur-gear, as indicated by the unfeathered arrows, and thus the reverse movement of the rollers B is produced. It will be observed that whereas the forward motion of the epicyclic train is equal to the forward stroke of the rocking shaft plus the rotary movement of bevel H^3 the reverse motion is limited to the return stroke of the rocking shaft minus the rotary movement of the bevel H^3. Hence the forward movement produced by the mechanism, as shown, is greater than that produced by its reverse movement, and this stepwise, or rather alternate unequal reversing, motion is faithfully transmitted to the series of rollers B.

The stroke of the rocking shaft may be altered by shifting the connecting-pivot of the eccentric-strap in the slot of the rocking shaft.

The formation of the flutes of the rollers B, as illustrated in Figs. 4 and 5, constitutes an essential feature of our invention and is as follows: The thickness of the flutes at the pitch-line must be so little as to provide an open space between the sides to insure the treatment of the fiber in a manner whereby it will be properly and efficiently broken without injuriously crushing it transversely throughout its length. It is to the rolling effect produced by this special formation of flutes in combination with the reciprocating motion of the rollers that the fine breaking of the straw without injury to the fiber is mainly due.

Our improved feeding-table is shown as forming part of the machine to the left in Figs. 1 and 2 of the drawings. It consists of angle-irons M M, which carry a platform N, the feed end of which is carried close to the rollers. On this platform is arranged a movable tray P, provided with rollers P′ on its under surface and its side edges, whereby it it is readily moved to and from the machine. It is also divided into longitudinal compartments by partitions P^2, which facilitate the distribution of the flax in equal and even layers before presenting to the rollers. The tray is charged with the necessary layer of flax while in position at the free end of the platform, as shown, whereupon it is pushed forward until the rollers take up and carry the fibers through the machine. The tray is then withdrawn, and being recharged the movement is repeated. Thus by the use of this improved feeding-table the attendants are not only enabled to arrange the flax in properly-distributed and even layers, but the operation of feeding is rendered practically continuous. A transverse bar P^3, Fig. 2, is dropped over the layer of flax to insure that the ends are presented to the rollers in a properly-formed horizontal layer.

As regards the differential speed, as likewise the pitch of the flutes of the rollers B, we propose, first, that the first and second pairs of rollers shall be provided with flutes of a coarse pitch, as illustrated in Fig. 5 of the accompanying drawings, and only slightly engaged; second, that the first pair shall revolve at a predetermined speed, which shall be quicker than that of the second pair, and, third, that the succeeding pairs forming the series shall revolve at increased speed, as hereinafter described, and shall be provided with flutes of a fine pitch—the finest that can be practically employed—as illustrated in Fig. 4. The object of this increased speed of the first pair of crushing-rolls is to obviate tension on the fibers, which is caused

by the flax being only partially crimped in passing between the first pair, after which it is more easily pressed into the flutes of the second and succeeding pairs, and consequently more crimped and more shortened in length.

In the operation of the machine it will be obvious that the first pair of rollers exercises only a slight breaking or crimping effect on the flax-straw, but softens it sufficiently to be easily operated on by the flutes of the second pair. Hence it follows that the flutes of the latter will naturally shorten the effective length of the flax more quickly, (owing to crimping it more,) and consequently the second pair must revolve at a slower rate than the first pair in order to provide for this effect. (See Fig. 6.) Having passed through the second pair of rollers, the flax is sufficiently broken and softened to enable the succeeding pairs to operate effectually in effecting the fine breaking and separating of the woody portion from the fiber. Hence the flutes on these rollers are of a fine pitch, Fig. 4, the number of flutes being by preference forty-four, as against twenty-two on the first and second pairs. In other words, the first two pairs of rollers accomplish the work of breaking and softening the straw, and the succeeding pairs complete the work for which the machine is designed. Since the pitch of the third and succeeding pairs of rollers is very fine—approximately half that of the first and second pairs, with flutes shallower in proportion—it follows that the shortening and crimping effect will be less than that of the second pair. Hence the speed of the third and succeeding pairs must be adjusted so as to receive the flax from the second pair at such a rate as will not involve, first, tension nor, second, slackness. The speed of the first and second pairs (being of same pitch) is regulated by the gearing. The speed of the third and succeeding pairs is also adjusted by the gearing to suit the pitch of the flutes of same—that is to say, the speed of the third and succeeding pairs of rollers in relation to that of the second pair is adjusted so as to fulfil the conditions just mentioned—namely, to receive the flax from the second pair without tension or slackness. By this arrangement of differential speed, as likewise of pitch, we attain a mechanical combination which affords vastly superior results to those afforded by any mechanical contrivance hitherto employed for the end in view. The centers of the third or fourth pairs of rollers are a little raised to accommodate the reception of the motion from the large gear-wheels E E′; but the series may be considered practically level.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In a machine for "breaking" flax and analogous fibrous plants, a pair of fluted rollers matched together, in combination with a driving-shaft K rotated continuously in one direction, a reciprocating rod L actuated thereby, a lever H oscillated by such rod, a bevel gear-wheel H′ carried on such lever and engaged both with a bevel gear-wheel H^2 connected to the train B and with a bevel gear-wheel H^3 turned continuously in one direction, the wheel H serving as a bridge to cause the train to be turned alternately in reverse directions, turning farther in one direction than the other, and gradually working the material through, all substantially as herein specified.

2. In a machine for "breaking" flax, and analogous fibrous plants, a pair of fluted rollers matched together, in combination with a driving-shaft K rotated continuously in one direction, a reciprocating rod L actuated thereby, a lever H oscillated by such rod, a bevel gear-wheel H′ carried on such lever and engaged with a bevel gear-wheel H^2 connected to the train B, and with a bevel gear-wheel H^3 turned continuously in one direction, the wheel H serving as a bridge to cause the train to be turned alternately in reverse directions, turning farther in one direction than the other, and also with provisions for varying the point of connection of the rod L with the lever H so as to make the oscillations greater or less so as to work the material through with more or less repetitions of the treatment at will, all substantially as herein specified.

3. In a machine for breaking flax and analogous fibrous plants, a pair of fluted rollers matched together, in combination with a driving-shaft K rotated continuously in one direction, a reciprocating rod L actuated thereby, a lever H oscillated by such rod, a bevel gear-wheel H′ carried on such lever and engaged both with a bevel gear-wheel H^2 connected to the train B and with a bevel gear-wheel H^3 turned continuously in one direction, the wheel H serving as a bridge to cause the train to be turned alternately in reverse directions, turning farther in one direction than the other, and a movable feeding-table comprising a sliding tray P having longitudinal partitions P^2 and the transverse bar P^3 whereby the feeding of the machine is facilitated and rendered uniform, all substantially as herein specified.

Dated this 11th day of June, 1900.

EDWARD JOSEPH DE COURCY.
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