(No Model.) 2 Sheets—Sheet 1.

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GRINDING MILL.

No. 345,493. Patented July 13, 1886.

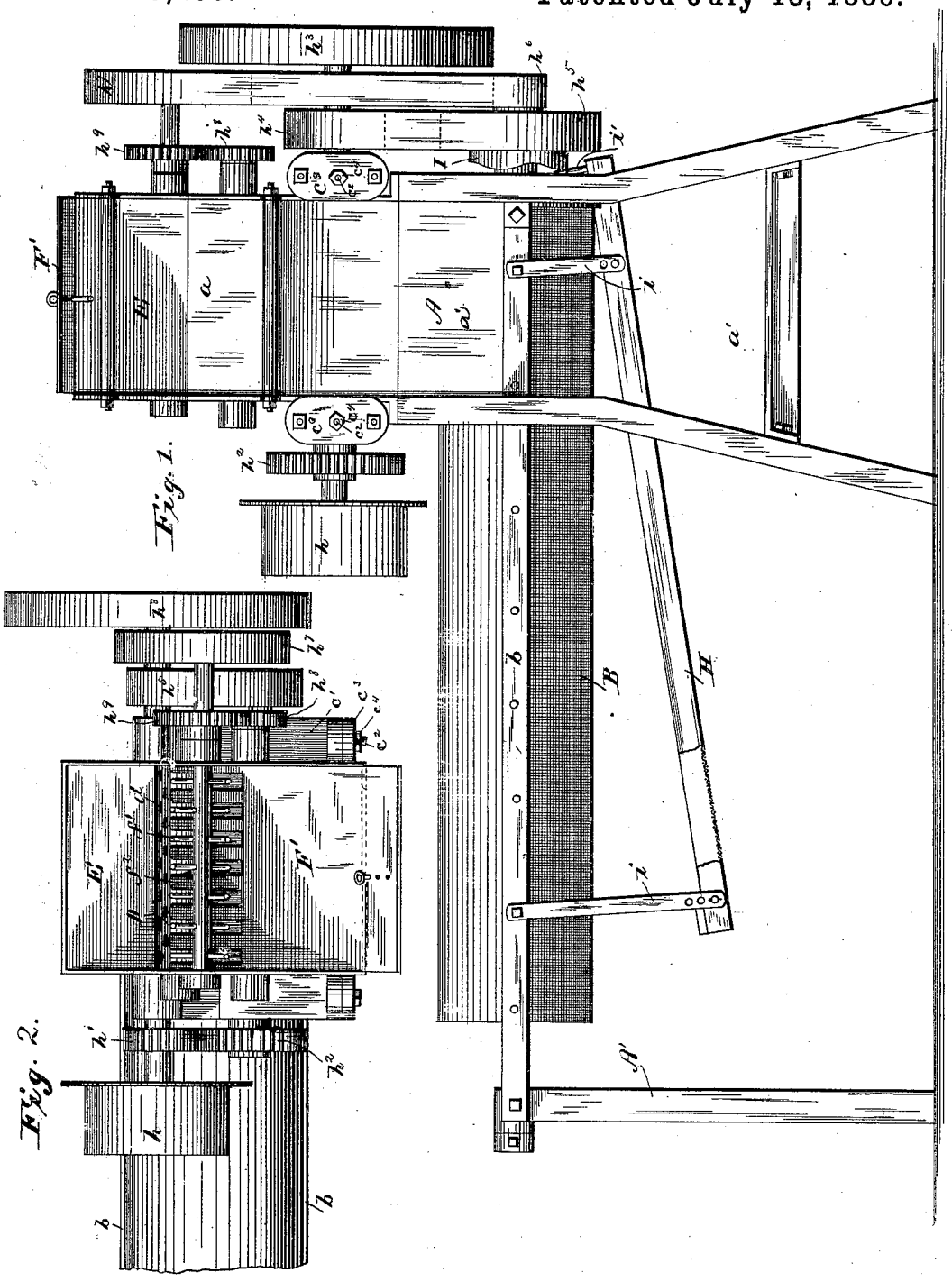

Fig. 1.

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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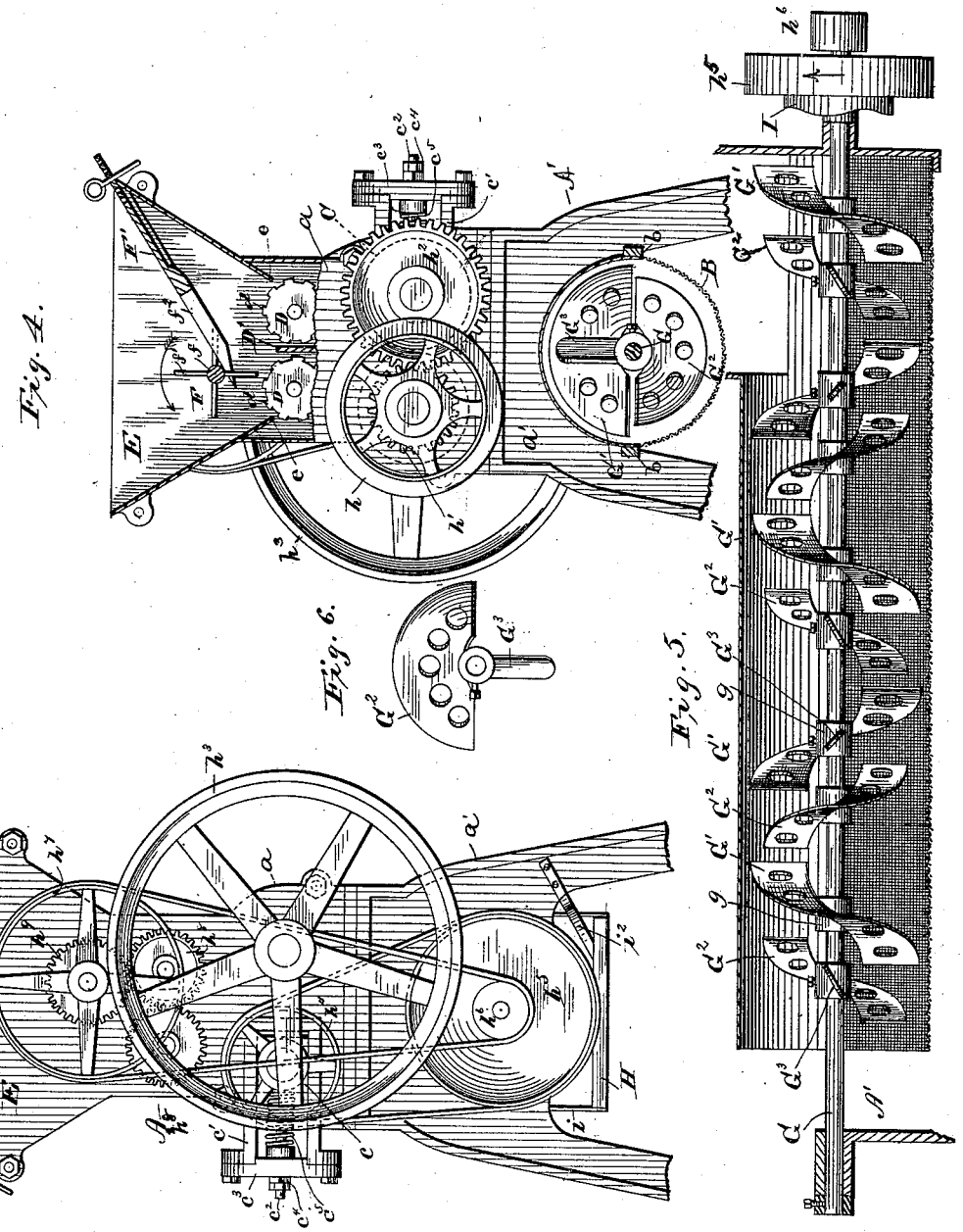

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UNITED STATES PATENT OFFICE.

NATHAN T. FITCH, OF WILMINGTON, DELAWARE.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 345,493, dated July 13, 1886.

Application filed February 27, 1886. Serial No. 193,496. (No model.)

To all whom it may concern:

Be it known that I, NATHAN T. FITCH, of Wilmington, in the county of New Castle and State of Delaware, have invented certain new and useful Improvements in Grinding-Mills; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

The object of my present invention is to improve the construction of that class of mills designed more especially for operating upon cotton-seed, to effect the separation of the kernel from the hulls and adherent fiber, but adapted for use in grinding and separating other materials; and my said invention consists in the novel construction, combination, and arrangement of parts, as hereinafter described, and pointed out in the claims.

In the accompanying drawings, illustrating my improvements, Figure 1 is a side elevation, and Fig. 2 a top plan view, of the machine. Fig. 3 is a view of the right-hand end of the machine, Fig. 1, and Fig. 4 a view of the opposite end of the main frame, with part of the hopper broken away to show the feeding mechanism. Fig. 5 represents a longitudinal section of the screen with conveyer in elevation. Fig. 6 illustrates one of the sectional conveyer-blades with stirrer attached.

Similar letters of reference in the several figures indicate the same parts.

The letter A designates the main frame proper; B, the semi-cylindrical or concave screen attached to side bars, *b*, secured at one end to the main frame A, and at the other to a supporting-frame, A′.

The main frame A is preferably made in two or more sections, the upper section, *a*, comprising the hopper and inclosing-case for the feeding and grinding mechanisms, being detachably secured to the lower section, *a′*, to which the side bars, *b*, are attached.

The rolls (shown in dotted lines, Fig. 4) which are designed to crush or cut the seed, so as to release the kernels from the hull, are preferably constructed as described in my pending application No. 170,624, filed July 3, 1885, although other suitable forms may be employed, and are mounted in bearings in the lower portion of the upper section, *a*, of the frame, and in position above the end of the screen to deliver the seeds upon the latter. One of these rolls is mounted in movable boxes *c*, sliding in ways *c′* in the frame. Each box *c* is provided with a threaded bolt, c^2, passing through a cap-plate, c^3, and is provided with adjustable nuts or collars c^4, which, by bearing against the outer surface of the cap-plate, serve to limit the movement of the roll toward the opposite roll, and thereby determine the proximity of the faces of the two rolls when in action. Upon each bolt c^2 is arranged a spring, c^5, which acts at one end upon the box *c* in a direction to force the roll toward the opposite roll, the movement being limited by the collars c^4, whereby the roll is held in adjusted position by the springs, and is permitted to yield by the compression of the latter should any hard substance or foreign body be fed between the rolls when in action. Above the rolls are arranged the two feeding-cylinders D, each armed with a series of teeth or projections, *d*, with their outer faces parallel, or nearly so, to the axis of the roll, and between said rolls is located a bridge or division plate, D′. The feed-rolls, which are designed to rotate in opposite directions or toward the division-plate D′, catch the seed as delivered upon them and carry it down in the space between each roll D and the plate D′, as will be readily understood. Above the feed-rolls the sides of the section *a* of the frame converge to form the hopper E and are continued down toward the feed-rolls, as at *e′*, to prevent the seed from passing down through the space between the feed-rolls and the frame, at the same time serving to direct the material to the said rolls, and in position to be caught by the teeth or projections thereon and be carried down to the rolls beneath.

In practice it is found that with the parts constructed and arranged as described, if a quantity of the seed is fed or deposited in the hopper and resting upon the feed-rolls owing to the presence of the fiber on the seed, the latter will not be carried down continuously and evenly by the feed-rolls, but will at times be held out of the reach of the feed-rolls, and at other times will be drawn down in such quantities as to clog the feeding devices and arrest the motion of the rolls. These difficulties are but partially overcome by the employment of a stirrer, F, in the hopper, as such a contrivance, while serving to agitate the mass of seed and in a measure prevent it from bridging

above the rolls, increases rather than diminishes the tendency which the feeding-rolls possess to become clogged. These practical difficulties in the operation of the feeding mechanism I have overcome by mounting the shaft *f*, carrying the pins *f'*, to one side of the hopper and arranging a sliding gate, F', upon the opposite side, said gate being provided with a series of slots, or formed with fingers f^2 at its lower end, for the passage of the pins *f'* on the stirrer.

The gate is supported in ways on the hopper with its lower end projected downward and under the shaft of the stirrer, so that it may be adjusted with respect to the latter, and its upper end is provided with a series of holes in which a pin is inserted and bears against ths edge of the hopper to maintain the gate in adjusted position, although as is obvious other well-known forms of adjusting and retaining devices may be employed for the purpose, if desired. The stirrer moving in the direction indicated by the arrow in Fig. 4, and at a higher rate of speed than the feed-rolls, the pins *f* are caused to pass in succession up through the slits in the gate and into the material contained within the hopper and resting partially upon the gate, which latter, being inclined, assists in directing the seed toward the feed-opening. As the arms of the stirrer are thus forced through the mass of seed, they separate and carry down a determinate quantity, which is regulated by the adjustment of the gate to the capacity of the feeding mechanism and rolls. The material thus fed down is deposited upon one of the feed-rolls, which carries a portion down, while the excess is thrown or carried over onto the opposite feed-roll by the motion of the stirrer, whose teeth move in proximity to the surface of the roll immediately below (upon which the seed is first delivered) but at a greater speed than said feed-roll.

The gate serves not only as an adjustable gage or cut-off to control the feeding, but also as a stripper to prevent the material from forming a roll upon and rotating with the stirrer.

The devices described constitute a simple, convenient, and, as demonstrated by use, a practical means for regulating and controlling the feeding of cotton-seed to the rolls, an operation which cannot be performed with the ordinary feeding devices, owing to the nature and condition of the material to be operated upon.

With my improved feeding mechanism all that is required in order to produce a continuous and regular delivery of seed is to maintain a full supply in the hopper, from whence it is drawn by the stirrer.

Not only does the fiber on the seeds interfere with the action of the feeding devices, but it operates to impede and, in a measure, prevent the separation of the kernels from the hulls after the seeds have been broken or cut, as it prevents the broken particles from becoming detached, so as to release the kernel, and forms a mat or mass in which the broken kernels are retained. To remedy this defect and improve the action of the separating mechanism, I locate above the screen a shaft, G, upon which are secured two sets or series of spiral conveyer-blades, G' G^2. The blades G', which are secured to hubs or bosses *g*, fitting the shaft, all have substantially the same pitch, and are applied to the shaft upon opposite sides and at regular intervals, and are inclined in a direction to cause the material lying upon the screen to move toward the tail end, while the blades G^2 incline in the opposite direction and are applied to the shaft between the alternate blades G'. The blades G' of the conveyer, which operate in a direction to advance the material on the screen, are formed on a longer radius than the blades G^2, and approach more nearly the surface of the screen, whereby they are caused to operate upon a larger quantity of the material.

The operation of such a device is as follows: The crushed, broken, or severed seeds, as delivered by the rolls C, fall into the screen near the head, and, being caught by the first blade, G', of the conveyer, are forced along and in contact with the screen until, by the continued rotation of the shaft G in the direction indicated by the arrow in Fig. 5, the next blade, G^2, enters and thrusts the material in the opposite direction, or toward the head of the screen. Owing, however, to the difference in the size of the contiguous blades G' G^2, the latter engages and forces back a part only of the material carried forward by the blade G', and thus exposes a portion not previously subjected to the action of the screen. By thus alternately advancing the material and returning a portion thereof the mass of broken seeds with the fiber clinging thereto is constantly being turned and shifted back and forth upon the surface of the screen, and at the same time is gradually carried toward the tail end of the latter and ultimately discharged, and during its passage along the screen the broken kernels are separated from the hulls and fiber and fall through the screen onto the chute H. In order the more effectually to agitate and turn the material within the screen while being acted upon by the reversed conveyer-blades, arms or beaters G^3 may be secured to the hubs *g* upon the opposite sides of the conveyer-blades, and each of said arms is preferably inclined or set at an angle the reverse of that of the blade on the same hub, to retard the movement of the material acted upon by the preceding blade, and prevent it from being carried so far along as not to be caught by the blade upon the hub of the beater. The blades may be perforated, as shown, to reduce the amount of metal employed, and to assist in breaking up the mass of material. By the use of a conveyer with reversed blades or sections in the manner described not only is the material thoroughly agitated, shifted about, broken up, and screened, but I am enabled

to employ a much shorter screen than could otherwise be made to produce similar results.

The mechanism for securing the requisite motions of the several parts of the machine, and for operating the latter from a single driving-pulley, is constructed and applied as follows: To one end of the shaft or journal of one of the rolls C is secured the driving-pulley h, and a gear-wheel, h', meshing with a larger gear-wheel, h^2, on the end of the opposite roll C. The driving-pulley h is preferably applied to that one of the rolls which is mounted in fixed bearings, and the fly-wheel h^3 is secured to the opposite end of said roll. Upon the outer end of the shaft of the adjustable roll is secured a pulley, h^4, from whence a belt extends to a larger pulley, h^5, on the conveyer-shaft G. The conveyer-shaft G carries a small pulley, h^6, from whence extends a belt to a larger pulley, h^7, on the shaft of the stirrer. The feed-rolls are connected through gears h^8, and are driven by a gear, h^9, on the shaft of the stirrer. The chute H, upon which the seeds fall after passing through the screen, has a screen-bottom, and is suspended in an inclined position upon links i, depending from the side bars, b, and upon the shaft G of the conveyer is secured a cam, I, which bears against a pin, i', on the chute, a spring, i^2, Fig. 3, serving to hold said pin in contact with the cam, so that as the shaft G is revolved the chute will be vibrated, thereby causing the coarsest of the material to traverse the chute and fall from the end thereof, while the finer drops through.

I claim as my invention—

1. The combination, with the hopper and the feeding-rolls, of the inclined slotted gate, and the stirrer provided with arms working up through slots in the gate, substantially as described.

2. The combination, with the pair of feeding-rolls, the hopper, and the stirrer arranged to revolve within the hopper above one of the feed-rolls, of the slotted gate extending from one side of the hopper to the shaft of the stirrer, substantially as described.

3. The combination, with the hopper and the feeding-rolls and bridge-plate located at the discharge-opening, of the inclined adjustable gate with slotted end, and the stirrer provided with arms working up through the slots in the gate, substantially as described.

4. In combination with the cutting-rolls, the inclosing case or frame, and the hopper, the feeding-rolls and interposed bridge-plate, the inclined slotted gate located within the hopper with its lower edge extending over the feed-rolls, and the stirrer arranged near the edge of the gate and to one side of the hopper with its arms or pins working in proximity to one of the feed-rolls, and up through the slots in the gate, substantially as described.

5. The combination, with a screen-surface, of a conveyer composed of a shaft and two series of independent reversed blades secured to said shaft alternately, substantially as described.

6. The combination, with a screen-surface, of a conveyer composed of a shaft and two series of independent reversed blades secured to said shaft alternately, the blades of one series having a shorter radius than those of the other, substantially as described.

7. In combination with a rotary shaft, a series of propelling-blades inclined in the same direction and secured to the shaft at intervals, and a second series of shorter propelling-blades inclined in the opposite direction, the blades of the last-mentioned series alternating with those of the first, substantially as described.

8. In combination with the shaft and the separate feeding conveyer-blades secured thereto, reversed conveyer-blades of less diameter applied between the contiguous sections of the feeding-blade, and projecting from the side of the shaft opposite the next preceding blade, whereby the material as advanced by the feeding-blades will be deposited in line with the next succeeding reversed blades, substantially as described.

9. The combination, with the rotating shaft of the conveyer and the alternating reversed blades secured thereto, of arms or beaters projecting from the shaft on the side opposite each blade, substantially as described.

10. In combination with the conveyer-shaft and alternating reversed blades of different radii secured thereto, arms G^3, applied to the hub of each blade and inclined in the opposite direction from the blade thereon, as and for the purpose set forth.

11. The improved conveyer for agitating, separating, and feeding material upon a screening-surface, constructed substantially as described, and consisting of the combination, with shaft G, of the hubs g, alternate reversed blades G' and G^2, and arms G^3.

12. In a cotton-seed mill such as described, the combination and arrangement, with the conveyer-shaft, rolls C, feeding-rolls, and stirrer, of the driving-pulley and fly-wheel applied to the shaft of roll C, the gears connecting the two rolls, the pulleys and belt for driving the conveyer-shaft from one of the rolls C, the pulleys and belt for communicating motion from the conveyer-shaft to the stirrer, and the gears connecting the latter and the feed-rolls, substantially as described.

13. In combination with the main frame carrying the feeding and seed grinding or cutting mechanism, and the side bars, b, the screen secured to said bars, the conveyer working therein, the chute suspended by links from the side bars, the cam on the conveyer-shaft, and the pin on the screen held in contact with the cam by a spring applied to the chute, substantially as described.

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