2 Sheets—Sheet 1.

G. LITTLE & T. C. EASTWOOD.

Combing-Machinery.

No. 226,332. **Patented April 6, 1880.**

Fig. 3.

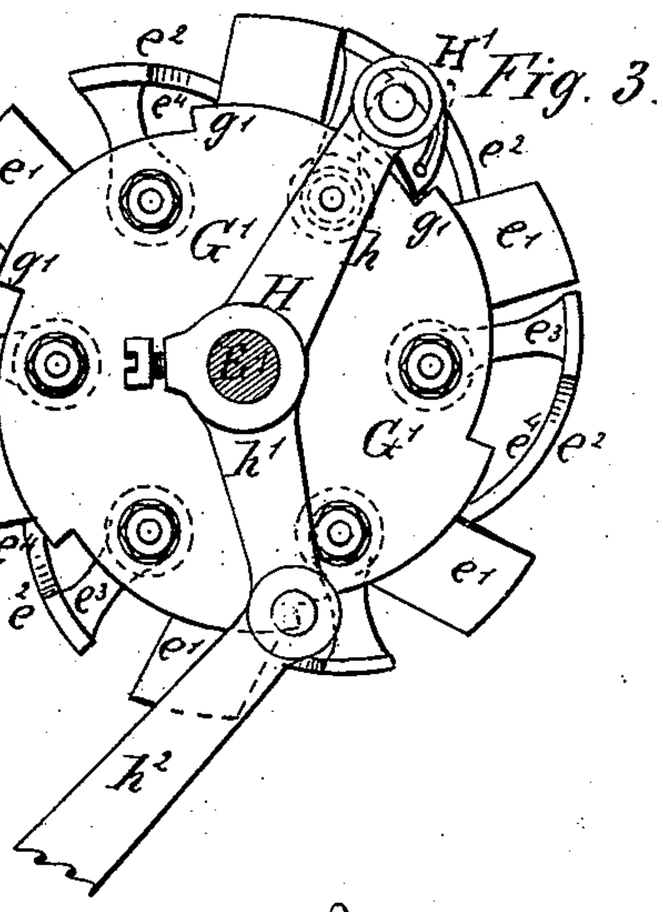


Fig. 4

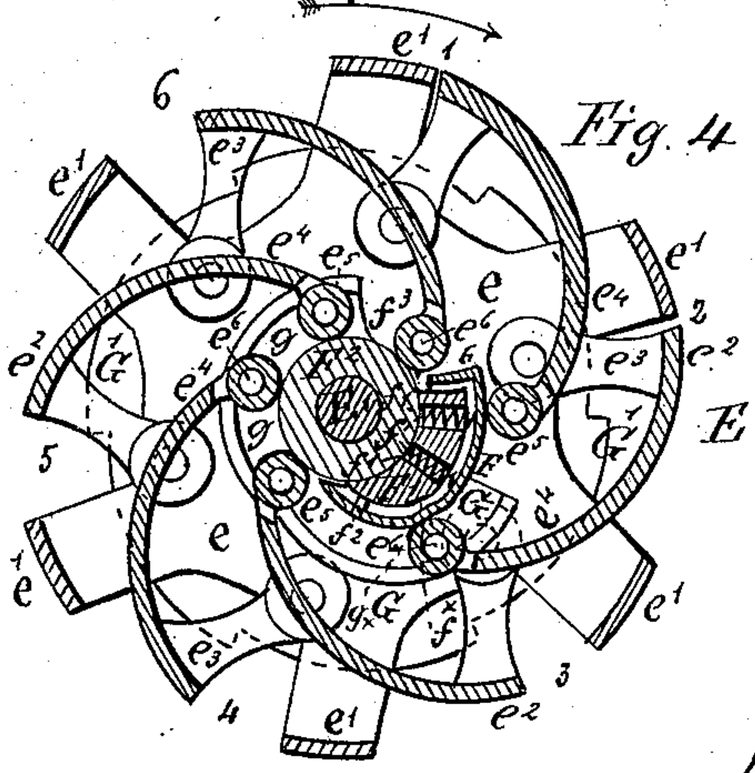
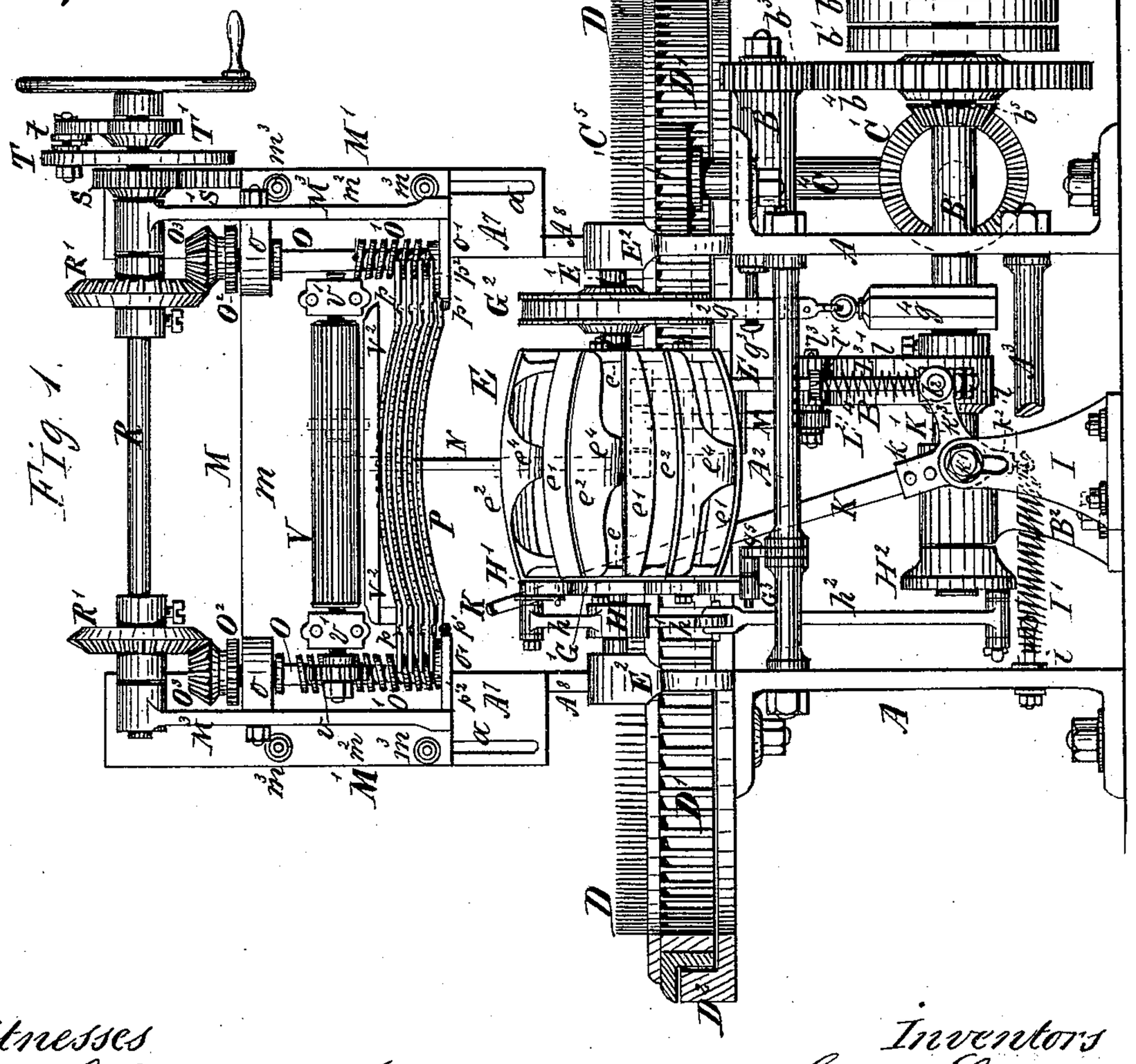


Fig. 1.



Witnesses
Alf. L. Leonard.
Henri Guillaume

Inventors
George Little
Thomas Charles Eastwood
by Henry Orth
atty.

2 Sheets—Sheet 2.

G. LITTLE & T. C. EASTWOOD.

Combing-Machinery.

No. 226,332. **Patented April 6, 1880.**

Fig. 5.

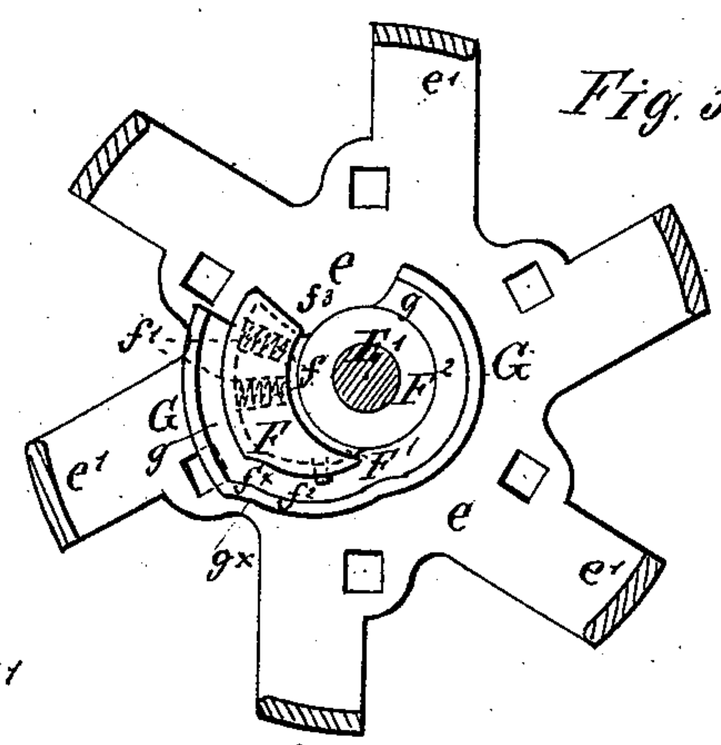


Fig. 6.

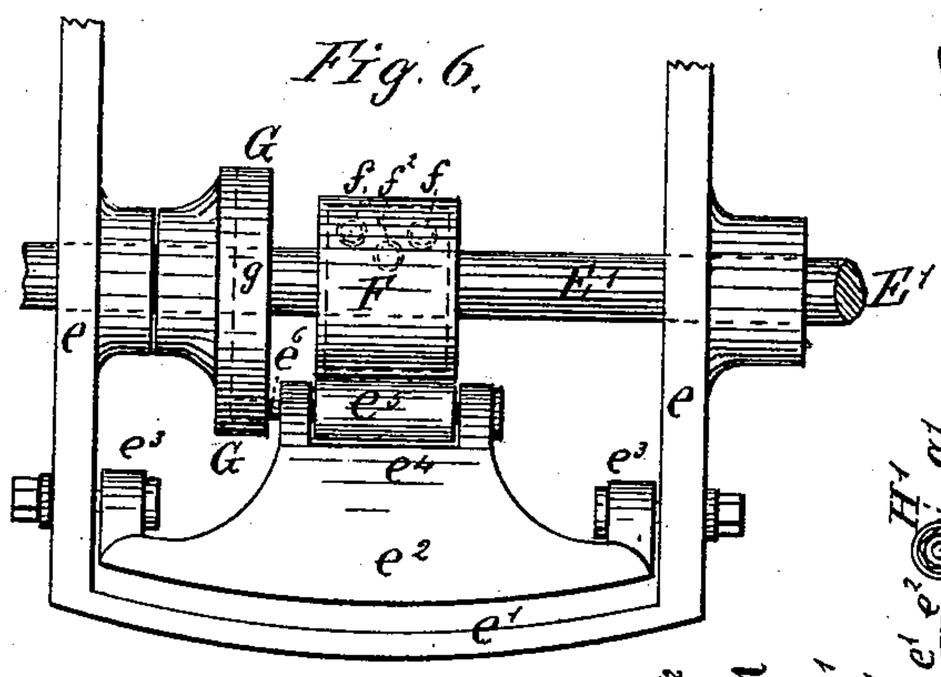
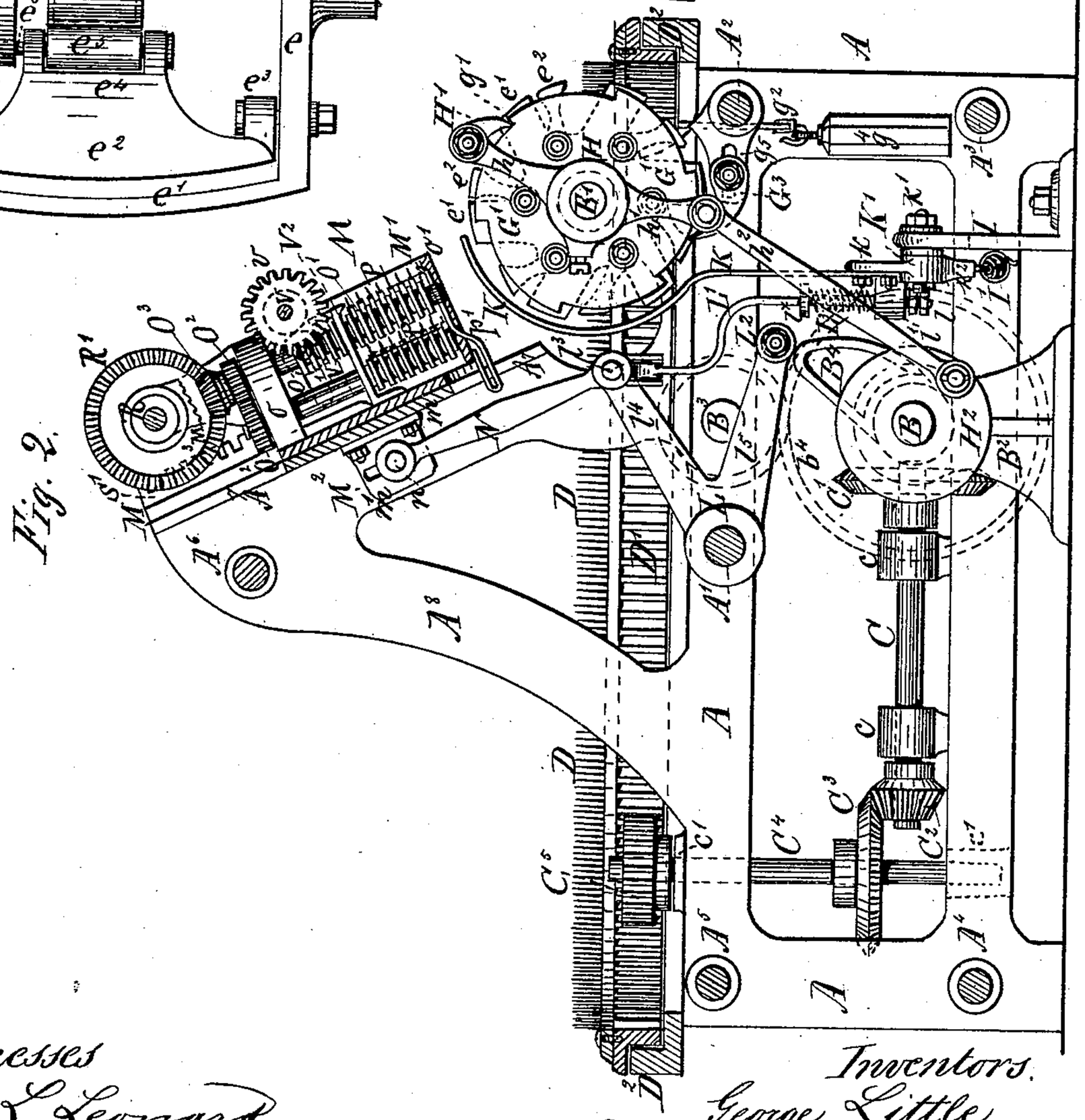


Fig. 2.



Witnesses
Alf. L. Leonard
Henri Guillaume

Inventors.
George Little
Thomas Charles Eastwood.
per Henry Orth
atty.

UNITED STATES PATENT OFFICE.

GEORGE LITTLE, OF OLDHAM, AND THOMAS C. EASTWOOD, OF BRADFORD, ENGLAND.

COMBING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 226,332, dated April 6, 1880.

Application filed June 25, 1877. Patented in England March 8, 1873.

To all whom it may concern:

Be it known that we, GEORGE LITTLE, of Oldham, in the county of Lancaster, and THOMAS CHARLES EASTWOOD, of Bradford, in the county of York, England, have invented certain new and useful Improvements in Combing Machinery; and we do hereby declare that the following is a full, clear, and exact description of the invention, that will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Our invention relates to improvements in machines for combing wool, flax, cotton, silk, or other fibrous substances, for which we have obtained Letters Patent in Great Britain under date of March 8, 1873, No. 839.

The invention has for its object the construction of combing machinery whereby wool, cotton, or other fibrous substances of the shortest length of staple may be combed, while the machine is equally applicable to the combing of long wool, flax, or other long-stapled fibrous substances; and it consists in the combination, with an inclined reciprocating feeding-head and a rotating circle-comb, of a nipping device and a divider-finger, arranged and operating as hereinafter described.

The invention further consists in certain details of construction and arrangement of parts, as fully set forth hereinafter, and shown in the accompanying drawings, in which—

Figures 1 and 2 represent front and side elevations, partly in section, of a combing-machine constructed according to our invention. Figs. 3, 4, 5, and 6 are detail views of the nipping device.

In the drawings, similar letters of reference are employed to indicate corresponding parts, wherever such may occur.

A is the main frame, adapted to receive the operating mechanism, and is braced together by a series of brace-shafts, A′, A², A³, A⁴, A⁵, and A⁶, some of which are also employed as bearings for certain portions of the operating mechanism, as described hereinafter.

B is the main driving-shaft, mounted in bearings in the standards B′ B². The shaft B carries at its outer end a fast and a loose pulley, *b b′*, respectively, and is driven from any suitable prime motor; or the fast and loose pulleys may be mounted on a counter-shaft, B³, and motion communicated to shaft B by means of the gearing *b*³ and *b*⁴, as shown. The shaft B carries a bevel-pinion, *b*⁵, which meshes with a bevel-wheel, C′, mounted on one end of a counter-shaft, C, which revolves in the bearings *c c*. At its opposite end said shaft C carries a bevel-pinion, C², that meshes with a bevel-wheel, C³, mounted on the lower end of a vertical shaft, C⁴, revolving in bearings *c′ c′*. The shaft C⁴ carries at its upper end a toothed pinion, C⁵, which gears with a circular toothed rack, D′, that revolves in a suitable frame, D², and carries the circle-comb D, to which the mechanism just described imparts a continuous rotary motion during the operation of the machine.

E is the nipping, carrying, and transferring device, mounted upon a shaft, E′, revolving in bearings on the standards E² E² in such manner as to bring the jaws of the nipping device in close proximity to the circle-comb D, the outer surface of the jaws being curved to an arc of corresponding radius to the inner periphery of the circle-comb, which latter revolves around said nipping device.

The nipping device consists of two disks, *e e*, loosely mounted upon shaft E′, and provided with a series of arms and jaws, *e′ e′*, connecting the two disks together.

*e*² *e*² are movable jaws, provided on both sides of their forward or upper end with depending ears *e*³, which serve to pivot said jaws to the disks *e*. These movable jaws terminate in a central arm, *e*⁴, curved inward and backward toward the shaft E′, and carrying at their lower end an anti-friction roller, *e*⁵, the axis *e*⁶ of which projects outward some distance from its bearing on one side of the arm *e*⁴, for a purpose presently explained.

F′ is a cam-boss formed upon a sleeve, F², rigidly mounted upon shaft E′, and F is a recessed or hollow cam fitting over the cam-boss F′. This cam is made yielding or self-adjustable by means of the spring-bearings *f*, located in recesses *f′*, formed in the cam-boss, and permit the cam F to adjust itself auto-

matically to the quantity of fiber fed to the jaws of the nipping device, and a pin, f^2, prevents the accidental displacement of the cam F.

G is a recessed or cam-grooved guide rigidly mounted upon the shaft E′ in such proximity to the cam F as to permit the projecting axes e^6 of the anti-friction rollers e^5 on the lower end of the arms e^4 of the movable jaws e^2 to enter into the recess at the proper time, for a purpose hereinafter explained.

G′ is a ratchet wheel or disk mounted upon the projecting sleeve or hub of one of the disks *e*, and a belt, g^2, one end of which is made fast to a stud, g^3, on the main frame A, passes over a grooved pulley, G^2, mounted upon the projecting hub or sleeve of the opposite disk *e*, and carries at its free end a weight, g^4, which serves to hold the nipping device against backward motion when the sliver fed to the nipping device is drawn through the gill-combs of the feeding-head by the receding or backward motion of the latter, and the tuft nipped from said sliver is severed by the divider-finger, as hereinafter explained. The ratchet-wheel G′ has a number of teeth equal to the number of pairs of nipping-jaws, of which we preferably use six.

The devices just described are fully illustrated in Figs. 1 and 2, and particularly in Figs. 3, 4, 5, and 6, and are operated as follows: H is a two-armed lever rigidly mounted upon shaft E′ by the side of the ratchet-disk G′. The upper arm, *h*, of this lever carries a spring-pawl, H′, engaging the teeth of the ratchet-disk, while its lower arm, *h*′, is connected by means of a rod, h^2, to a disk, H^2, on the inner end of the main driving-shaft B, near its bearing-standard B^2, forming a crank motion. When the shaft B is rotated the shaft E′, its cam F, and cam-guide G are oscillated through the crank H^2, connecting-rod h^2, and lever H, while the nipping device is intermittently rotated through the pawl H′ of lever H taking into the teeth of the ratchet-disk G′, which latter is rigidly connected with the nipping device.

Referring more particularly to Figs. 3 and 4, the operation of the nipping device is as follows, said device revolving in the direction of the arrows of said figures: At each backward oscillation of the shaft E′ the pawl H′ rides back over the ratchet-wheel G′, from one tooth to another. The cam F and cam-guide G, moving with the shaft E′, produce the following movement in the movable jaws of the nipping device, which itself remains stationary during this backward oscillation of the shaft, namely: That arm of one of the movable jaws lying upon the cam-sleeve F^2 is raised to the nose or highest point of the cam F, to close upon its rigid jaw *e*′, as shown at 1, Fig. 4. The arm of the preceding movable jaw at the same time is caused to slide down the incline of the cam until it reaches the depression f^x of said cam, its projecting roller-axis having meanwhile entered the recess of the cam-guide, and lies in said depression f^x, causing the arm to approach the shaft E′ and the jaw to partially recede from its fixed or rigid jaw, to release the tuft of fiber previous to depositing it upon the pins or teeth of the rotating circle-comb, as shown at 2, Fig. 4. The arm of the movable jaw next preceding, sliding down the rear incline of the cam, with its roller on the cam-sleeve and its roller-axis in the cam-groove of the guide, will cause said jaw to recede fully from its corresponding rigid jaw, the arms of the next two preceding jaws being in a like position, as shown at 3, 4, and 5, Fig. 4, while the roller-axis of the arm of the last movable jaw will issue from the groove of the cam-guide, and its roller will lie upon the cam-sleeve in the opening or space between the cam and guide, as shown at 6, Fig. 4.

The next oscillation of the shaft E′ will carry the nipping device around in the direction of the arrow the distance of one tooth on the ratchet-wheel without changing the relative position of the movable jaws. Thus at each backward oscillation of the shaft E′ one pair of the movable jaws is caused to close upon the end of the sliver fed thereto by the reciprocating feeding-head, and the pair preceding and carrying a tuft of fiber previously severed from the sliver by the divider-finger is caused to release said tuft in order that it may be deposited upon the pins of the circle-comb, while the forward oscillation revolves the nipping device step by step to bring each pair of jaws, in turn, in position or in the path of the feeding-head to receive the end of the sliver, and in proximity to the pins of the circle-comb to deposit thereon the tuft of fiber previously severed from said sliver.

At each partial or intermittent rotation the nipping device remains stationary for a moment, while the spring-pawl H′ travels back from one tooth to another on the ratchet-disk G′, and during the time occupied by the backward oscillation of the shaft E′.

From what has been said above it will be seen that the nipping device first nips a tuft of fiber from the sliver fed thereto, remaining stationary for a moment to permit of the sliver being drawn through the combs of the feeding-head, when the latter is caused to recede from the nipping device, the tuft being then severed from the sliver, as hereinafter described, and carried around one step, when the jaws partially open to release the tuft, and deposit it on the circle-comb at the next step, where it is then held in such manner that the uncombed part of said tuft will lie on the inside of the teeth of said comb to be combed by being drawn laterally through said comb by the ordinary drawing-off rolls, the tuft having previously been pressed or dabbed into the circle-comb by the usual dabbing-brushes.

It is evident that any other traveling comb than that hereinbefore described may be employed, as well as any other feeding-head than that to be more fully described hereinafter; but by employing a circle-comb and a

reciprocating gill-comb feeding-head, in combination with the nipping device, the ordinary carrying comb or leathers are dispensed with, and two such nipping devices and feeding-heads, all driven from one driving-shaft, B, may be employed on opposite sides of the diameter of the circle-comb, the feeding-heads being so arranged that when one is ascending the other will be descending. By these means a great saving in power, mechanism, and necessary expenses connected therewith is effected.

G^3 is a pawl pivoted to a slotted arm, g^5, attached to the brace-shaft A^2, said pawl taking into the teeth of the ratchet-wheel G′ to hold the nipping device against retrograde movement, its purpose being similar to that of the belt and weight g^2 g^4, above referred to.

K is a divider-finger, curved at its upper end to the shape of the nipping device, and vibrating in the plane of the latter, between it and the feeding-head, in the path of the sliver fed to the nipping device, to sever the tuft of fiber from said sliver when the end thereof is held between the jaws of the nipping device. The finger K is attached to the upper arm, k, of the three-armed lever K′, oscillating upon a pin, k', that has its bearings in a vertical slot of the standard I. A spring, I′, connected to a stud, i, on the main frame, and to the lower arm, k^2, of the lever K′, serves to return the divider-finger into its normal position when vibrated in one direction.

The divider-finger is operated by the following mechanism: L′ is a connecting-rod, the lower end of which passes through a block, l', the stud l^2 of which has its bearings and turns freely in the horizontal arm k^3 of the lever K′, the connecting-rod L′ being prevented from slipping out of the block by the retaining-nut l. The upper end of the rod is curved and loosely mounted upon a wrist-pin, l^3, on the upper arm, l^4, of the angle-lever L, that is loosely mounted upon the brace-shaft A′ of the main frame A. (See Fig. 2, Sheet 2.) The lower arm, l^5, of the lever L carries an anti-friction-roller, L^2, a vertical reciprocating or oscillating motion being imparted to said lever by a cam, B^4, mounted upon the main driving-shaft B.

When the latter shaft is revolved and the cam B^4 raises the roller-arm of the lever L, and with it the arm l^4 and connecting-rod L′, the latter necessarily raises the arm k^3 of the three-armed lever K′, to impart a horizontal vibration in one direction to the divider-finger K, and when the angle-lever L descends again a corresponding movement in a reverse direction is imparted to said finger K by the spring I′, as will be readily understood, the relative arrangement of the cam B^4 and the crank which operates the ratchet-disk G′ being such that the finger K will be moved across the face of the nipping device just before the pawl engages one of the teeth of the ratchet-disk and the shaft E′ commences its forward oscillation to carry the nipping device around one step, during which motion of the nipping device the finger K is returned to its normal position by the spring, as above described.

By means of this arrangement of mechanism the divider-finger K is moved to sever a tuft of fiber from the sliver while the nipping device is stationary, and just before the feeding-head has reached the limit of its upward throw, to permit of the sliver, while held by the nipping device, of being drawn through the gill-combs of said feeding-head by the receding motion of the latter, to be partially combed before being severed by the divider-finger, and said finger is returned to its normal position simultaneously with the partial rotation of the nipping device, to be again moved to sever a tuft of fiber when said nipping device is stationary and before again rotating one step, for the purpose as above set forth, and so on continuously.

M is the gill-comb feeding-head, consisting of the frame M′, adapted to receive and support the mechanism hereinafter described. This frame M′, together with the mechanism mounted thereon, has a vertically-inclined reciprocating motion imparted thereto by means of the following devices: M^2 is a slotted bracket connected with the back plate, m, of the frame M′. A connecting-rod, N, pivoted to a pin, n, which has its bearings in the slot m' of the bracket, has its opposite end mounted on a wrist-pin, l^3, attached to the arm l^4 of the angle-lever L. Thus when the lever-arm l^4 is raised by the action of the cam B^4, above described, the connecting-rod N, and with it the frame M′, follows a similar motion, and when the lever-arm again descends the frame and its mechanism also descend.

The arrangement of this operating mechanism in relation to the divider-finger and the nipping device, being fully set forth above, will be readily understood by referring to Figs. 1 and 2.

The frame M′ has two wing-plates, m^2, which rest upon the slides A^7, secured to the standards A^8 of the main frame, and upon which slides or reciprocates the frame M′, held in position and guided by the bolts m^3, passing through slots a, formed for this purpose in the slides A^7.

As it is evident that the reciprocating motion of the feeding-head must be limited to the movements of the nipping device and divider-finger, especially in its descending movement, this may be effected by limiting the length of the slots a of the slides A^7, to permit of the feeding-head to descend just sufficiently to bring the sliver in proper proximity to the jaws of the nipping device. The shock of the feeding-head frame to the end of the slots, and the corresponding jar to the mechanism supported on said frame, would speedily wear out and disarrange both. To avoid this we employ a spring-bearing, L^3, consisting of a coiled spring surrounding the lower end of the connecting-rod L′, between the block l' and the shoulder l^x on said rod L′, (see Figs. 1 and 2,)

to arrest the frame M′ before reaching the lowest point in the slots *a*. As this stopping of the feeding-head necessarily arrests the backward motion of the divider-finger K before it reaches the limit of that motion, we employ the spring I′ to complete it, as will be readily seen.

O O are four vertical shafts, the lower halves of which are screw-threaded, and one of said shafts has its upper half screw-threaded also, for a purpose which will be explained. These shafts have their bearings in brackets *o* and in a foot or sole plate, *o′*, on the frame M′. In the threads O′ of these shafts lie the ends of the gill-combs P, which are curved to conform to the shape of the nipping device E, and each of the gill-combs is provided near its extremity with a recess, *p*, for the reception of the yielding supporting-springs *p′ p′*, mounted on the frame M′ at the foot, and by the side of the shafts O, as shown by Fig. 2.

The springs *p′* support the gill-combs and permit of their being slightly depressed when changed or transferred by the cam p^2, at the lower end of the shafts O, from the shafts in front to those in rear in their intermittent ascending and descending motion down the screw-path of the front shafts and up the screw-path of the rear shafts. This intermittent movement of the gill-combs is imparted to them by the following mechanism, to wit:

O^2 O^2 are four toothed pinions mounted at the upper ends of the shafts O, above the bearings *o*, and serve to gear each pair of shafts together, and O^3 O^3 are two bevel-pinions mounted on the two front shafts O, above the pinions O^2, which mesh with two bevel-wheels, R′ R′, upon the shaft R, that revolves in bearings in the standards or projections M^3, formed on the gill-comb frame M′.

A pinion, S, loosely mounted upon the outer end of shaft R, carries upon its hub a disk, T, upon which is pivoted a pawl, *t*, that takes into the teeth of the ratchet-wheel T′, which latter is rigidly mounted upon the shaft R and is provided with three teeth. The pinion S meshes with a toothed rack, S′, on the slide A^7 of the main frame A, and when the main driving-shaft B is revolved and the cam B^4 oscillates the angle-lever L to impart a reciprocating motion to the feeding-head M, the pinion S revolves freely around the shaft R, during the upward movement of said head; but when the latter has reached the limit of this upward movement the pawl *t* will engage with one of the teeth on the ratchet-wheel T′, to lock the pinion S to the shaft R, which is thus caused to revolve with said pinion during the descending movement of the feeding-head. This rotation of the shaft R is communicated to the shafts O through the pinions O^2 O^3 and the bevel-wheels R′, as above described, the relative dimension of the latter and the pinions O^3 being such as to impart a complete rotation to the shafts O, causing the cams p^2 to push the lower gill-comb of the front series back to the screw-shafts in rear, and said shafts, being provided with similar transferring-cams p^2 at the upper end of their screw-threads, will at the same time transfer the upper gill-comb of the rear series to the front shafts. The front series of combs will, simultaneously with such movements, be caused to advance downward one step, and the rear series to advance upward correspondingly.

By these means an intermitting vertically-inclined ascending and descending movement is imparted to the series of gill-combs, and an intermitting feed effected, which will cause the sliver of fiber to be fed forward one step at each descending movement of the gill-comb feeding-head, and at a time when both the divider-finger and nipping device are stationary, the latter having one pair of its jaws open to receive the end of the sliver.

The moment the feeding-head commences its upward motion the backward oscillation of the shaft E′ will cause the pair of jaws opposite the feeding-head to close upon the end of the sliver and hold it until the feeding-head has nearly reached the limit of its upward throw. During this upward movement the gill-combs P are stationary, as above described, and the sliver is drawn through them and partially combed. When the feeding-head is about to reach the limit of its upward movement the divider-finger is vibrated through the angle-lever L to sever a tuft from said sliver, and when the feeding-head commences its downward motion said finger is brought back to its normal position, as hereinbefore set forth. The sliver is again fed forward during each downward movement into position to be seized by the next pair of the nipping-jaws, brought into position to receive it, and the tuft of fiber held by the preceding jaws is carried around one step previous to being deposited on the circle-comb, as already explained, and so on continuously.

V V′ are two corrugated feed-rolls, which revolve in brackets *v′*, projecting from the back plate, *m*, of the frame M′. The outer roll, V, carries a toothed pinion, *v*, which meshes with the screw-thread formed on the upper half of one of the front shafts, O, above referred to, so that at each revolution of the shafts O a partial or intermittent rotation is imparted to the roller V, and by friction to the roller V′, to feed the sliver intermittingly and relatively to the distance traveled by the gill-combs P, the sliver passing between said rollers V V′, behind the guide V^2, and over the front series of the gill-combs. As the gill-combs and their operating mechanism are stationary during the upward movement of the feeding-head, the feed-rolls will necessarily remain stationary also, to hold the sliver tightly at that point, the extremity of the sliver being held by the nipping device, to permit the drawing of said sliver through the gill-combs during the receding motion of the feeding-head.

By the use of the nipping device fiber of the shortest length of staple may be effectually combed, and the device is equally applicable

to the combing of wool, flax, and other long-stapled fibrous material.

Having now described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The combination of an inclined reciprocating feeding-head, an intermittingly-rotating nipping device, a divider-finger vibrating in the plane of said nipping device and between it and the feeding-head, a continuously-rotating circle-comb, and mechanism, substantially as described, for operating said parts, whereby the end of a sliver of fiber is fed intermittingly to the nipping device and a tuft of fiber is severed from said sliver, carried around, and deposited upon the rotating circle-comb, substantially as described.

2. The combination of an inclined reciprocating feeding-head, an intermittingly-rotating nipping device, a divider-finger vibrating in the plane of said nipping device and between it and the feeding-head, a continuously-rotating circle-comb traveling around said nipping device and divider-finger, and mechanism, substantially as described, for operating said parts, whereby the end of a sliver of fiber is fed intermittingly to the nipping device and a tuft of fiber is severed from said sliver, carried around, and deposited upon the circle-comb, with the uncombed part of the tuft held between the jaws of the nipping device on the inside of the line of teeth of said rotating circle-comb, substantially as and for the purpose specified.

3. In a nipping device for combing-machines, the combination of the disks e, having the rigid jaws e', the movable jaws e^2, provided with arms e^4, carrying the rollers e^5, the recessed cam-F, springs f, and pin f^2, the shaft E′, the cam-boss F^2, having projection F′ and recesses f', and mechanism, substantially as described, for operating said parts, all constructed and operating substantially as and for the purpose specified.

4. The shaft E′, the disks and jaws e e', the jaws e^2, carrying anti-friction rollers e^5, in combination with the yielding cam F, substantially as and for the purpose specified.

5. The nipping device E, consisting of a series of rigid jaws, e', and a corresponding series of movable jaws, e^2, in combination with a yielding or self-adjusting cam, F, to adapt the jaws e^2 to adjust themselves to various thicknesses of sliver fed thereto, substantially as described, for the purpose specified.

6. In a nipping device for combing-machines, the combination, with the disks e and rigid jaws e', the movable jaws e^2, having arms e^4, provided with rollers e^5 and projecting roller-axes e^6, of the shaft E′, provided with the yielding cam F and cam-guide G, and mechanism, substantially as described, for operating said parts, as and for the purpose specified.

7. In a nipping device for combing-machines, the combination, with the disks e and jaws e', the movable jaws e^2, having arms e^4, provided with anti-friction rollers e^5 and projecting roller-axes e^6, of the shaft E′, provided with the yielding cam F, having the depression f^x, and the cam-guide G, having the depression g^x, and mechanism, substantially as set forth, to operate the said parts, as and for the purpose specified.

8. The combination of the driving-shaft B, the cam B^4, the oscillating lever L, connecting-rods L′ N, the former provided with a spring-bearing, the three-armed lever K′, having an adjustable bearing, and the divider-finger carried thereby, the spring I′, and the feeding-head M, all arranged and operating as and for the purpose specified.

9. The combination, with the feeding-head and its frame, provided with toothed rack S′ and means for reciprocating said feeding-head, of the comb-plates P, screw-threaded shafts O, provided with cams p^2 and pinions O^2 O^3, shaft R, provided with pinion R′, and wheel T′, pinion S, and disk T, provided with pawl t, all combined and operating substantially as and for the purpose specified.

In testimony that we claim the foregoing we have hereunto set our hands this 13th day of March, 1877.

GEORGE LITTLE.
THOMAS CHARLES EASTWOOD.

Witnesses:
JNO. HERBERT BROWNE,
ARTHUR C. HALL,
Clerks to the Consulate, Manchester.