(No Model.) 4 Sheets—Sheet 1.

J. A. McFERRAN.

PILL MACHINE.

No. 387,002. Patented July 31, 1888.

FIG. 1.

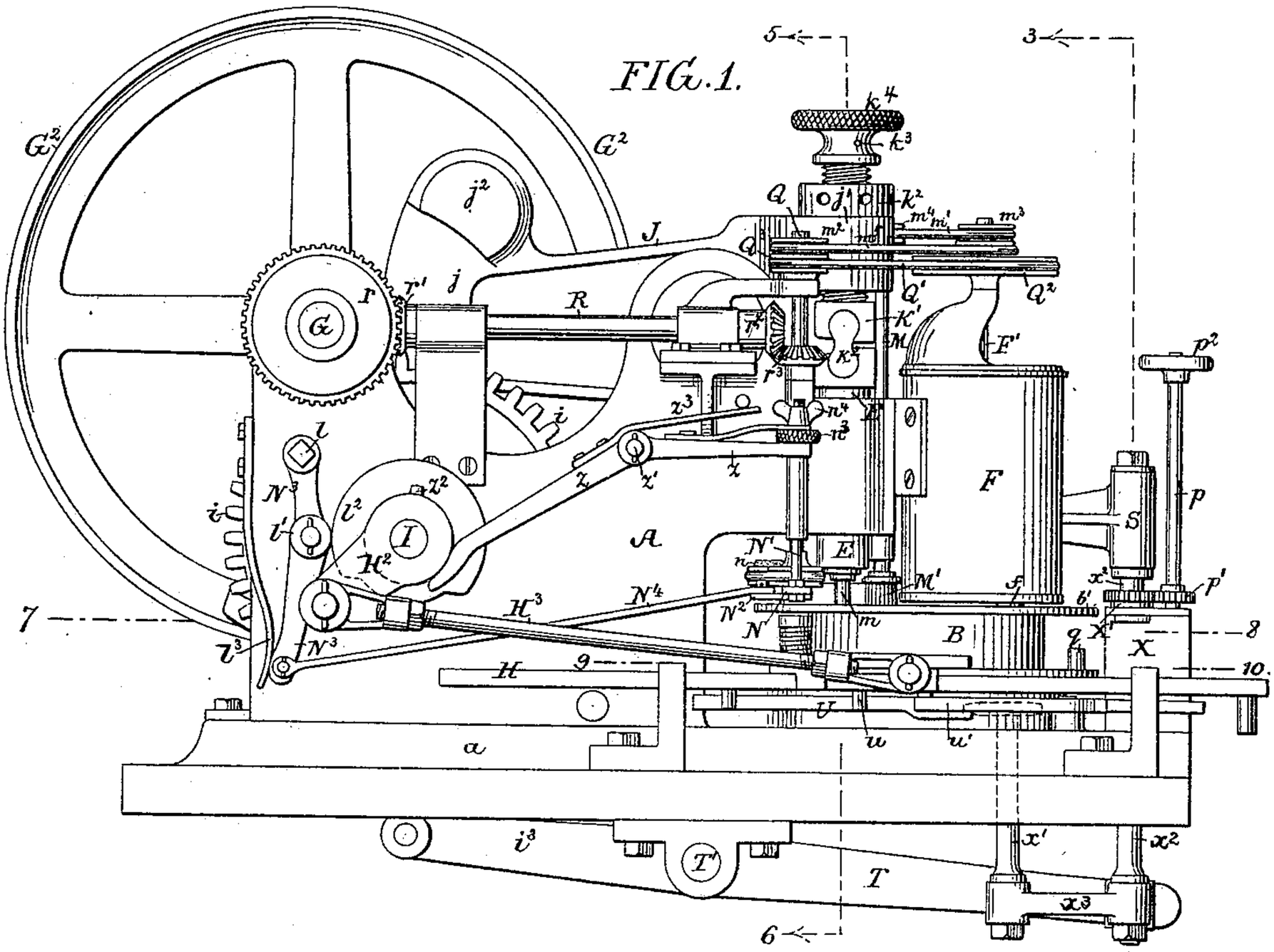
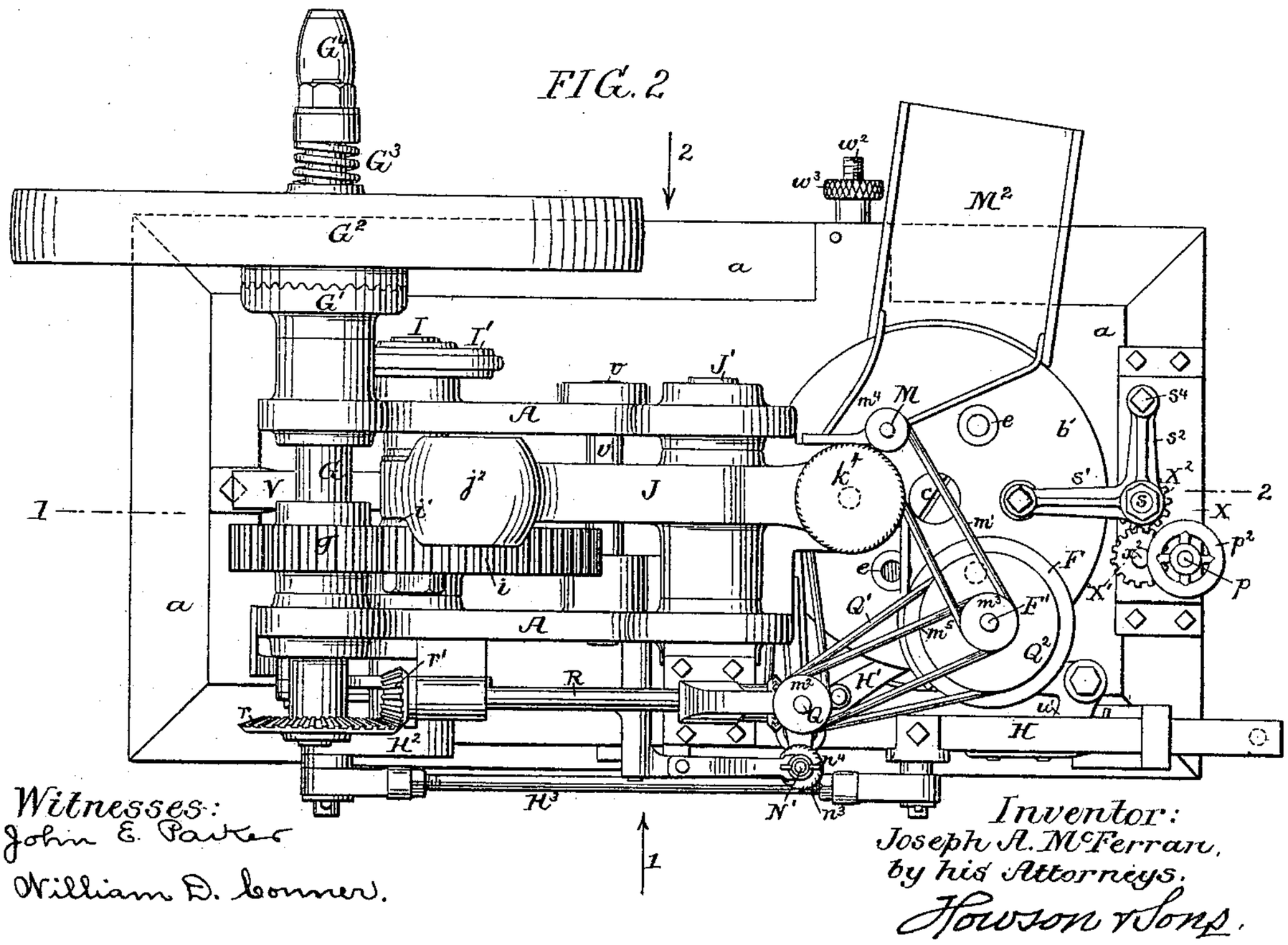


FIG. 2.



Witnesses:
John E. Parker
William D. Bonner.

Inventor:
Joseph A. McFerran,
by his Attorneys.
Howson & Sons.

(No Model.) 4 Sheets—Sheet 2.

J. A. McFERRAN.

PILL MACHINE.

No. 387,002. Patented July 31, 1888.

FIG. 4.

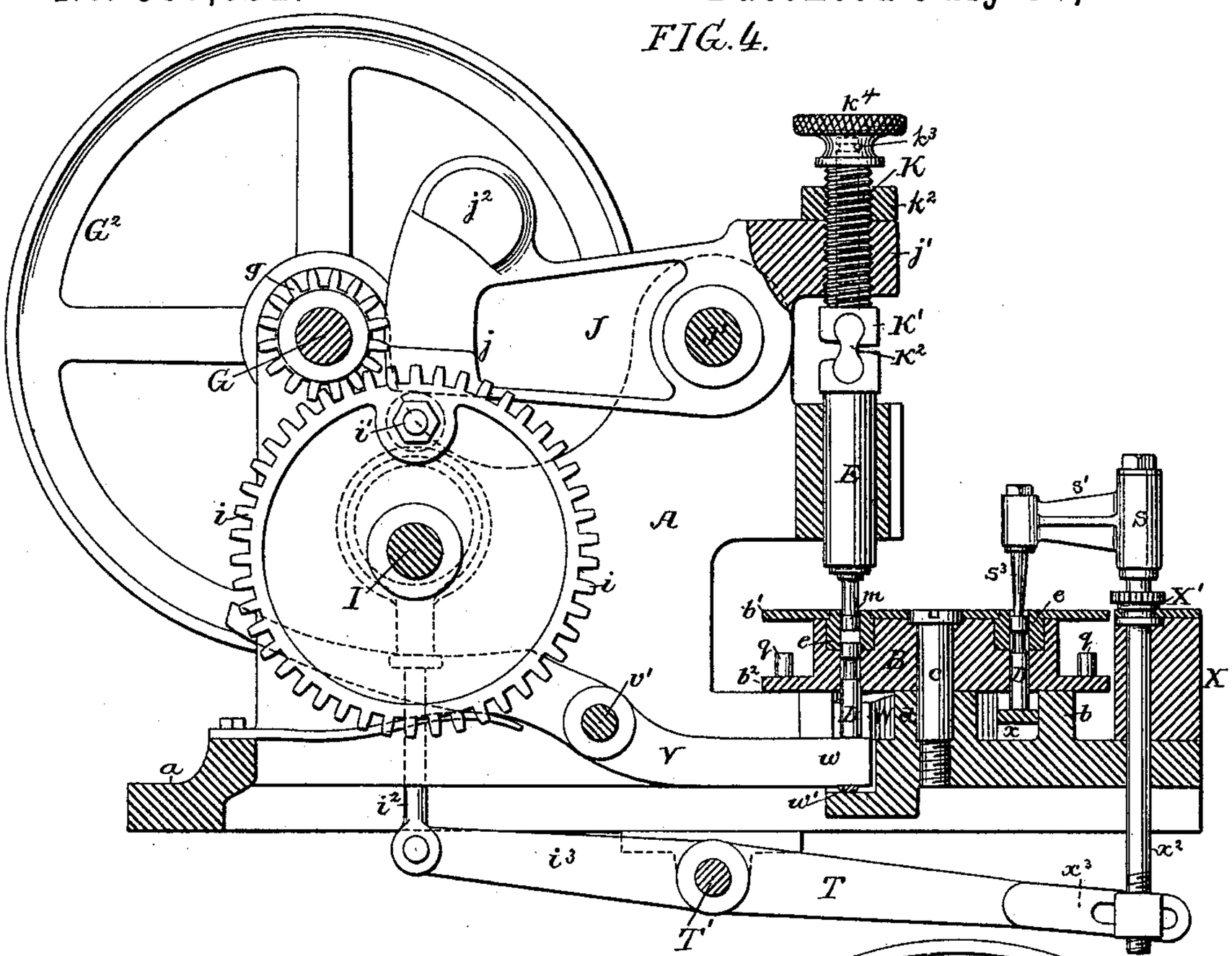
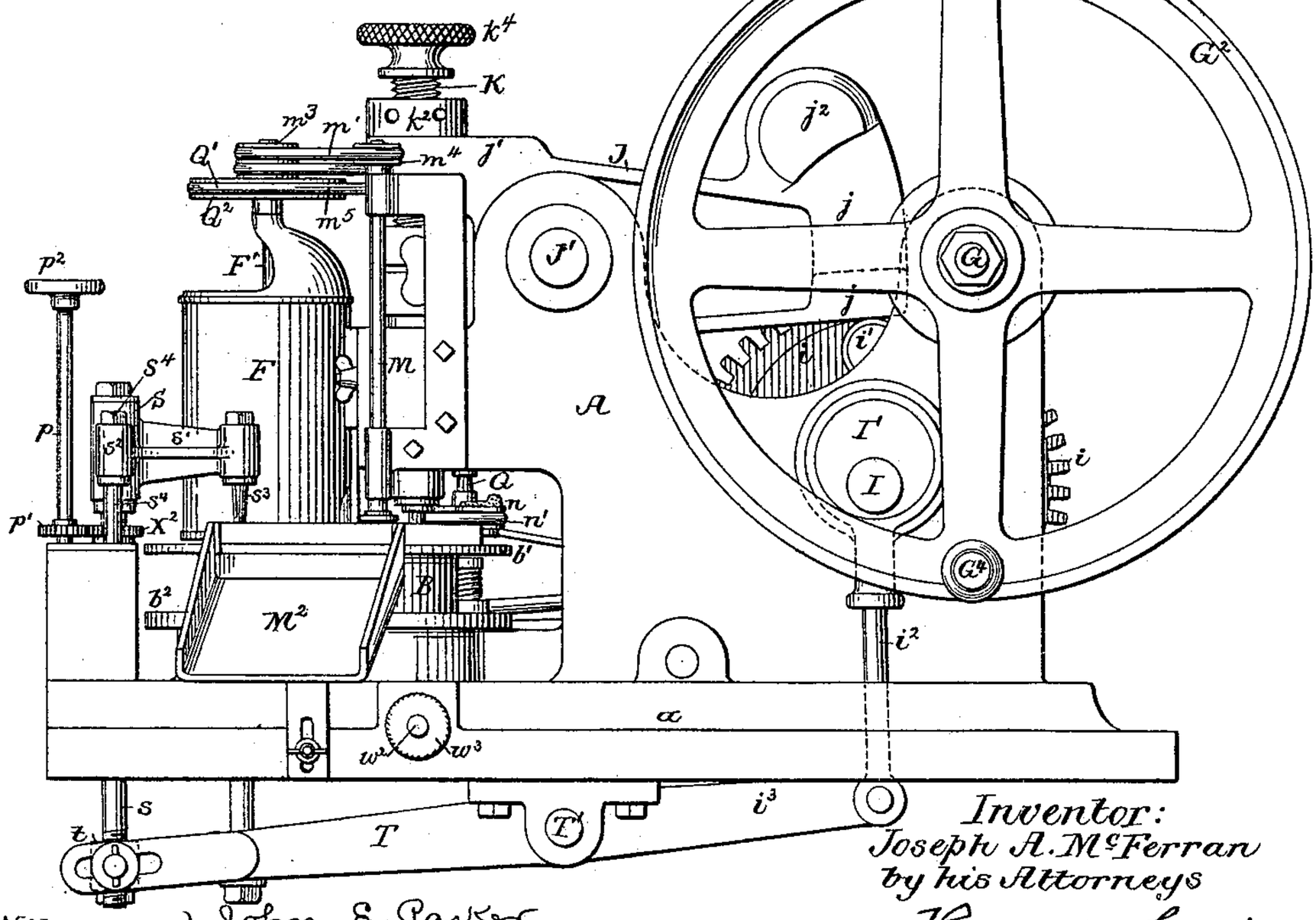


FIG. 3.



Witnesses: John E. Parker
William D. Bonner.

Inventor:
Joseph A. McFerran
by his Attorneys
Howson & Sons

(No Model.) 4 Sheets—Sheet 3.

J. A. McFERRAN.

PILL MACHINE.

No. 387,002. Patented July 31, 1888.

FIG. 15.

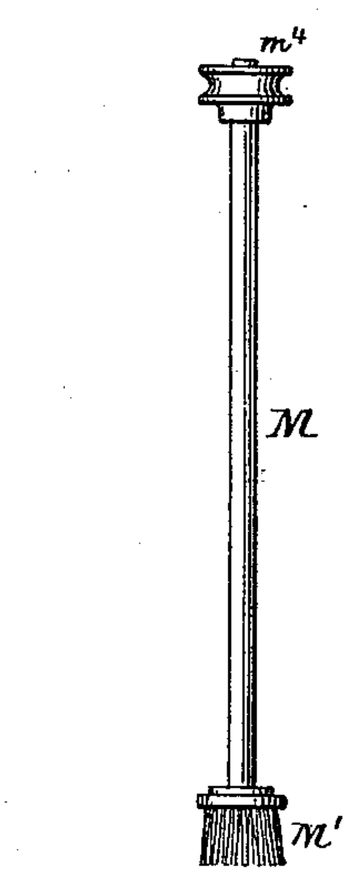


FIG. 11.

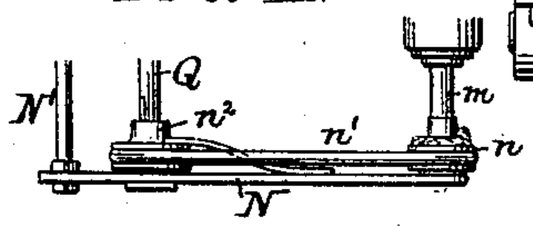


FIG. 12.

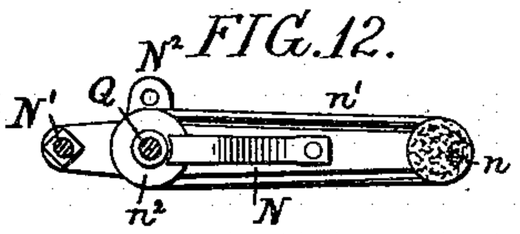


FIG. 14.

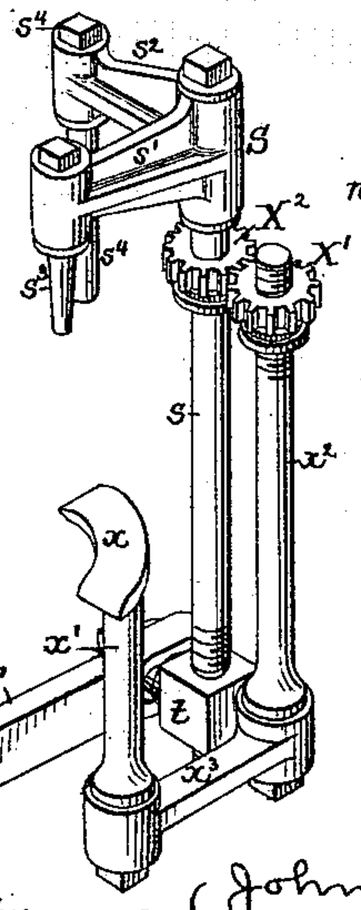


FIG. 5.

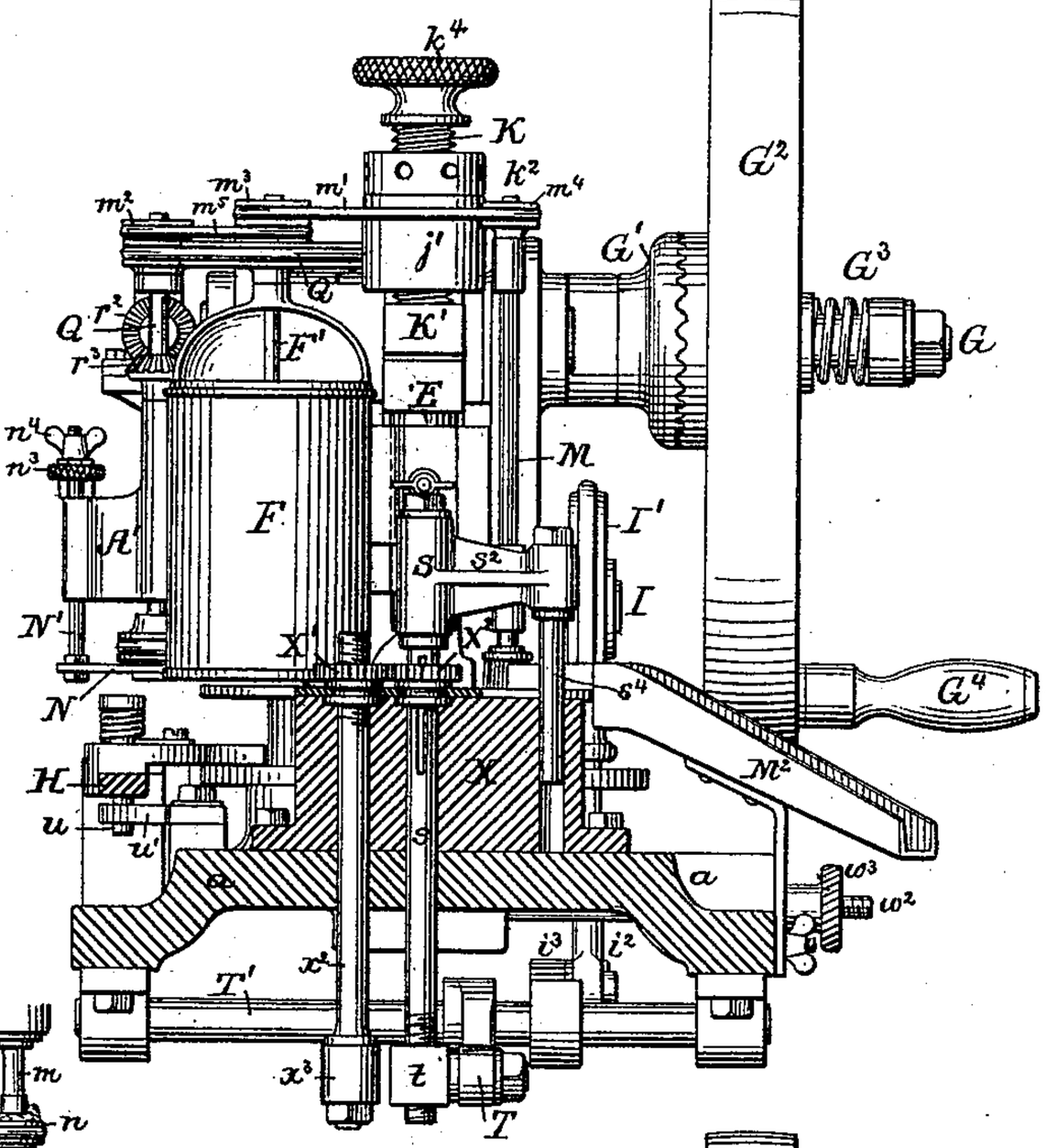
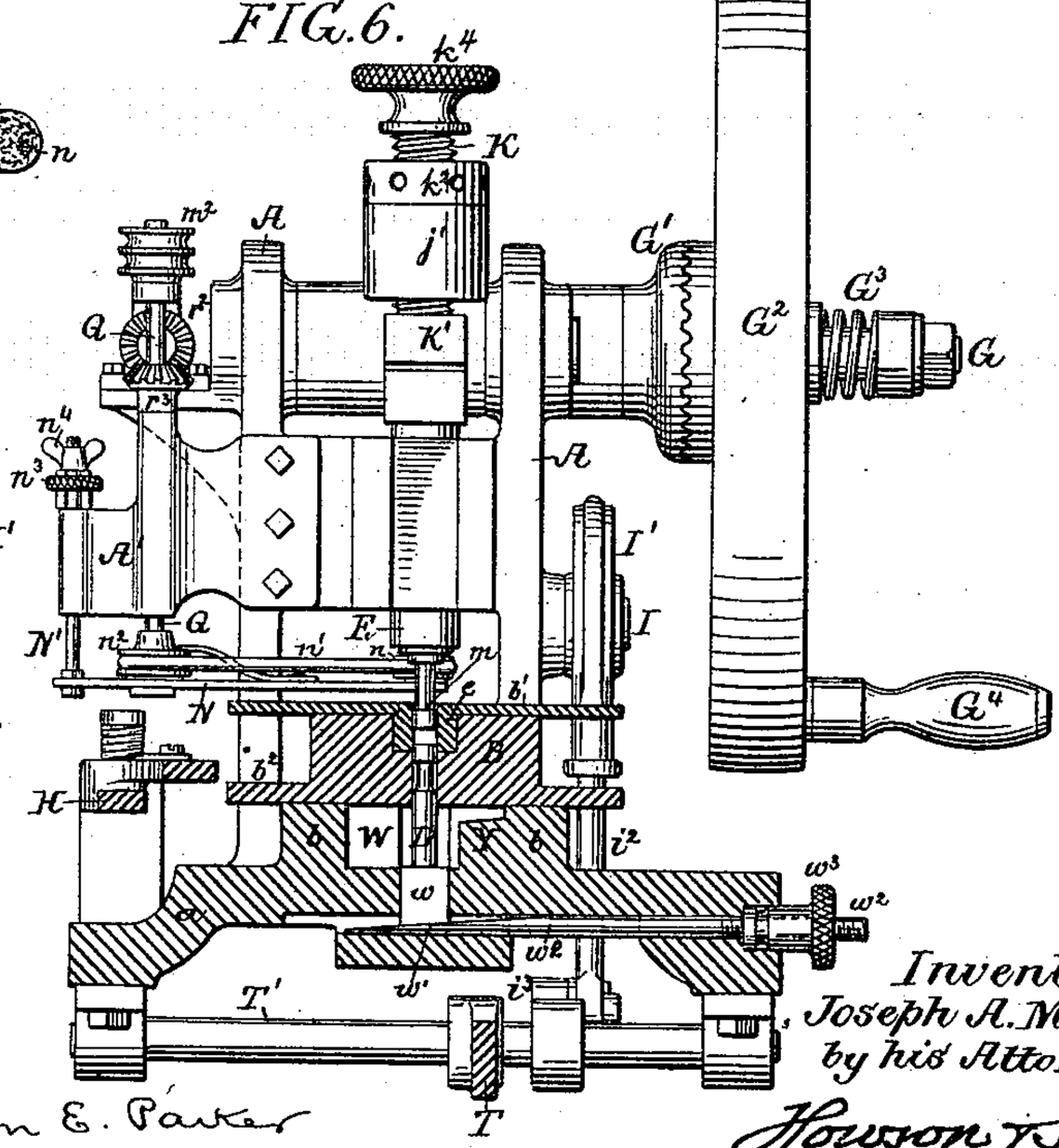


FIG. 6.



Witnesses: John E. Parker, William D. Bonner.

Inventor: Joseph A. McFerran by his Attorneys Howson & Sons

(No Model.) 4 Sheets—Sheet 4.

J. A. McFERRAN.

PILL MACHINE.

No. 387,002. Patented July 31, 1888.

FIG. 7.

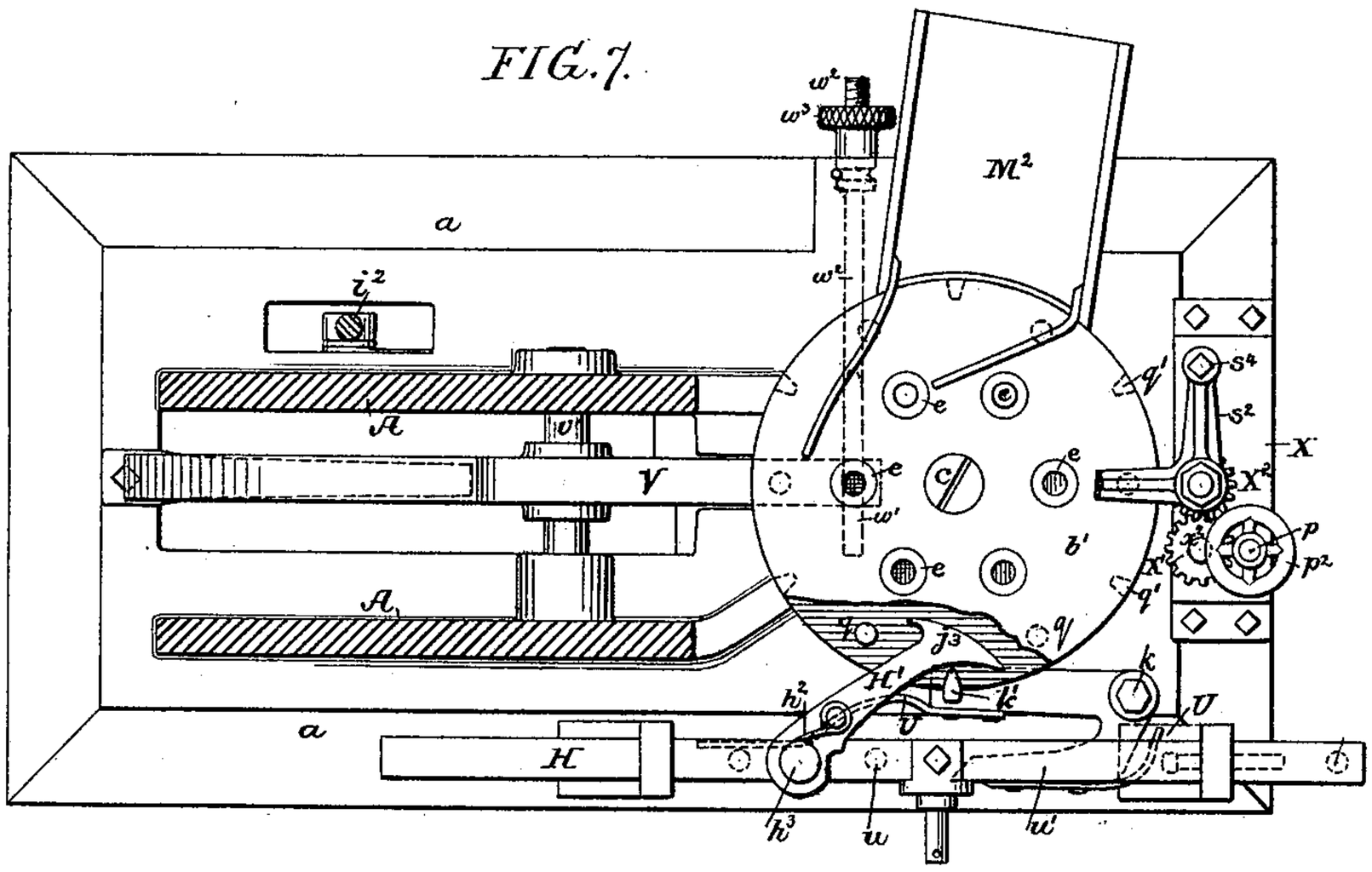


FIG. 9.

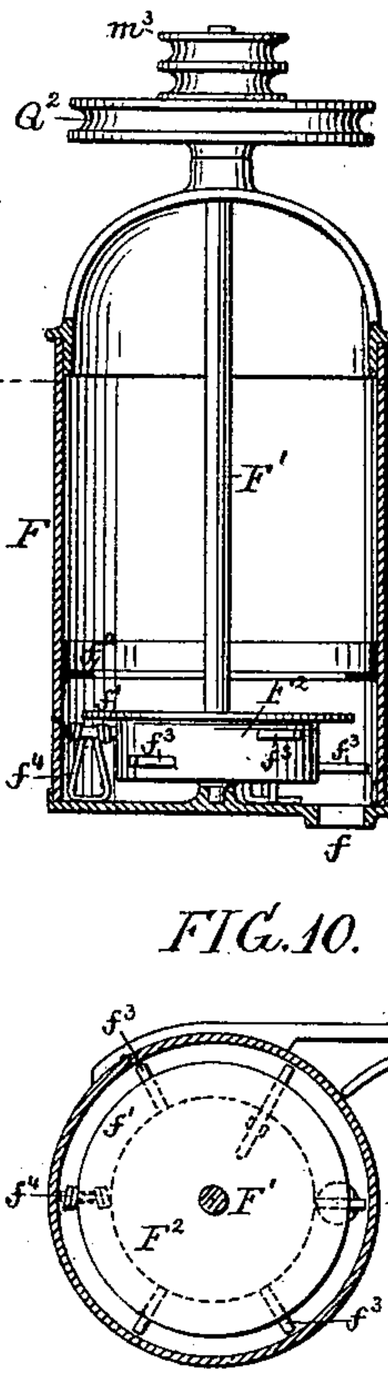


FIG. 8.

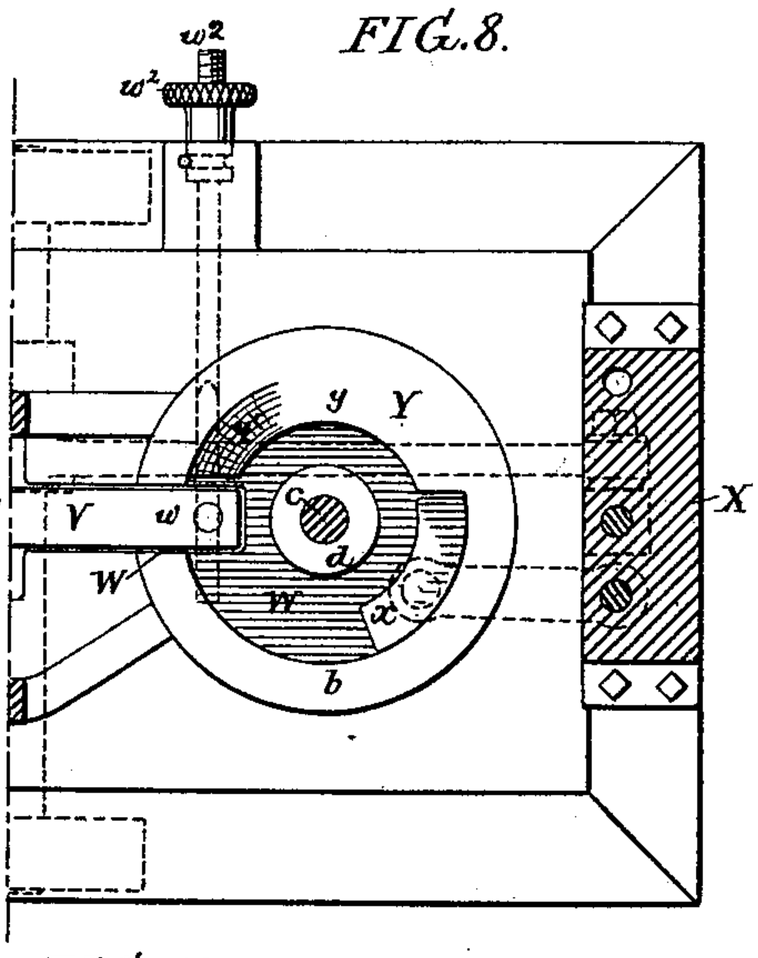


FIG. 17.

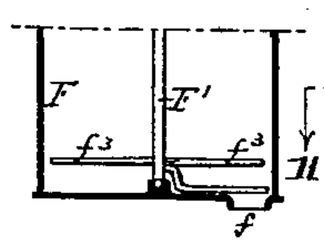


FIG. 16.

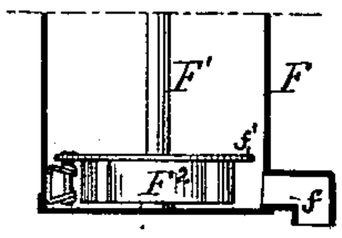
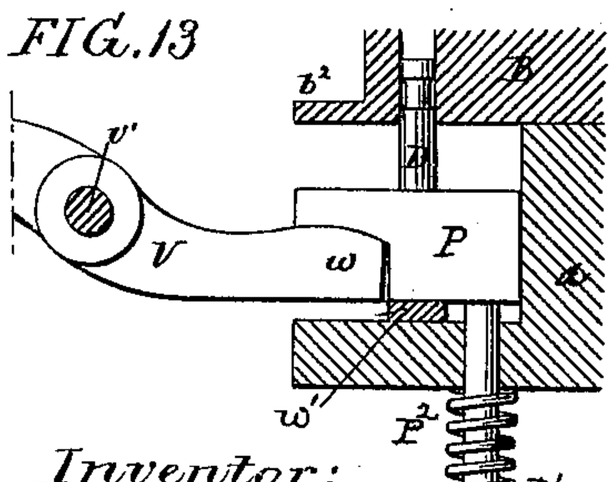


FIG. 10.

FIG. 13



Witnesses:
John E. Parker.
William D. Conner.

Inventor:
Joseph A. McFerran.
by his Attorneys,
Howson & Sons.

UNITED STATES PATENT OFFICE.

JOSEPH A. McFERRAN, OF PHILADELPHIA, PENNSYLVANIA.

PILL-MACHINE.

SPECIFICATION forming part of Letters Patent No. 387,002, dated July 31, 1888.

Application filed May 2, 1887. Serial No. 236,758. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH A. McFERRAN, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Pill-Machines, of which the following is a specification.

My invention consists of certain improvements in the pill-machine for which Letters Patent were granted to me November 25, 1884, No. 308,508, the improvements relating especially to the feeding mechanism, to the adjusting devices for the different parts of the machine, to the cleaning devices, and to the general construction of the operating mechanism, as fully described hereinafter.

In the accompanying drawings, Figure 1 is a side view of my improved pill-machine, looking in the direction of the arrow 1, Fig. 2. Fig. 2 is a plan view. Fig. 3 is a view looking in the direction of the arrow 2, Fig. 2. Fig. 4 is a longitudinal section on the line 1 2, Fig. 2. Fig. 5 is a transverse section on the line 3 4, Fig. 1. Fig. 6 is a transverse section on the line 5 6, Fig. 1. Fig. 7 is a sectional plan on the line 7 8, Fig. 1. Fig. 8 is a sectional plan of part of the machine on the line 9 10, Fig. 1. Fig. 9 is a sectional view of the feed-hopper detached. Fig. 10 is a sectional plan view of Fig. 9 on the line 11 12, Fig. 9. Figs. 11 and 12 are detached views of the plunger-cleaning device. Fig. 13 is a view of the die-lifter provided with a shoe. Figs. 14 and 15 are detached views of parts of the machine, and Figs. 16 and 17 are views of modified forms of hopper.

Referring to Figs. 1, 2, 3, and 4, A represents part of the frame of the machine, and *a* the base, preferably cast in one piece with the frame.

As in the patent above referred to, B is the intermittently-rotated die-holder, consisting of a metal disk resting on an annular rib, *b*, and on a central projection, *d*, both preferably cast with the base *a*, the die-holder being pivoted to the base by the pin *c*. The die-holder in the present instance carries six dies, as shown in Fig. 7, of the same form as that shown in the above patent. The dies are held in place by a detachable plate, *b'*, secured to the holder B, and bearing on the shoulders of the dies, serving to maintain the latter in place, the upper surface of the plate being flush with the tops of the dies. Each die is provided with an ejector, D, operating substantially in the manner described in the above patent.

A plunger, E, has its bearings in the frame A, and is intermittently reciprocated by mechanism described hereinafter. To this plunger is fitted the upper die, *m*, which enters each lower die in succession, and the material to be formed into pills is compressed between this die *m* and the ejectors of the dies *e*, as will be fully described hereinafter.

The hopper F is secured to the frame of the machine, and the opening *f* of the hopper is on the same circumferential line as are the six dies *e*, the dies being at equal distances apart, and on the flange b^2 of the die carrier are, in the present instance, six equidistant pins, *q*, six equidistant wedge-shaped notches, *q'*, being formed in said flange.

The die-holder B is intermittingly rotated through the medium of a guided and reciprocated rod, H, connected by a rod, H^3, to a crank, H^2, on the shaft I, Figs. 1 and 2. A pawl, H', is pivoted to the reciprocated rod H, and is acted upon by a spring, h^2, which is wound around the pivot-pin h^3. The hooked end j^3 of this pawl engages with the pins *q* on the die-carrier B, and at each reciprocation of the bar H the pawl H' will move the carrier to the extent of one-sixth of a revolution—a movement equal to the distance from one lower die to another—so that the lower dies are brought under the upper die in rotation.

In order to prevent the lower die from moving out of line with the upper die, I pivot to the base of the machine at *k* a detent-lever, as in my aforesaid patent, one arm, *u'*, of said lever being acted on by a pin, *u*, on the bar H. Springs U tend to force a projection, *k'*, of the detent-lever toward the periphery of the die-carrier B, and into one of the notches therein; but when the forward reciprocation of the bar H takes place the pin *u* on said bar operates the lever so as to withdraw said projection *k'* from the notch *q'* in the die-carrier, and during the interval when said projection of the detent-lever is clear of the notch the pawl H' moves the die-carrier sufficiently to prevent the projection from again entering the same notch; but as soon as the die-carrier has moved one-sixth of a revolution the detent-lever will be

free from the control of the pin *u* and the projection *k'* will drop into a succeeding notch, thus locking the die-holder securely while the die *m* of the plunger E presses a pill into form.

I have described above the intermittingly-rotated die-holder and the devices for rotating it.

I will now describe the compressing plunger and the devices for discharging the compressed pill from the die.

Having its bearings in the frame A is a shaft, G, provided with a face-clutch, G', which engages with a face-clutch on the fly-wheel G^2, a spring, G^3, tending to keep the faces of the clutches together, and the fly-wheel is provided with a suitable handle, G^4, so that the machine can be operated by hand, a driving-belt being applied to the wheel G^2 when power is employed. The object of the clutch G' is to prevent injury to or breaking of any of the parts of the machine, the spring yielding and permitting the clutch to slip when there is any undue resistance to the movement of the shaft G. On the shaft G is a pinion, *g*, which engages with a spur-wheel, *i*, on a shaft, I, having its bearings in the frame A of the machine. This wheel has a pin, *i'*, which acts upon the under face of an arm, *j*, of a lever, J, pivoted at J' to the side frames of the machine, a counter-balance, j^2, on said arm *j* tending to depress the lever when it is released from the control of the pin *i'*. The arm *j'* of the lever has a threaded orifice for the reception of a screw, K, which is provided with a head, k^4, and a jam-nut, k^2, and is bored out to receive the shank of a block, K', the upper portion of said shank being grooved for the reception of a pin, k^3, so that the block may be free to turn in the screw K, but will be secured to it longitudinally, as shown in Fig. 4.

The block K' is connected to the upper portion of the plunger E by a link, K^2, and this link has rounded and enlarged ends, which fit snugly into orifices in the block and in the head of the plunger E, forming what may be termed a "knuckle-joint," so that as the pin *i'* lifts the arm *j'* of the lever J the die *m* of the plunger E will be forced into a lower die to compress the pill, and as soon as the lever is released from the control of the pin *i'* the weight j^2 will effect the raising of the plunger E until its die *m* is clear of the lower die. By manipulating the screw K the plunger can be adjusted to any position required, and locked in this position by the jam-nut k^2. The pin *i'* on the wheel *i* also acts on one arm of a lever, V, pivoted at *v'* to the frame of the machine, the other arm, *w*, of the lever projecting into a cavity, W, formed in the annular rib *b*. This arm supports and at a certain time lifts the ejector D of each of the series of dies.

Under the arm *w* is a wedge-block, *w'*, forming part of a rod, w^2, which has at the outer end a screw-thread adapted to a thumb-screw, w^3, longitudinally secured to the frame, but free to turn in an orifice in the base of the machine. By turning this thumb-screw, therefore, the arm *w* can be adjusted to a nicety without the necessity of removing any portion of the machine. A set-screw passing through the base and acting on the arm *w* of the lever V may, if desired, replace the wedge *w'*; but the latter is preferred.

When the ejector D is raised by the lever V, the lower end of said ejector will as the die-carrier B rotates pass onto an inclined plane, *y y'*, formed by a segmental rib, Y, which is located inside of the rib *b*, and preferably forms part of the same. The object of this incline is to raise the pill gradually out of the die, the straight portion *y* of the incline holding the plunger fully elevated until the pill can be brushed off into a spout at the side of the machine.

Beyond the segmental rib Y is an adjustable segmental platform, *x*, onto which the ejector D passes. This platform is supported on a post, *x'*, connected to an upright rod, x^2, by a yoke, x^3, as shown in Figs. 1 and 14. The rod x^2 extends up through the base and through a block, X, secured to the base, and the rod is threaded at its upper end for adaptation to a nut, X', having its bearings in a plate on the block X.

Situated at one side of the rod x^2 is a small shaft, *p*, having a hand-wheel, p^2, and on the periphery of the nut X' are teeth, which mesh into a small pinion, *p'*, on the lower portion of the shaft *p*, so that by turning the latter the rod x^2 can be raised or lowered and a like movement of the platform *x* effected, thus increasing or diminishing the capacity of the mold to accord with the desired size of the pill.

Situated at one side of the rod x^2 is a rod, *s*, having a nut, X^2, provided with teeth which mesh into those of the nut X', said nut X^2 having its bearings in the same plate as the nut X', and being splined to the rod *s*, so as to allow said rod to have a vertical movement independent of the nut. Secured to the upper portion of the rod *s* is a head, S, having two arms, *s' s²*, the arm *s'* being provided with a downwardly-projecting pin, s^3, which, as the ejector D passes from the segmental rib Y on the base to the platform *x*, forces the ejector down onto said platform *x*, thus preventing the sticking of the ejector in the die, which would interfere with the desired uniformity in the size of the pills. The arm s^2 is provided with a steady-pin, s^4, which works in an orifice in the block X, as shown in Fig. 5, for the purpose of insuring the truth of the pin s^3 in respect to the dies *e*.

The lower portion of the rod *s* has a thread of the same pitch as that of the rod x^2, and this threaded portion of the rod is adapted to a threaded block, *t*, adjustable at the end of a lever, T, which is secured to a rock-shaft, T', having its bearings on the under side of the base of the machine.

By turning the nut X^2 of the shaft *s* said shaft will also be turned and consequently raised or lowered by reason of its screw-thread

tapped into the block *t*, the object of gearing together the two shafts x^2 and *s* being to insure the simultaneous elevation or depression of the platform *x* and pin s^3 to the same extent, so that when the parts are once set for a certain depth of die this adjustment cannot be changed by a careless operator.

The rod *s*, as remarked above, has a vertical movement, which is obtained in the present instance from an eccentric, I′, on the shaft I, Figs. 3 and 5, this eccentric having a strap, the rod i^2 of which is connected to an arm, i^3, secured to the rock-shaft T′. The eccentric is so timed in respect to the mechanism for moving the die-carrier that the pin s^3 will be elevated when the die-carrier is rotated, and when the die-carrier is stationary the pin will be depressed, so as to force the plunger to its seat on the platform *x*, and will then be again raised prior to the next movement of the die-carrier.

In the hopper F, which contains the material to be made into pills, is a vertical shaft, F′, having a disk, F^2, near the bottom of the hopper, this disk being provided with a flange, f', which is somewhat less in diameter than the hopper F, and above this disk is an internal flange, f^2, on the hopper. The object of this disk and flange is to prevent the material from packing near the bottom of the hopper, in order to allow the pulverized material to be fed evenly and regularly through the openings *f* into the dies. A series of agitating-fingers, f^3, project from the disk F^2 beneath the flange f', and hung to one or more of these agitators is a spring feeding-arm, f^4, which rests on the bottom of the hopper.

The shaft F′ is driven from a small vertical shaft, Q, at the side of the machine by means of a belt, Q′, which passes around a pulley, Q^2, on the shaft F, and a pulley, Q^3, on the shaft Q. The shaft Q is driven from the main shaft G through the medium of a shaft, R, and bevel-wheels *r*, *r*′, r^2, and r^3, as shown in Fig. 1. The vertical brush shaft M is driven from the same shaft Q by means of belts $m^5 m'$, passing around pulleys m^2 m^3 m^4.

The shaft M is provided with a brush, M′, at its lower end, as shown in Fig. 15, and is so situated in respect to the die that as the ejector D forces the pill to the surface the brush M sweeps the pill into the spout M^2, and at the same time cleans the face of the ejector and surrounding die before it receives the material to be made into another pill.

I have found by a series of experiments that a brush revolving on a vertical axis with a brushing or cleaning surface substantially at right angles to its axis of rotation and acting upon the face of the die will clean the die more thoroughly than when the brush is revolved horizontally or with its cleaning-surface parallel with the axis of rotation, for I am thus enabled to use a brushing-surface which is in contact with all parts of the die, whereas in a horizontally-rotating brush the only portion in contact is on a line of limited width parallel with the axis of rotation.

In Figs. 6, 11, and 12 is shown the device for cleaning the face of the upper die, *m*, which device is constructed as follows: An arm, N, is pivoted to a spindle, N′, located at one side of the shaft Q, and having its bearings in a bracket, A′, on the frame of the machine. At the outer end of the arm N is a receptacle, *n*, containing felt or other suitable material for cleaning the upper die. This receptacle is journaled in the outer end of the arm N, and is rotated by a belt, *n*′, passing around it and around a belt-pulley, n^2, on the shaft Q, Figs. 11 and 12, said pulley n^2 turning with the shaft Q, but being free to slide vertically upon it. A projection, N^2, of the arm N is connected by a rod, N^4, to a lever, N^3, pivoted to the side of the machine at *l*, this lever having a friction-roller, *l*′, which bears against the face of a cam, l^2, on the shaft I, Fig. 1. A spring, l^3, tends to keep the roller always in contact with the face of the cam, and the latter is so shaped that when the upper die, *m*, is raised the arm N will be swung under the same, in order that the rotating cleaner may come in contact with the under face of the die, the cleaner being thrown back clear of the die before the latter begins its downward movement. By having the cleaner rotate on a vertical axis I am enabled to clean the die perfectly, as described above in reference to the cleaning brush M. When the receptacle *n* is moved under the upper die, *m*, the arm N is raised bodily through the medium of the spindle N′, which is connected to one arm of a lever, *z*, pivoted at *z*′, the other arm of the lever being acted upon by a lug, z^2, on the hub of the crank H^2. A spring, z^3, keeps the end of the arm pressed against the hub, except when acted upon by the lug, as shown in Fig. 1. The driving-wheel n^2 can slide on the shaft Q, as before remarked, and is carried up with the arm N when it is raised to clean the upper die, *m*.

The arm N is adjusted by a nut, n^3, and a jam-nut, n^4, Fig. 1, so that proper contact of the cleaning pad *n* with the face of the die *m* can always be insured. In some cases, where adjustment is required and a firm base is necessary for the ejector D, I place a block, P, directly above the end of the lever V, as shown in Fig. 13, this block having a steady pin or pins, P′, passing through the frame A and forming a guide for the block when it is raised by the lever V, springs P^2 tending to keep the block always to its seat on the wedge *w*′. By this arrangement the bearing for the ejector D will always be perfectly level irrespective of the position to which it is adjusted by the wedge. I prefer to round the faces of the lever and block where they are in contact, as shown in Fig. 13.

In some cases the outlet *f* of the hopper may be at one side, as shown in Fig. 16, wings on the disk f^2 forcing the material into the outlet, from which it drops into the lower die; but I

prefer in all cases where practicable to use the devices shown in Fig. 9.

I have described my machine as used in the manufacture of pills; but it will be understood that it can be used for the compression into different forms of any powdered or plastic material.

In Fig. 17 I have shown the outlet *f* of the hopper F at one side of the center, the shaft F′ being provided with arms f^3 to agitate the material, so that as the arms are moved the material will be thrown from the center by centrifugal force and will pass through the opening *f*, which may be either in the bottom or side of the hopper.

I claim as my invention—

1. The combination of the rotated die-carrier, the ejector, a platform therefor, and a pin for depressing the ejector, said pin and platform being geared together, so as to be adjusted simultaneously, but the pin having a vertical movement independent of the platform, substantially as described.

2. The combination of the rotated die-carrier, the ejector, a platform therefor carried by a rod, a depressing-pin, also carried by a rod, gearing for connecting said rods, and mechanism for reciprocating the rod of the depressing-pin, substantially as and for the purpose set forth.

3. The combination of the threaded rod x^2, carrying the ejector-platform and provided with a toothed nut, X′, the threaded rod *s*, carrying the depressing pin and geared to the rod x^2, an operating-lever having a threaded block adapted to the rod *s*, and an operating-shaft having a pinion for operating the nuts of the two rods, so as to simultaneously adjust the platform and depressing-pin, all substantially as specified.

4. The combination of the frame of the machine, a rod, *s*, adapted to slide in said frame, a lever, T, connected to said rod and to operating mechanism, whereby the raising and lowering of the rod is effected, a head, S, on said rod, and a depressing-pin carried thereby, all substantially as and for the purpose specified.

5. The combination of the die-carrier with a rod guided in the frame of the machine, and having a head, S, with two arms, one carrying a depressing pin and the other having a steady-pin, all substantially as specified.

6. The combination of the die-carrier of a pill-machine, provided with a series of dies, and a rotating brush having its cleaning-surface at right angles to the axis of rotation, whereby the end of the brush acts upon the face of the die, substantially as specified.

7. The combination of the hopper and a shaft carrying a retarding-flange and agitators near the bottom of the hopper, as and for the purpose specified.

8. The combination of the hopper, having an outlet at or near the bottom and an internal flange above the same, with a vertical shaft provided with agitators below said flange, all substantially as specified.

9. The combination of the rotated die-holder carrying ejectors, a lever having a lifter-arm, a guided block acted on by said arm, and an adjusting device for raising and lowering the block, all substantially as specified.

10. The combination of the upper die of a pill-machine with a revolving die cleaner having its cleaning surface at right angles to its axis of rotation, and carried by an arm movable into and out of the path of the die, and means for positively rotating said die-cleaner, substantially as and for the purpose specified.

11. The combination of the upper die of a pill-machine with a revolving die-cleaner having its cleaning-surface at right angles to its axis of rotation, and movable into and out of the path of the die, and free to move vertically, so as to press the cleaner against the face of the die, all substantially as specified.

12. The combination of the upper die of a pill-machine with an arm carried by a spindle having its bearings in the frame of the machine, a shaft, Q, carrying a driving-pulley, a cleaner-receptacle free to turn in the arm, and a belt, whereby the die-cleaner is rotated from the pulley on the shaft Q, all substantially as specified.

13. The combination of the upper die of the machine, and an arm carried by a spindle and provided at its outer end with a die-cleaner, with a lever and cam for raising the die-cleaner and pressing it against the face of the upper die while the latter is in the raised position, all substantially as specified.

14. The combination of the upper die of the machine, and an arm carried by a spindle and having at its end a die-cleaner, with a lever, cam, and connecting devices, whereby said arm is swung so as carry the cleaner into and out of the path of the die, all substantially as specified.

15. The combination of the upper die of the machine, the arm carried by a spindle and provided at its outer end with a die-cleaner, a lever for lifting the spindle, and means for adjusting the latter, so as to govern the pressure of the cleaner against the die, all substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH A. McFERRAN.

Witnesses:
HENRY HOWSON,
HARRY SMITH.