

(No Model.)

3 Sheets—Sheet 1.

O. SMITH & H. K. MULFORD.

MACHINE FOR MANUFACTURING COMPRESSED PILLS.

No. 413,310.

Patented Oct. 22, 1889.

Fig. 2.

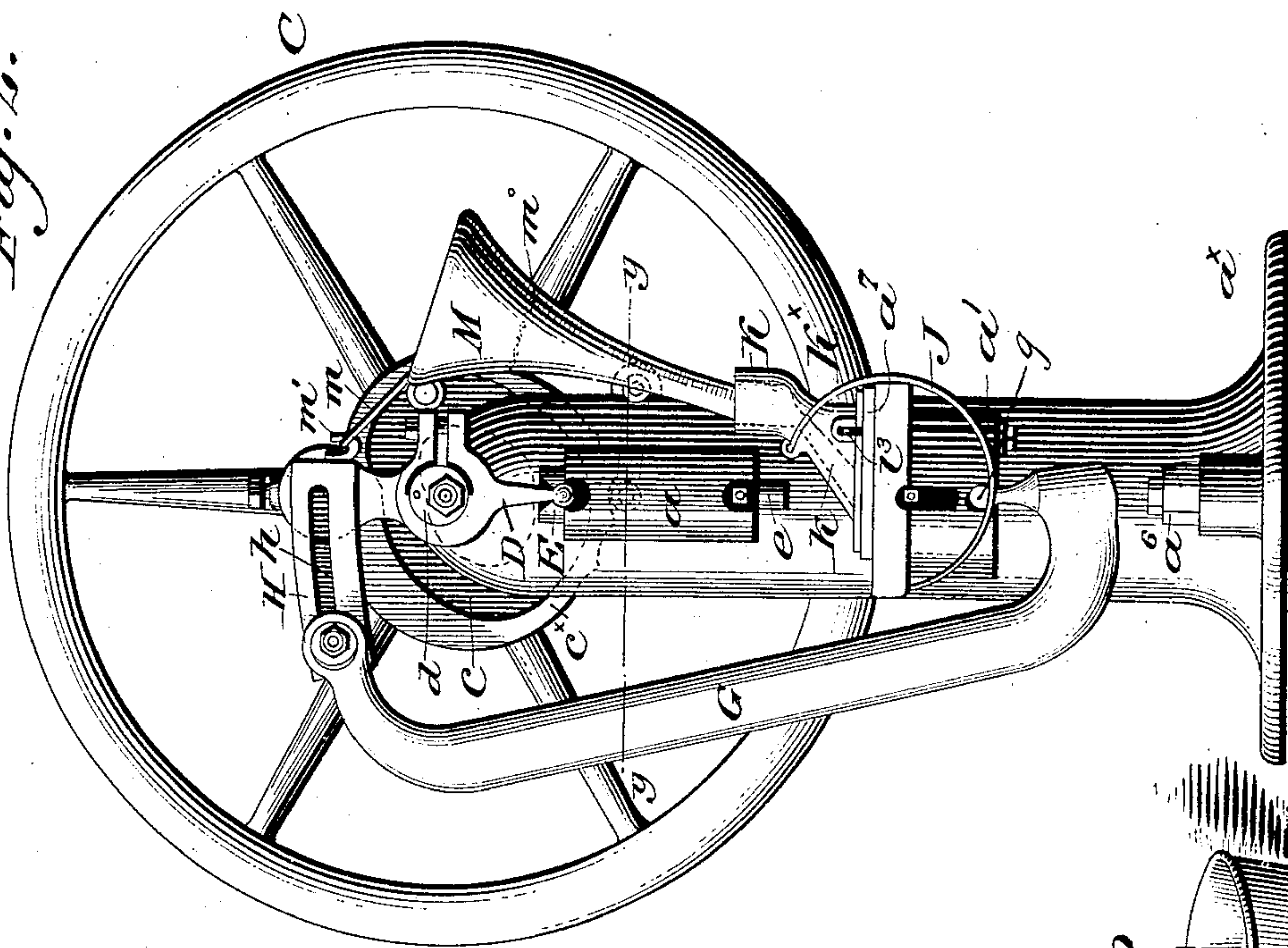
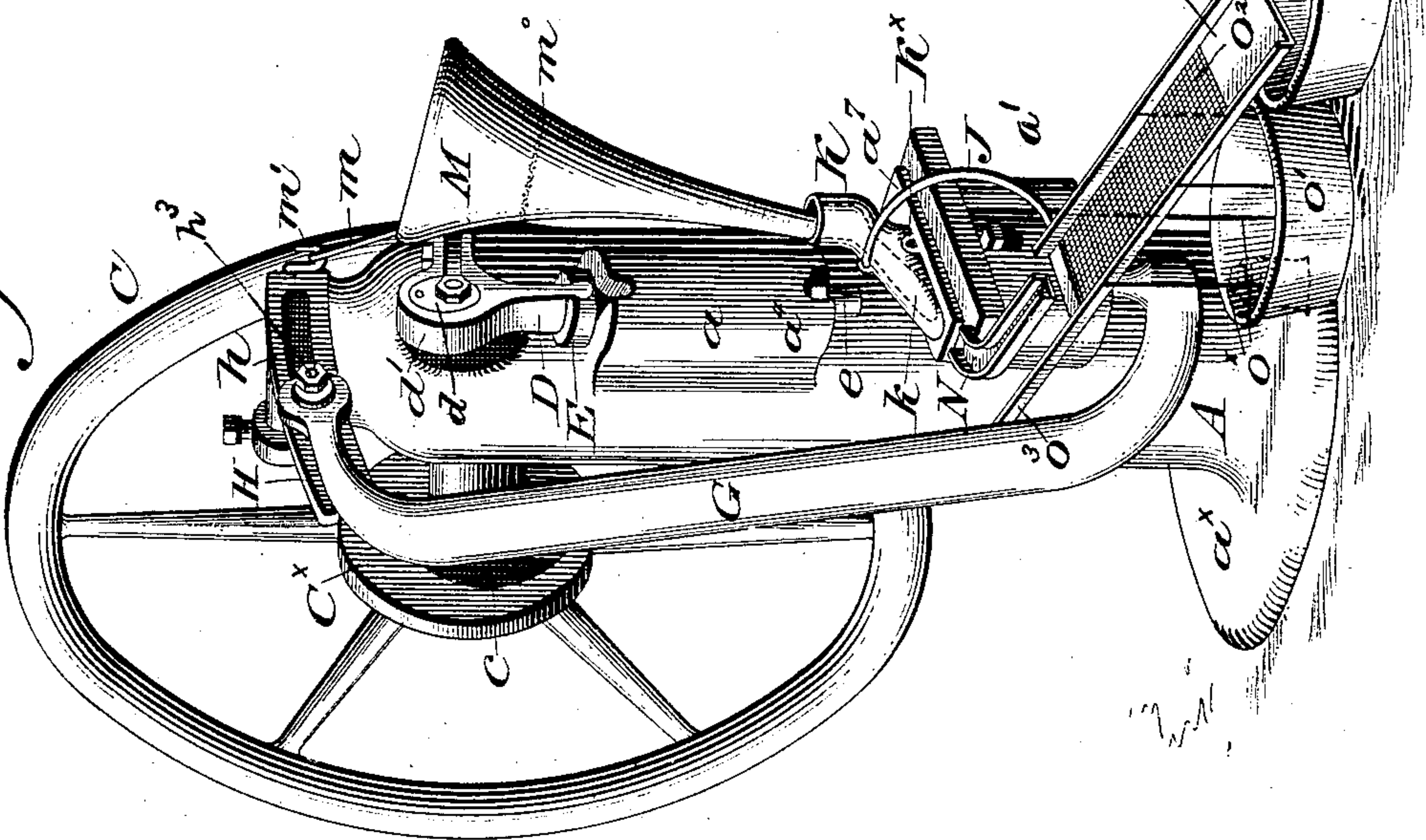


Fig. 1.



WITNESSES:

P. H. Bagley

J. Norman Dixon.

INVENTORS

Oberlin Smith

Harry K. Mulford

By their attorneys,

Strawbridge & Taylor

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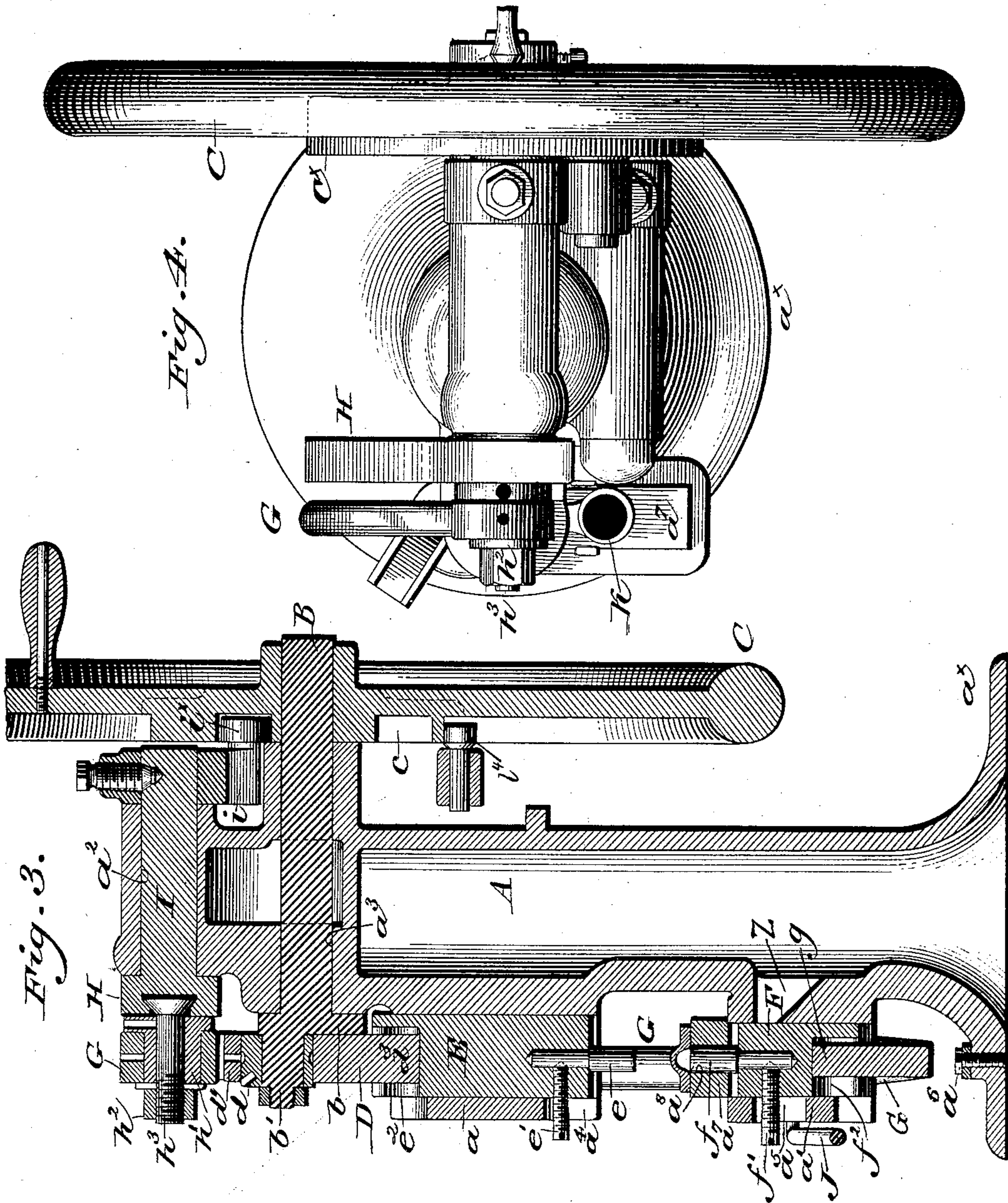
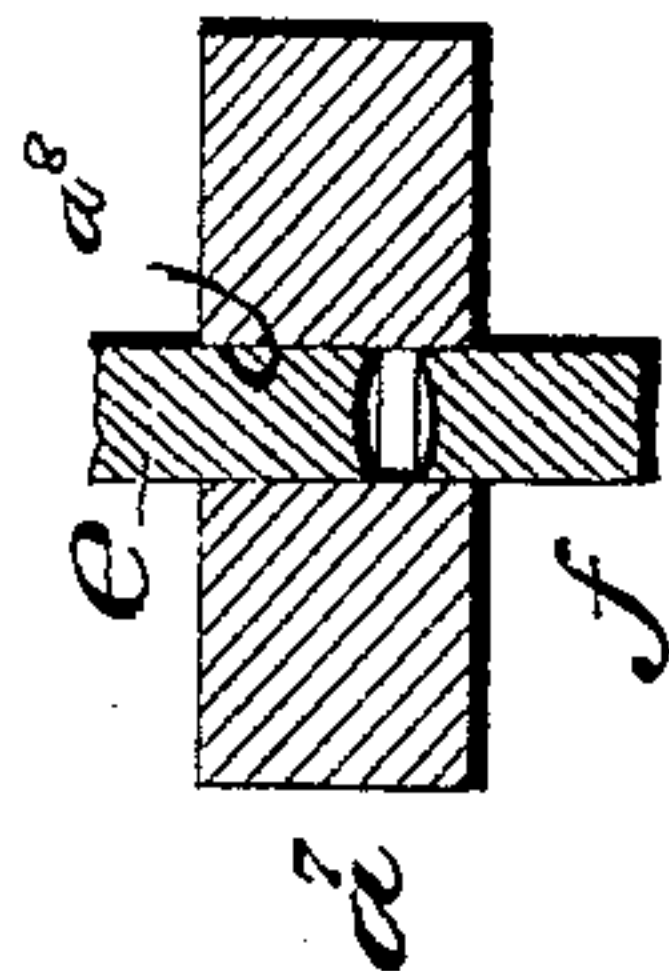


Fig. 5.



WITNESSES:

P. H. Chagel.
J. Norman Dixon.

INVENTORS

Oberlin Smith,
Harry K. Mulford,
By their Attorneys,
Strawbridge & Taylor.

(No Model.)

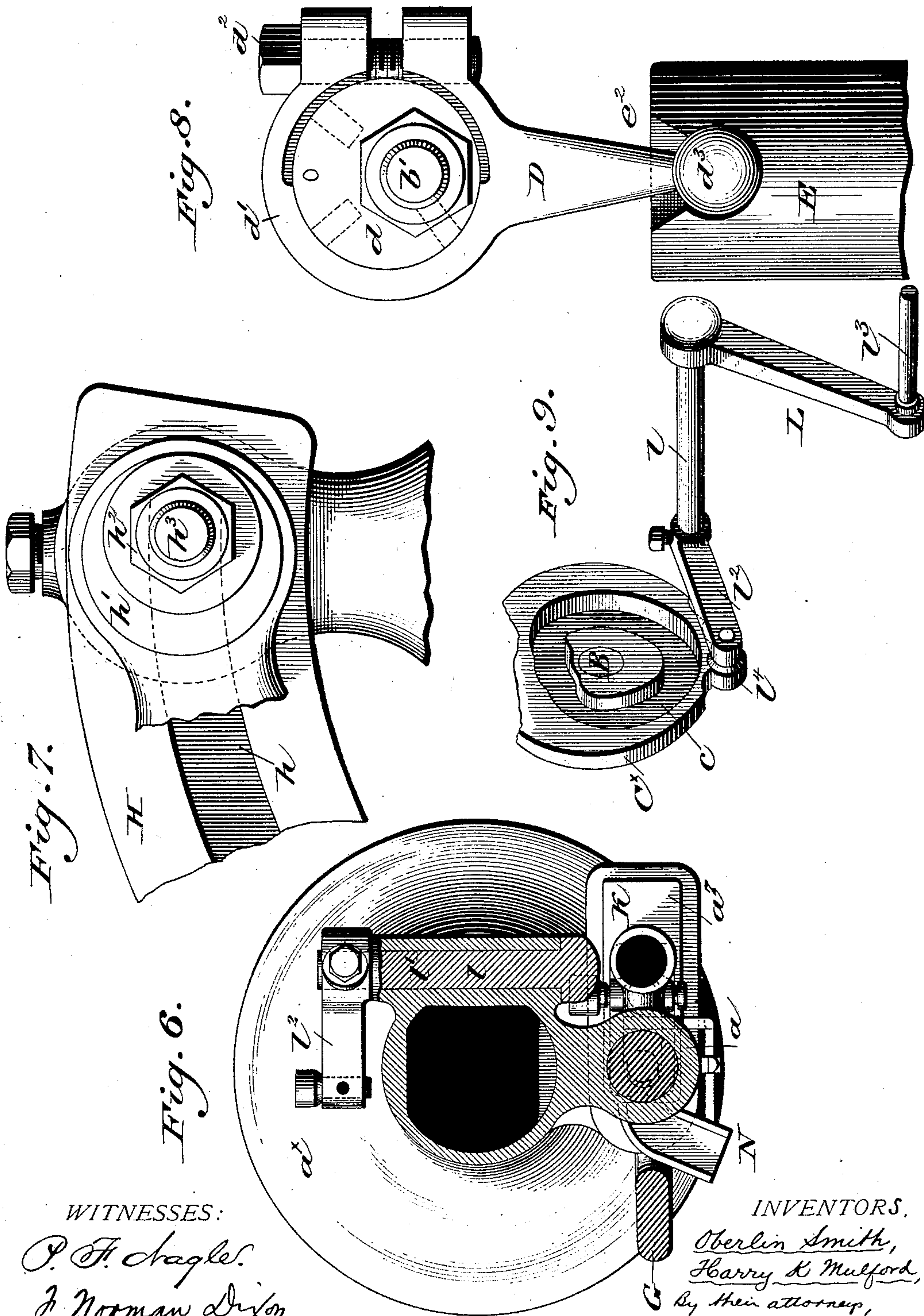
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WITNESSES:

P. H. Hagler.
J. Norman Dixon

INVENTORS,

Oberlin Smith,
Harry K. Mulford,
By their attorney,
Strawbridge & Taylor.

UNITED STATES PATENT OFFICE.

OBERLIN SMITH, OF BRIDGETON, NEW JERSEY, AND HARRY K. MULFORD,
OF PHILADELPHIA, PENNSYLVANIA; SAID SMITH ASSIGNOR TO SAID
MULFORD.

MACHINE FOR MANUFACTURING COMPRESSED PILLS.

SPECIFICATION forming part of Letters Patent No. 413,310, dated October 22, 1889.

Application filed March 15, 1889. Serial No. 303,415. (No model.)

To all whom it may concern:

Be it known that we, OBERLIN SMITH, a citizen of the United States, residing at Bridgeton, in the county of Cumberland, and State of New Jersey, and HARRY K. MULFORD, likewise a citizen of the United States, residing in the city and county of Philadelphia, in the State of Pennsylvania, have jointly invented certain new and useful Improvements in Machines for the Manufacture of Compressed Pills, Lozenges, &c., of which the following is a specification.

Our invention relates to a well known class of machines in which pulverulent, granular, or plastic materials are compressed into solid forms by the operation of oppositely disposed, and usually concave-ended, plunger dies or punches, which come together or nearly together within the confines of a fixed bed die into which the material to be compressed has by a suitable feed contrivance been previously fed and from out of which the compressed pill or lozenge is ejected by the elevation of the lower plunger die after the act of compression has been performed.

Our invention comprehends certain improvements in the mounting and adjustment of the plunger dies, certain improved means for actuating said dies, and certain improvements in the construction of and means for operating the material fed,—its object being not only to render the construction of the machine more simple, inexpensive, and durable, but also to provide in such a machine accurate means of adjustment of the plunger dies.

A machine embodying our improvements is represented in the accompanying drawings and described in this specification, the particular subject matter claimed as novel being hereinafter definitely specified.

In the accompanying drawings, Figure 1 is a view in perspective of a machine embodying our invention; Fig. 2, a front elevational view of the same, the pill chute shown in Fig. 1 being, however, for clearer illustration of the connection between the plunger stirrup and ejector die, omitted. Fig. 3 is a central, vertical, sectional, elevation, of the machine

shown in Fig. 2, the upper end of the stirrup rocker being moved in to the inner end of the groove *h*, and the pill chute shown in Fig. 1 being omitted. Fig. 4 is a top plan view of the said machine, the magazine and pill chute being supposed removed. Fig. 5 is a fragmentary, sectional, elevation of the bed die, with both plunger dies within it and in the position which they occupy when performing the act of compression. Fig. 6 is a horizontal sectional plan of the machine in the plane of the dotted line *y y* of Fig. 2. Fig. 7 is a fragmentary front elevational view of a portion of the stirrup rocker and plunger stirrup. Fig. 8 is a magnified elevational detail of a portion of the upper plunger and of the pitman which actuates it. Fig. 9 is a perspective view of the cam which actuates the hopper lever, of said lever and of its hopper shaft and lever rocker.

Similar letters of reference indicate corresponding parts.

In the drawings, *A* is the frame work of the machine, the same being a vertical standard or housing, preferably of the general form of a tubular body springing from a flat flaring base *a^x*, formed as to its front face with two projections or bosses, the upper of which we term the plunger boss *a* and the lower the bed boss *a'*, and formed as to its head or upper portion with two transversely extending bosses the upper of which is drilled to constitute it the bearing *a²* for the rock shaft, and the lower of which is likewise drilled to constitute it the bearing *a³* for the driving shaft. The front face of the frame-work or standard proper of the machine is that from which the plunger and bed bosses project.

B is the driving shaft of the machine,—a horizontal shaft mounted as stated in the bearing *a³* and extending from front to rear of the machine. Beyond the rear face of its bearing this shaft is equipped with the driving fly wheel *C* of the machine, the rotation of which, whether by hand or power, occasions the rotation of the shaft. Beyond the front face of its bearing the driving shaft is formed into or equipped with a crank wheel *b* to the wrist pin *b'* of which is connected a

link or pitman D the lower or depending extremity of which is pivotally connected with the upper plunger E, which latter is free for vertical movement within the plunger boss a to the vertical bore of which it is adapted, and which carries the upper or compressor die e .

It is proper here to state that in this specification we employ the term plunger die as comprehending both the plunger and the die proper which it carries, and distinguish between the upper plunger and its so-called compressor die and the lower plunger and its so-called ejector die, hereinafter described, by the terms upper and lower plunger dies.

The compressor die may be formed as a part of the upper plunger or may as shown in Fig. 3 be made separately therefrom and be connected therewith by a set screw e' which in the reciprocation of the upper plunger moves in a vertical slot a^4 in the front face of the plunger boss a , an arrangement which incidentally assists to prevent any rotation of the upper plunger within its boss bearing when such plunger is made of cylindric form.

The link or pitman D which connects the wrist pin of the crank wheel on the main shaft with the upper plunger, may be of any desired construction, but, in order to readily and accurately adjust the normal vertical set of the upper plunger die in order to thereby adjust its stroke, we prefer to adopt the well known "Stiles" pitman represented in detail in Fig. 8, and which consists essentially of an eccentric bushing d mounted upon the wrist pin of the crank wheel and clamped in any position within a circumscribing spring clamp or bushing yoke d' , which constitutes the upper portion of the pitman proper, and is clamped with the requisite binding pressure upon the bushing by means of a compressing bolt d^2 . The lower extremity of the pitman is pivotally connected with the upper plunger preferably by being provided with a transverse cylindric knob or enlargement d^3 adapted to a cylindric seat e^2 in the upper extremity of the upper plunger. It will now from a consideration of the above described devices be apparent that the rotation of the driving fly wheel will be accompanied by the vertical reciprocation of the upper plunger die, and that the limit of the downward movement of said die can be regulated to a nicety by the adjustment of the bushing of the pitman.

F is the lower plunger which is provided with the lower or ejector die f , and which is adapted to a vertical bearing in the bed boss a' . The lower plunger die as an entirety is in alignment with the upper plunger die, and the respective dies proper of said plungers are adapted to approach and recede from each other at predetermined times and with predetermined but not correspondent movements, as hereinafter more fully set forth. As in the case of the compressor die of the upper plunger, the ejector die of the lower plunger may be either formed as a part of

said plunger or applied to it in the same manner as is said compressor die applied to its plunger, that is to say by the application of a set screw f' passing through and playing within a vertical slot a^5 in the front face of the bed boss a .

Z is an aperture in the rear face of the bed boss a' , placing the interior of the boss in communication with the interior of the standard A and designed for the escape of any particles of material working down past the ejector die.

Motion of intermittent reciprocal travel is imparted to the lower plunger die by means of what we term a plunger stirrup G, the same being a hanger or yoke-like pitman the upper extremity of which is pivoted by any preferred adjustable connection to a rocker arm which we term a stirrup rocker H projecting from and connected with the front extremity of a rock shaft I, and the lower extremity of which is inturned and upturned and as to its upturned end, provided with a cylindric knob g adapted to a cylindric seat f^2 in the lower plunger.

It will be evident that an oscillatory up and down movement will be imparted to the stirrup and consequently to the lower plunger die whenever the rock shaft is oscillated, and that such up and down movement will naturally be either uniform or irregular according as the movement of the rock shaft itself is uniform or irregular. The oscillation of the rock shaft is accomplished by a rocker i applied to the rear extremity of the said rock shaft and equipped with a heel in the form of a friction roll i^x which is adapted to travel in a cam way c , Figs. 3 and 9, in a cam C^x , being preferably either connected with or a part of the driving fly wheel or else being independently mounted upon the driving shaft.

In the operation of the machine, the compression of the material is effected at the time when the lower plunger die is at the lowest point of its stroke, the ejector die being then near the bottom of the bed die and the plunger stirrup having come to a bearing upon what we term the stirrup rest a^6 upon the base of the machine. When the parts referred to are in the foregoing position, the upper plunger descends until the compressor die has entered the bed die and descended therein to such point as to accomplish the required compression. Immediately thereafter both dies ascend until the ejector die is flush with the upper face of the bed die, and in such position comes to rest; but the compressor die continues its ascent to the limit of its upward travel and the ejector die after the advance of the feeding hopper, whereof hereinafter, again descends to its first position.

It will be observed that the foregoing movement of the upper plunger die is a regular one without dwell, and such as would be naturally occasioned by the constant rotation of the crank wheel of the driving shaft,—

while the movement of the lower plunger die is irregular, accompanied by a dwell at both the bottom and the top of the stroke and such as would also be readily effected by a cam way of irregular path or such in fact as is the cam way c of the cam C^x . The stirrup rest a^6 upon which the plunger stirrup comes to a basal bearing and which performs the office of a bed or anvil for the lower or ejector die to rest upon during the period of the compression, may be of any desired construction. We prefer to constitute it by an adjustable bolt of the character shown in Figs. 1, 2, and 3, of the drawings.

In order to adjust the length of the stroke of the lower plunger die, that is to say to determine the depth to which the ejector die shall sink so to speak within the bed die, in order thereby to regulate the amount of material to be fed at one stroke of the feed, the connection between the plunger stirrup and the stirrup rocker is an adjustable one, which we prefer to form in the following manner: The stirrup rocker which is formed as a part of or is rigidly attached to the front extremity of the rock shaft is of segmental form and embodies in its front face a segmental tongued groove h into which is entered the tongue-shaped head of a bolt h^3 the threaded shank of which is encircled by an eccentric bolt-bushing h' the peripheral face of which serves as a pivot pin upon which is mounted the upper boxing or bearing formed upon or being the upper extremity of the stirrup rocker. The set of the eccentric bushing with respect to the bolt which it embraces, as well as its set, together with that of the bolt, with respect to the slot within the stirrup rocker, is readily determined by manual adjustment and readily maintained by the tightening up of a nut h^2 upon the threaded extremity of the bolt which binds said bolt-bushing against the front face of the stirrup rocker and locks both said bushing and the bolt in the then position of parts. According, therefore, to the set of the said bushing with respect to its circumscribed bolt, and to the set of said bolt with respect to the slot in the stirrup rocker, is, as stated, the vertical movement of the plunger stirrup and consequently of the lower plunger die.

The appliances for feeding the material to the dies and for discharging the compressed pill, are the following: The bed boss a^7 is surmounted by a laterally extending bed or table a^7 , either integral with said boss or applied thereto, upon which is mounted, for travel longitudinally as to the said bed but laterally as to the machine, a feeding hopper K which not only feeds the material into the bed die a^8 but discharges the finished pill from off the face of the bed after the lower plunger die has ejected it to above the level of said bed and so as to present it in the path of the said hopper. The bed a^7 is made of length equal to the length of the movement of the hopper and is formed of a single piece of

metal so as to present a continuous unbroken surface to said hopper.

The bed die a^8 is simply a vertical cylindrical aperture through the bed, so disposed as to be aligned with the compressor and ejector dies, which, being of the same diameter, are of a diameter externally correspondent with the internal diameter of the said bed die. If the dies of the plunger are of other than circular cross-section, the bed die must correspond with them in cross-section, be that cross-section what it may. The ejector die is always within the bed die and forms the bottom to it,—the depth to which, in the movement imparted to it, the said ejector sinks within the said bed die determining the amount of material to be subjected to compression.

The feeding hopper may be of any suitable form, but is preferably shoe-shaped as shown in Figs. 1 and 2, has upon its under surface a flat bottom which rests and travels upon the flat upper face of the bed, and, through said bottom, is provided with a hole or opening k which in the advance position of the hopper is in alignment with the bed die so as to permit of a discharge of the contents of the hopper into said bed die.

In the foregoing or advance position the hopper is maintained by the action of a C-shaped, or other preferred, spring J , while its retraction or backward movement is, against the contracting stress of said spring, effected by the backward movement of a hopper lever L which is provided at its free extremity with a laterally projecting lever pin l^3 entered within a transverse pin socket l^x in the hopper, which hopper lever is mounted upon a rock shaft, being the hopper shaft l , housed in a bearing l' on the frame work, and is provided with a rocker arm, being the lever rocker l^2 , which, through a roller l^4 , makes contact with the peripheral face of the cam C^x hereinbefore referred to. The said face of the said cam is of such outline or swell as to at the proper time occasion the depression of the lever rocker, the oscillation of the hopper shaft, and the backward swing of the hopper lever, with the result that, as the pin socket for the lever pin of said lever is of sufficient vertical depth to permit of the arc movement of said lever pin, the hopper is retracted until its front edge is clear of the bed and plunger dies, without however lifting said hopper from the bed plate. Opposite to the swell or crest of the cam which serves to effect the foregoing backward movement of the hopper, the peripheral face of the cam is corrugated or formed with a succession of small crests and hollows which serve to impart to the lever rocker, hopper shaft, and hopper lever, a movement of rapid and short vibration, which is transmitted to the hopper as a series of short sharp shocks which serve during the time when the act of feeding the bed die is being performed to prevent the packing, and insure the discharge, of the contents of the

hopper, but which do not raise the hopper from the bed or affect its regular movement backward and forward for the feeding of material.

5 The spring J not only serves to occasion the advance of the hopper and to hold it down upon its bed, but also maintains the roller l^1 of the lever rocker l^2 against the face of the cam.

10 M is a magazine, being a funnel-shaped device suspended by a link m connected conveniently by a hook m' with the stirrup rocker H, the spout of which is entered within the upper throat of the feeding hopper and which, 15 containing the material to be fed into the hopper, feeds it thereinto by reason of the vibratory movement imparted to it by the vibration of the stirrup rocker. Within this magazine is a sieve m^0 . The feeding hopper 20 proper and the magazine together constitute the material-feed of the machine, but, as is evident, the magazine is not essential to the operation of the hopper. As mentioned, the advance of the hopper after the action of the 25 dies for the formation of the pill sweeps the pill so formed from off the ejecting die, which during the period of the advance of the hopper is level with the upper face of said bed, from off said bed, and, conveniently, into a discharging spout N connected with said bed. 30 Beneath the spout N and so located with reference thereto as to receive the discharge therefrom, is a chute O, conveniently supported, so as to be free for an oscillatory motion, upon vertical supporting wires O^x , the 35 lower ends of which are preferably attached to a dust pan O' . The bottom O^2 of the chute is formed as a sieve and beneath its discharge end is placed a receptacle for the finished 40 pills. The pills which are swept from the bed plate by the advance movement of the hopper slide down the discharge spout N and enter the chute. Oscillatory motion being imparted to the chute the further descent of 45 the pills to the pill receptacles is facilitated, but any dust or particles of drug which may exist among them pass through the sieve and are caught by the dust pan. We find it convenient to oscillate the chute by forming an 50 arm O^3 as an extension of one of the side pieces of the chute, and making it of such shape or so locating the chute, that said arm will be encountered by the plunger stirrup in its reciprocation.

55 Such being a description of a convenient embodiment of our invention, its operation will therefrom have been sufficiently understood,—it being only now necessary to add that changes in the form of the parts, as well 60 as modifications in their relative dispositions or applications, may obviously be made without departure from the invention. Thus we contemplate employing instead of a single pair of plunger dies, a series of pairs in such 65 case of course increasing the number of bed dies and so modifying the material feed as to cause it to co-operate with them all.

Having thus described our invention, we claim:

1. In a machine for forming pills by compression, a vertical standard or frame work, a horizontal bed supported upon said frame-work and embodying a bed die, vertically operating upper and lower plunger dies, a driving shaft in the upper part of the frame-work, 75 a crank on said shaft which is connected with and reciprocates the upper plunger die, a cam on said driving shaft, a rock shaft provided with a rocker oscillated by said cam, a stirrup rocker connected to said rock shaft, 80 and a plunger stirrup, depending from said rocker, which actuates the lower plunger die, substantially as set forth.

2. In a machine for forming pills by compression, a vertical standard or frame-work, 85 a horizontal bed supported upon said frame-work and embodying a bed die, vertically operating upper and lower plunger dies, a driving shaft in the upper part of the frame-work, a crank on said shaft which is connected 90 with and reciprocates the upper plunger die, a cam on said driving shaft, a rock shaft provided with a rocker oscillated by said cam, a stirrup rocker connected to said rock shaft, a plunger stirrup depending from said rocker, 95 which actuates the lower plunger die, a feeding hopper adapted to travel upon the bed, and mechanism for occasioning both the travel and the shaking of the hopper, substantially as set forth. 100

3. In a machine for forming pills by compression, in combination, the vertical standard or frame work, the upper plunger die, the lower plunger die, the bed embodying the bed die, the main shaft, a crank thereon, a pitman connecting said crank and the upper 105 plunger die, a plunger stirrup the lower end of which is attached to the lower plunger die, a cam, and mechanism for supporting said plunger stirrup and transmitting to it 110 motion from said cam, substantially as set forth.

4. In a machine for forming pills by compression, in combination, the upper plunger die, the lower plunger die, the bed embodying 115 the bed die, the main shaft, a crank thereon, a pitman connecting said crank and the upper plunger die, a cam, and a plunger stirrup the lower end of which is attached to the lower plunger die and the upper end of 120 which is connected by intermediate adjusting devices to the cam, substantially as set forth.

5. In a machine for forming pills by compression, in combination, the upper plunger 125 die, the lower plunger die, the bed embodying the bed die, the main shaft, the crank thereon, a pitman connecting the crank and the upper plunger, a plunger stirrup the lower end of which is attached to the lower 130 plunger die, a rock shaft, a stirrup rocker mounted thereon to which the upper end of the plunger stirrup is connected, a cam, a rocker mounted on said rock shaft and oscil-

lated by the cam, a hopper, and means for causing said hopper to travel backward and forward on the bed plate, and for shaking it when over the bed die, substantially as set forth.

6. In a machine for forming pills by compression, in combination, the supporting standard or frame-work, the upper plunger die, mechanism for supporting and occasioning the reciprocation of said die, the bed plate embodying the bed die, the plunger stirrup formed with an up-turned lower end, the lower plunger die pivotally connected thereto, the stirrup rocker on which the plunger stirrup is hung, the rock shaft to which said rocker is attached, the rock shaft arm, and the cam, substantially as set forth.

7. In a machine for forming pills by compression, in combination, the supporting standard or frame work, the upper plunger die, mechanism for supporting and occasioning the reciprocation of said die, the bed plate embodying the bed die, the plunger stirrup, the stirrup rest which said plunger stirrup encounters at the lowest point of its stroke, the lower plunger die pivotally connected to the plunger stirrup, the rocker provided with a segmental dove-tailed slot, in which slot the stirrup is hung, the rock shaft to which said rocker is attached, the rock shaft arm, and the cam, substantially as set forth.

8. In a machine for forming pills by compression, the upper plunger die, the lower plunger die, a bed plate embodying the bed die, means for causing the reciprocation of the plunger dies, a feeding hopper, and means for causing said hopper to travel backward and forward on the bed plate, and for shaking it when over the bed die, substantially as set forth.

9. In a machine for forming pills by compression, in combination, the upper and lower plunger dies, a bed plate embodying a bed die, means for occasioning the reciprocation of the plunger dies, a feeding hopper, means for occasioning the travel of the said hopper relatively to the bed die, a magazine for supplying said hopper, and means for imparting vibratory movement to the magazine, substantially as set forth.

10. In a machine for forming pills by compression, in combination, the upper plunger die, the lower plunger die, a bed plate embodying a bed die, mechanism for occasioning the reciprocation of the upper plunger die, mechanism for reciprocating the lower plunger die, part of which latter mechanism consists of the slotted stirrup rocker, and the plunger stirrup adjustably mounted in the slot of said stirrup rocker, substantially as set forth.

11. In a machine for forming pills by compression, in combination, the vertical standard or frame-work, the upper plunger die, the lower plunger die, the bed embodying the bed die, the main shaft, a crank thereon, a pitman connecting said crank and the upper plunger

die, a plunger stirrup the lower end of which is attached to the lower plunger die, mechanism for supporting said plunger stirrup, a cam for actuating the plunger stirrup, mechanism for transmitting motion from said cam to the plunger stirrup, a feeding hopper having a flat bottom surface through which an aperture in communication with the interior of the hopper opens, embodying also a pin socket, the spring, the hopper shaft, the lever arm, the lateral pin, the rocker arm, and the cam for actuating said rocker arm, substantially as set forth.

12. In a machine for forming pills by compression, in combination, the upper and lower plunger dies, a bed plate embodying a bed die, means for occasioning the reciprocation of the plunger dies, a feeding hopper, a cam having both a crest and corrugations, connective mechanism through which the crest occasions the retraction and the corrugations the shaking of the said hopper, and a spring for advancing said hopper, substantially as set forth.

13. In a machine for forming pills by compression, in combination, the upper and lower plunger dies, a bed plate embodying a bed die, means for occasioning the reciprocation of the plunger dies, a feeding hopper, and a magazine adapted to discharge into the hopper and connected to a rocking or oscillating portion of the machine, substantially as set forth.

14. In a machine for forming pills by compression, in combination, the upper and lower plunger dies, a bed plate embodying a bed die, means for occasioning the reciprocation of the plunger dies, a feeding hopper, a magazine adapted to discharge into the hopper, and a link connecting the said magazine to a moving part of the machine, substantially as set forth.

15. In a machine for forming pills by compression, in combination, the upper plunger die, the lower plunger die, means for occasioning the reciprocation of said plunger dies, a feeding hopper, means for occasioning the backward and forward movement of said hopper on a bed plate, and a bed plate embodying a bed die, which bed plate is, as to that part of its surface in contact with the feeding hopper, formed of a single piece or surface of material, substantially as set forth.

16. In a machine for forming pills by compression, in combination, the upper and lower plunger dies, a bed plate embodying a bed die, means for occasioning the reciprocation of said plunger dies, the feeding hopper, means for occasioning the backward and forward travel of the hopper, and the chute, provided with a sieve bottom, substantially as set forth.

17. In a machine for forming pills by compression, in combination, the upper and lower plunger dies, a bed plate embodying a bed die, means for occasioning the reciprocation of said plunger dies, means for sweeping fin-

ished pills from the bed plate, the sieve bottomed chute, and devices for causing the jarring of said chute, substantially as set forth.

18. In a machine for forming pills by compression, in combination, the upper and lower dies, means for occasioning the reciprocation of the upper die, a train of devices, of which the plunger stirrup forms a part, for occasioning the reciprocation of the lower plunger, the bed plate, devices for sweeping the finished pills from the bed plate, the sieve bottomed chute, and an arm connected to said chute and projecting into the path of the plunger-stirrup, substantially as set forth.

19. In a machine for forming pills by compression, in combination, the upper and lower dies, means for occasioning the reciprocation

of the upper die, a train of devices, of which the plunger stirrup forms a part, for occasioning the reciprocation of the lower plunger, the bed plate, devices for sweeping the finished pills from the bed plate, the sieve bottomed chute, supporting wires upon which said chute is mounted, and an arm connected to said chute and projecting into the path of the plunger stirrup, substantially as set forth.

In testimony that we claim the foregoing as our invention we have hereunto signed our names, this 28th day of February, A. D. 1889.

OBERLIN SMITH.

HARRY K. MULFORD.

Witnesses:

JNO. W. SHEPPARD,

FRANK S. HORT.

Correction in Letters Patent No. 413,310.

It is hereby certified that in Letters Patent No. 413,310, granted October 22, 1889, upon the application of Oberlin Smith, of Bridgeton, New Jersey, and Harry K. Mulford, of Philadelphia, Pennsylvania, for an improvement in "Machines for Manufacturing Compressed Pills," an error appears in the printed specification requiring correction, as follows: In line 31, page 1, the word "fed" should read *feed*; and that the Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned and sealed this 12th day of November, A. D. 1889.

[SEAL.]

CYRUS BUSSEY,
Assistant Secretary of the Interior.

Countersigned:

C. E. MITCHELL,
Commissioner of Patents.