(No Model.)

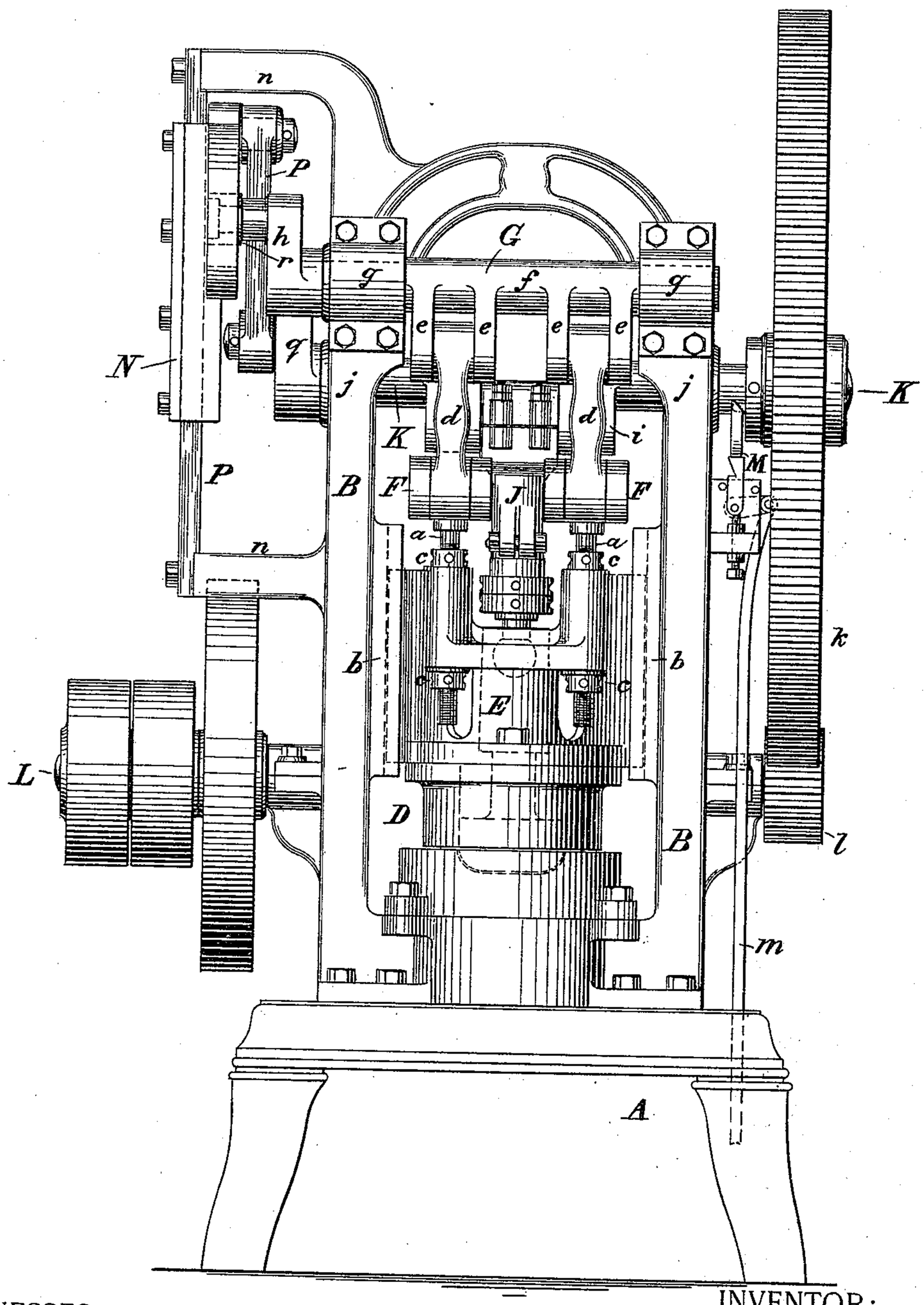
3 Sheets—Sheet 1.

F. M. LEAVITT.

DRAWING OR STAMPING PRESS.

No. 451,224. Patented Apr. 28, 1891.

FIG. 1.



WITNESSES:
John Becker
Fred White

INVENTOR:
Frank M. Leavitt,
By his Attorneys,
Arthur G. Fraser & Co.

(No Model.) 3 Sheets—Sheet 2.

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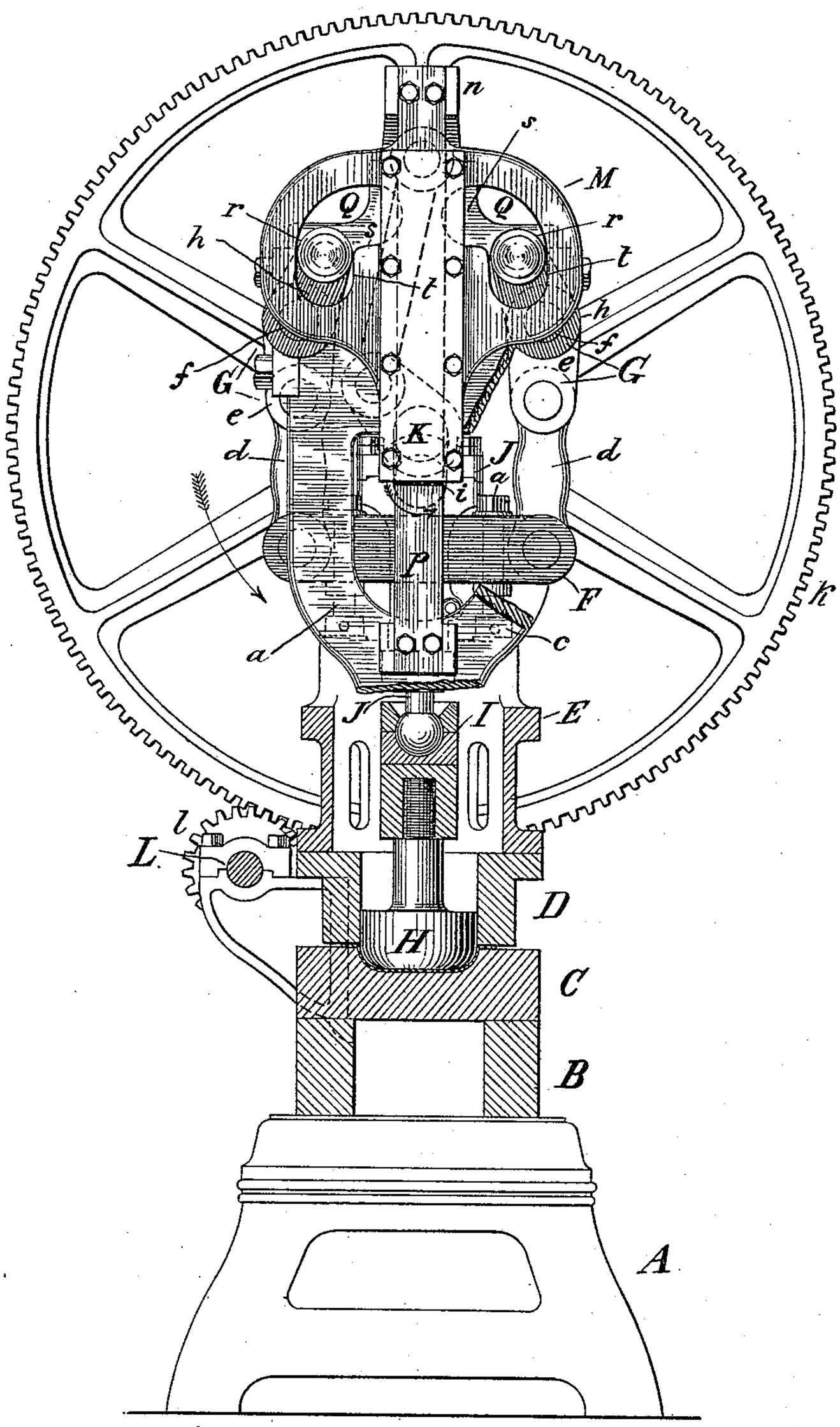
FIG. 2.



WITNESSES:
John Becker
Fred Whitey

INVENTOR:
Frank M. Leavitt,
By his Attorneys,
Arthur O. Brayer & Co.

(No Model.) 3 Sheets—Sheet 3.

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FIG. 5.

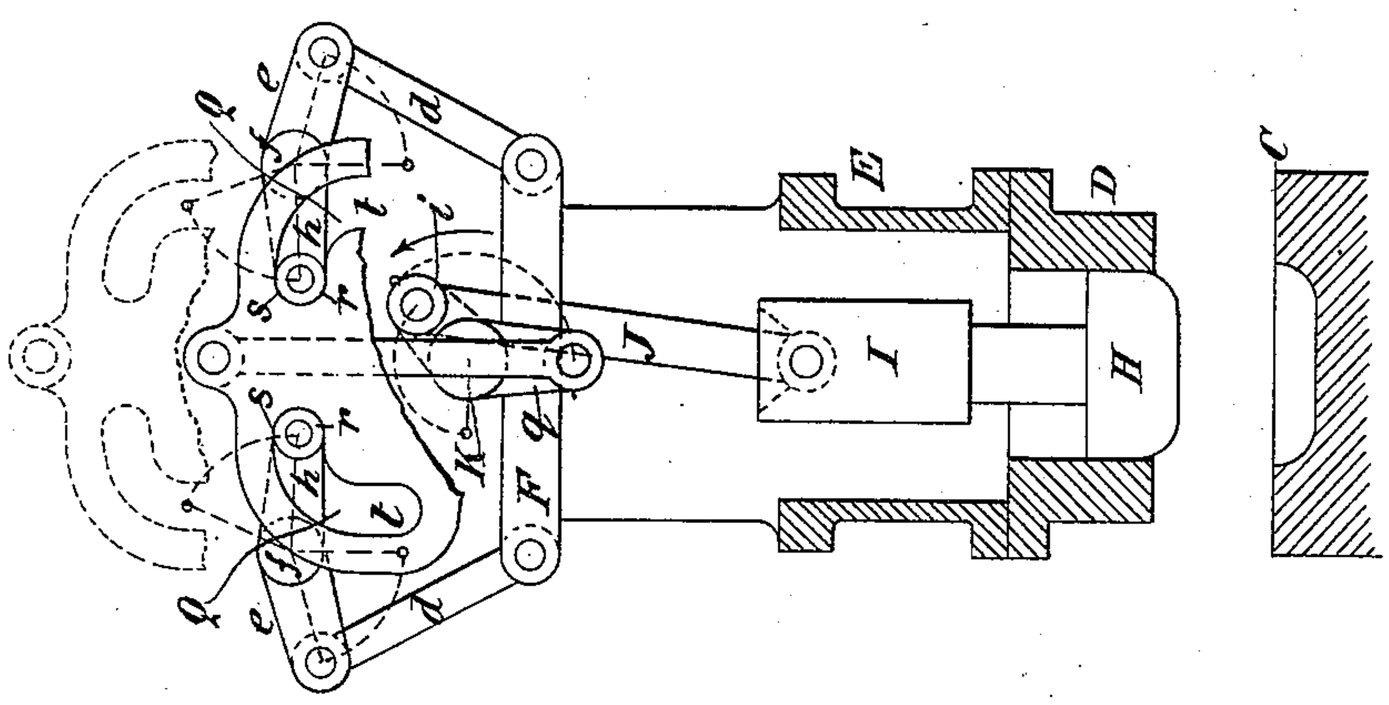


FIG. 4.

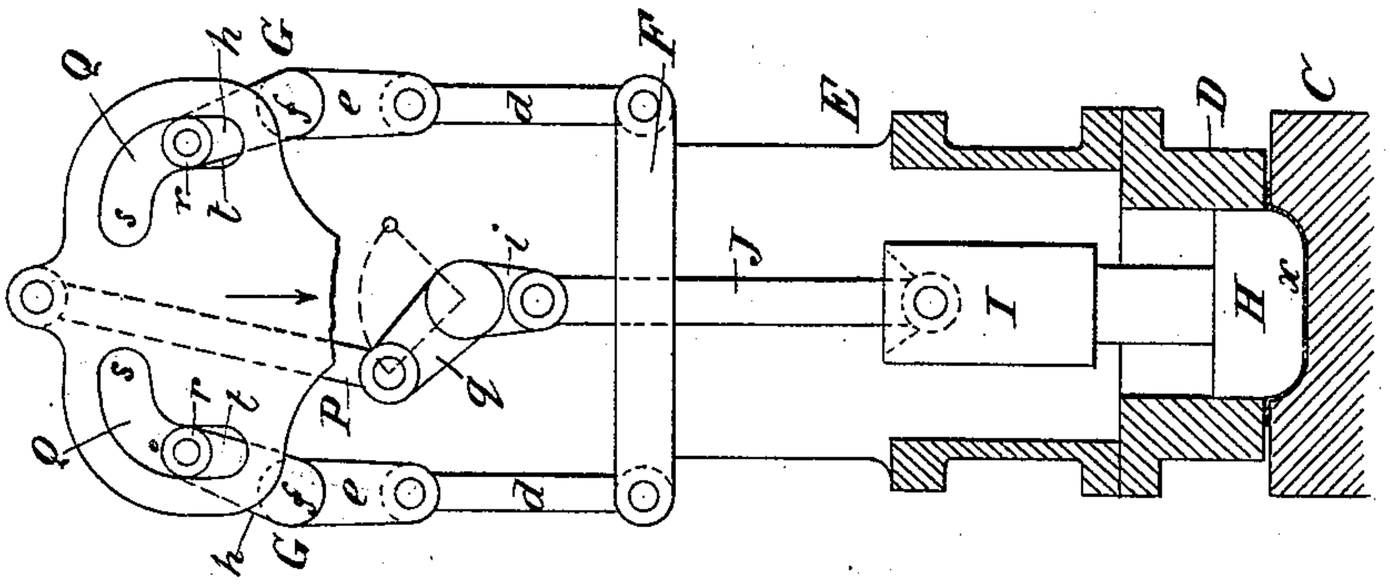
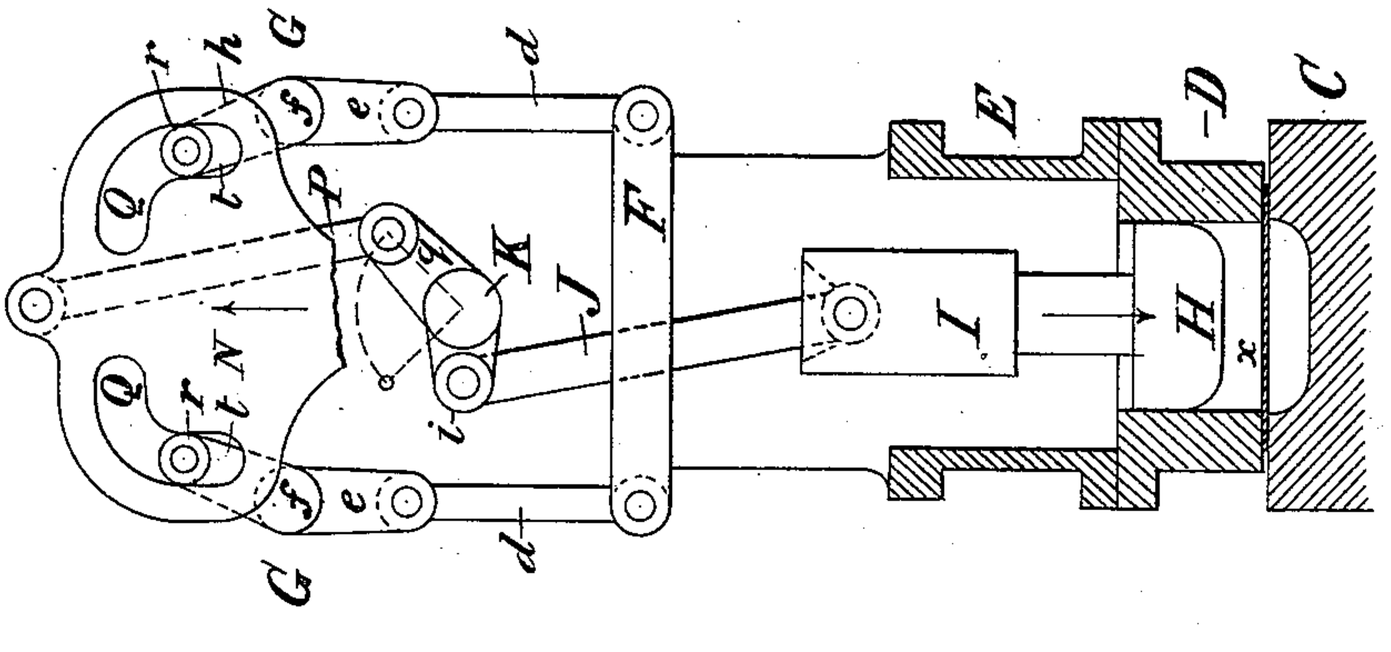


FIG. 3.



WITNESSES:
John Becker
Fred Whitz

INVENTOR:
Frank M. Leavitt,
By his Attorneys,
Arthur C. Fraser & Co.

UNITED STATES PATENT OFFICE.

FRANK M. LEAVITT, OF BROOKLYN, NEW YORK.

DRAWING OR STAMPING PRESS.

SPECIFICATION forming part of Letters Patent No. 451,224, dated April 28, 1891.

Application filed September 8, 1890. Serial No. 364,360. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. LEAVITT, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Drawing or Stamping Presses, of which the following is a specification.

This invention relates to presses for working sheet metal or other material wherein the blank or sheet to be operated upon is gripped against the die by a blank-holder and held there during the operation of the plunger or punch. Such presses are most commonly used for drawing sheet metal into deep dies in forming pans, basins, can-covers, &c., and are known as drawing-presses. Presses of this character are also used for cutting out and embossing a blank, or for first cutting out and subsequently punching a blank, and are known as double or triple action cutting, punching, or embossing presses, as the case may be. In presses of this general character the plunger or male die or punch is usually connected to a crank on the driving-shaft, which at each operation of the press forces the plunger down and lifts it again. The blank-holder through which the plunger moves descends in advance of the plunger until it reaches the blank or piece of sheet metal and stops, pressing this firmly against the fixed die. It then pauses or dwells in this position in order to firmly hold the blank during the action of the plunger, and it then ascends either with or immediately after the plunger to regain its normal elevated position. This movement of the blank-holder, being somewhat complicated, has usually been imparted by means of cams, which are subject to wear, so that the blank-holder is not held firmly to its work. For the avoidance of this difficulty various arrangements of toggles have been devised, some of which have been mechanically objectionable.

The object of my present invention is to provide an improved and simplified mechanism for imparting the requisite movement to the blank-holder. I provide one or more oscillating levers connected by toggle-links or other mechanical connection to the blank-holder, so that as the levers are vibrated to bring their arms into line with the direction of movement of the blank-holder the latter is forced against the die, and for operating this lever I provide a reciprocating slide driven from the driving or crank shaft and having a movement independent of that of the plunger. This slide is connected with the lever or levers through the medium of a cam connection so constructed that toward one end of the movement of the slide the cam shall act to communicate its movement to the levers, while toward the opposite end of its movement the cam shall be idle, serving only to hold the levers stationary in their extended position in order to cause the blank-holder to dwell in contact with the die. A cam-surface of this construction is subject to the minimum of wear and acts upon the levers by imparting a direct thrust to them, which by the movement of two oppositely-arranged levers is exactly balanced between them.

Figure 1 of the accompanying drawings is a front elevation of my improved drawing-press in its preferred form. Fig. 2 is a side elevation thereof, looking from the left in Fig. 1, the frame of the machine being partly broken away and the die and blank holder and plunger-frame in mid-section. Figs. 3, 4, and 5 are diagrammatic views corresponding to Fig. 2, Fig. 3 showing the machine at the instant when the blank-holder has gripped the blank, Fig. 4 showing it when the plunger is at extreme downstroke and the plunger and blank-holder are ready to reascend, and Fig. 5 showing it when both plunger and blank-holder are raised to their normal positions.

On a suitable base A is mounted a fixed frame B, forming the bearings for the working parts, and to this frame is fixed a stationary or female die C. The blank-holder D is fastened to a frame E, which reciprocates between vertical guides *b b* on the inner sides of the frame B. Transverse bars or cross-heads F F are fastened rigidly but adjustably to the frame E through the medium of screw rods or posts *a a* and nuts *c c*. These cross-heads F F are connected by links or connecting-rods *d d* to cranks or lever-arms *e e*, projecting from shafts *f f*, which are hung in bearings *g g* at the upper part of the frame B on opposite sides thereof. There are two shafts *f f* on opposite sides of the frame and

two sets of links *d d*. Each shaft *f* has at one end a crank-arm *h*. Each shaft *f*, with its arms *e e* projecting downwardly or outwardly and its arm *h* projecting upwardly or inwardly, constitutes a lever of the first class, which is designated as a whole by the letter G.

The plunger or male die H, commonly called the "punch," which enters the hollow in the female die C and is made of any suitable shape conforming to that of the article to be produced, is carried by the plunger-frame I, Fig. 2, which is connected by a pitman or connecting rod J to a crank *i*, formed on the main crank-shaft K. This shaft has bearings in the frame B at *j j*. The shaft K is driven from a driving-shaft L, having fast and loose pulleys, through a pinion *l* and gear-wheel *k*. This wheel *k* is mounted so as to turn freely on the shaft K, which is normally stationary, and whenever it is desired to operate the press this wheel is clutched to the shaft K by means of a one-revolution clutch M, Fig. 1, of any usual construction, which is brought into action by pressing down a treadle (not shown) which connects with the clutch through a rod *m*. The construction of such clutches is well understood in the art, and I have therefore not shown the clutch in detail.

So far as described the machine is of a well-known construction. I will now proceed to describe those features which are added or altered in the application of my present invention.

The frame B carries on one side two lateral extensions *n n*, between which is fixed a vertical bar *p*, constituting a slideway. On this bar is mounted a plate or slide N, which is connected by a connecting-rod P with the crank *q* on the end of the main shaft K. Hence at each revolution of this shaft the slide N is reciprocated from its lowest position upwardly and back downwardly to the starting-point. The slide N is constructed to engage the crank-arms *h h* of the two levers G G through the medium of a cam connection so constructed that when the slide is at the bottom of its stroke the crank-arms *h h* shall be turned inwardly and downwardly; but as the slide rises they will be thrust outwardly and upwardly during the first part of this movement and during the latter portion of its upward movement and the first portion of its downward movement the arms shall be unaffected by it, and during the remaining portion of its downward movement the arms shall be again drawn inwardly and downwardly. This cam connection may be variously constructed; but I prefer the construction shown, which consists of cam-grooves Q Q in the slide N, engaging anti-friction rollers *r r*, mounted on the ends of the crank-arms *h h*, as best shown in Fig. 2. The cam-slots Q Q are approximately of inverted-L shape, their upper branches *s s* being approximately horizontal, while their lower branches *t t* extend vertically parallel with each other, the two branches being united by easy curves. The lower or parallel branches *t t* constitute idle portions of the cam connection, by means of which the dwell of the blank-holder while pressed against the die C is attained.

The operation may be best understood from Figs. 3, 4, and 5, which are somewhat diagrammatic in character, the cranks, levers, cam-slots, &c., being reduced in width to render their movements more clear.

While at rest the machine stands with its moving parts in the position shown in Fig. 5. The sheet of metal *x* is first laid on the lower die C, as shown in Fig. 3, and the press is then started by operating the clutch M, causing the shaft K to execute one revolution. The crank *q* by revolving in the direction of the arrow in Fig. 5 during the first half-revolution moves the slide N upwardly to the position shown in dotted lines in Fig. 5. This upward movement causes the cam-slots Q Q to first lift the rollers *r r* and then thrust them outwardly, vibrating the arms *h h* and levers G G until the rollers have traveled through the upper branches and curved portions of the slots. While the rollers are moving in the curved portions of the slots the angular movement thus communicated to the arms *h h* gradually decreases in speed, and finally stops as the rollers enter the vertical portions *t t*. While the rollers are traveling in the vertical portions of the slots the arms *h h* are stationary, their levers G G having now reached their extreme positions with their arms *e e* directed downwardly in line with the links *d d*, so that the frame E and blank-holder D are lowered to their lowest positions and forced tightly against the blank *x*, which is thus pressed tightly between the blank-holder and die. With the proportions shown this occurs at the first three-eighths of a revolution, the parts having now reached the positions shown in Fig. 3. During the ensuing quarter of a revolution, until the position shown in Fig. 4 is reached, the slide N is completing its upward and commencing its downward movement, and the vertical portions *t t* of the slots are engaging the rollers *r r*, holding the latter and the levers G G stationary and causing the blank-holder D to dwell in contact with the blank, so that it maintains its pressure against the latter. The remaining portion of the revolution carries the parts from the position shown in Fig. 4 back to the normal position shown in Fig. 5. In so doing the descent of the slide N brings first the curved and then the horizontal portions of the slots into engagement with the rollers *r r*, thereby tilting the levers G G to the position shown in Fig. 5 and pulling up through the links *d d* on the frame E, so that the blank-holder is lifted to its highest position.

The crank *i*, operating the plunger, is set at an angle of approximately one hundred and thirty-five degrees in advance of the crank *q*, as shown, so that normally it stands some-

what below its uppermost position, and upon starting it first lifts the plunger H slightly until it passes over the center, and then carries down the plunger, but at a slower rate of speed than that at which the blank-holder descends. At the instant that the blank-holder reaches its lowest position the plunger H has not yet reached the blank. (See Fig. 3.) During the period of dwell of the blank-holder the plunger completes its downward movement and acts upon the blank, drawing it or embossing or punching it, as the case may be, while its margins are held by the blank-holder. Fig. 4 shows the parts at the instant that the plunger has completed its work. From this moment both the plunger and blank-holder reascend, finally stopping in the positions shown in Fig. 5.

The exact relative angle of the two cranks q and i is not essential, as the crank i might be set somewhat farther in advance of the crank q than the exact relation shown, provided it be not set so far as to bring the plunger H into contact with the blank x until after the blank-holder D has clamped the blank.

It will be understood that when the lever-arms e and links d are brought into line, after the manner of toggle-levers, the thrust due to the pressure transmitted to the blank-holder is received against the bearings g g of the shafts G G. Consequently the maintenance of the levers in this position involves no strain on the crank-arms h, rollers r, or the surfaces of the cam-slots Q. There is consequently no appreciable wear of the cam-slots in the portions t during the idle movement of the parts. It is only in this portion of the cam that wear is objectionable, as in this portion only will wear affect the pressure with which the blank is gripped between the blank-holder and die. Any wear elsewhere will simply vary the extent of lift of the blank-holder or the exact time at which it descends, both of which are immaterial. It follows that when the proper adjustment of the height of the blank-holder is once made by means of the screws a a and adjusting-nuts c c to give the requisite pressure against the blank this adjustment will be maintained unimpaired as long as the machine may be operated with blanks of the same thickness and until some wear occurs in the bearings that necessitates a new adjustment; or, in other words, the adjustment is maintained for an indefinitely long time.

I am aware that cams have been heretofore used in drawing-presses to hold a toggle stationary and secure a dwell of the blank-holder during the operation of the plunger; but in such constructions the toggle has been operated directly by some part moving with the plunger or its operating-crank or connecting-rod and necessarily partaking of the motion thereof. In such constructions it is impossible to secure any lead of the blank-holder-operating mechanism over the plunger-operating mechanism, and it is consequently necessary to give both the plunger and blank-holder a much longer stroke, thereby increasing the size of the machine and reducing its working capacity as compared with the construction provided by my invention. By my introduction of a separate reciprocating part N as an intermedium by which to operate the toggles I secure the advantage of driving all the parts in the best relative order to secure the most compact structure, affording the greatest strength for a given weight.

I have stated that the blank-holder-operating mechanism has a lead over the plunger-operating mechanism. By this I mean that the blank-holder is given an effective operation in advance of the plunger. The actual lead of the crank, operatively considered, is different from the apparent lead shown in the drawings, since from the fact that the slide N in the construction shown moves in the opposite direction to the blank-holder the crank q is set to one hundred and eighty degrees from the position it would occupy if it acted directly instead of inversely on the blank-holder. The actual lead of the cranks is approximately forty-five degrees. This would be apparent if the slide N were inverted and caused to move first downwardly and then upwardly, by which the same resulting movement might be attained.

By the expression "cam connection" between the slide N and crank-arms h h, I desire to cover any suitable construction of cam-faces on the one part acting against suitable faces or rollers on the other, which shall secure the idle movement or dwell hereinbefore described. The construction shown is believed to be most simple and practical; but other arrangements of cam-surfaces might be substituted. For example, the arrangement of the cam-grooves in the slide and the rollers on the lever-arms might be reversed to the same effect.

It must not be inferred from the particularity of detail with which I have described the construction of press shown in the drawings that my invention is limited to the exact or even to the general construction shown. For example, the construction of the blank-holder frame with cross-heads F F and adjusting-screws a a and nuts c c is not essential, as other ways are known in the art for adjusting the height of the blank-holder relatively to the die, almost any one of which might be adopted in lieu of that shown.

My invention is to be understood as limited only to the novel features specified in the claims, and as to all other features the construction or arrangement of the parts may be varied in any manner that the skill, judgment, or taste of the constructer may suggest.

I claim as my invention the following-defined novel features or improvements, substantially as hereinbefore specified, namely:

1. In a press of the character described, comprising a fixed die, a reciprocating plunger, a reciprocating and pausing blank-holder, a driving-shaft, and connections for com-

munication motion from the shaft to the plunger, a means for imparting the requisite movement to the blank-holder, consisting of the combination of an oscillating lever connected to the blank-holder, a reciprocating slide driven from the shaft and having a movement independent of the plunger, and a cam connection between said slide and lever for oscillating the latter by the reciprocation of the slide, constructed with an idle cam-surface in engagement at one end of the movement of the slide and while the lever is in the position to hold the blank-holder against the die, whereby during such portion of the movement of the slide the blank-holder pauses and holds the blank against the die during the action of the plunger.

2. In a press of the character described, comprising a fixed die, a reciprocating plunger, a reciprocating and pausing blank-holder, a driving-shaft, and connections for communicating motion from the shaft to the plunger, a means for imparting the requisite movement to the blank-holder, consisting of the combination of oppositely-arranged oscillating levers connected to the blank-holder, a reciprocating slide driven from the shaft and having a movement independent of the plunger, and opposite cam connections between said slide and the respective levers for oscillating the latter by the reciprocation of the slide, constructed to exert a balanced thrust in opposite directions against the levers and having idle cam-surfaces in engagement at one end of the movement of the slide and while the levers are in the position to hold the blank-holder against the die.

3. In a press of the character described, comprising a fixed die, a reciprocating plunger, a reciprocating and pausing blank-holder, a driving-shaft, and connections for communicating motion from the shaft to the plunger, a means for imparting the requisite movement to the blank-holder, consisting of the combination of an oscillating lever connected to the blank-holder, a reciprocating slide driven from the shaft and having a movement in advance of and independent of the plunger, and a cam connection between said slide and lever for oscillating the latter by the reciprocation of the slide, constructed with an idle cam-surface in engagement at one end of the movement of the slide and while the lever is in the position to hold the blank-holder against the die, whereby during such portion of the movement of the slide the blank-holder pauses and holds the blank against the die during the action of the plunger and the blank-holder-operating mechanism by having a lead relatively to the plunger-operating mechanism enables the throw of the parts to be shortened and the time wasted in idle movements reduced.

4. The combination of a fixed die C, reciprocating plunger H, a crank-shaft K, a blank-holder D, oscillating levers G G, links *d d*, connecting the lower arms of said levers to the blank-holder, reciprocating slide M, having cam-surfaces engaging the upper arms of said levers, and driving connections between the crank-shaft and plunger and between the crank-shaft and said slide.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

FRANK M. LEAVITT.

Witnesses:
GEORGE H. FRASER,
FRED WHITE.