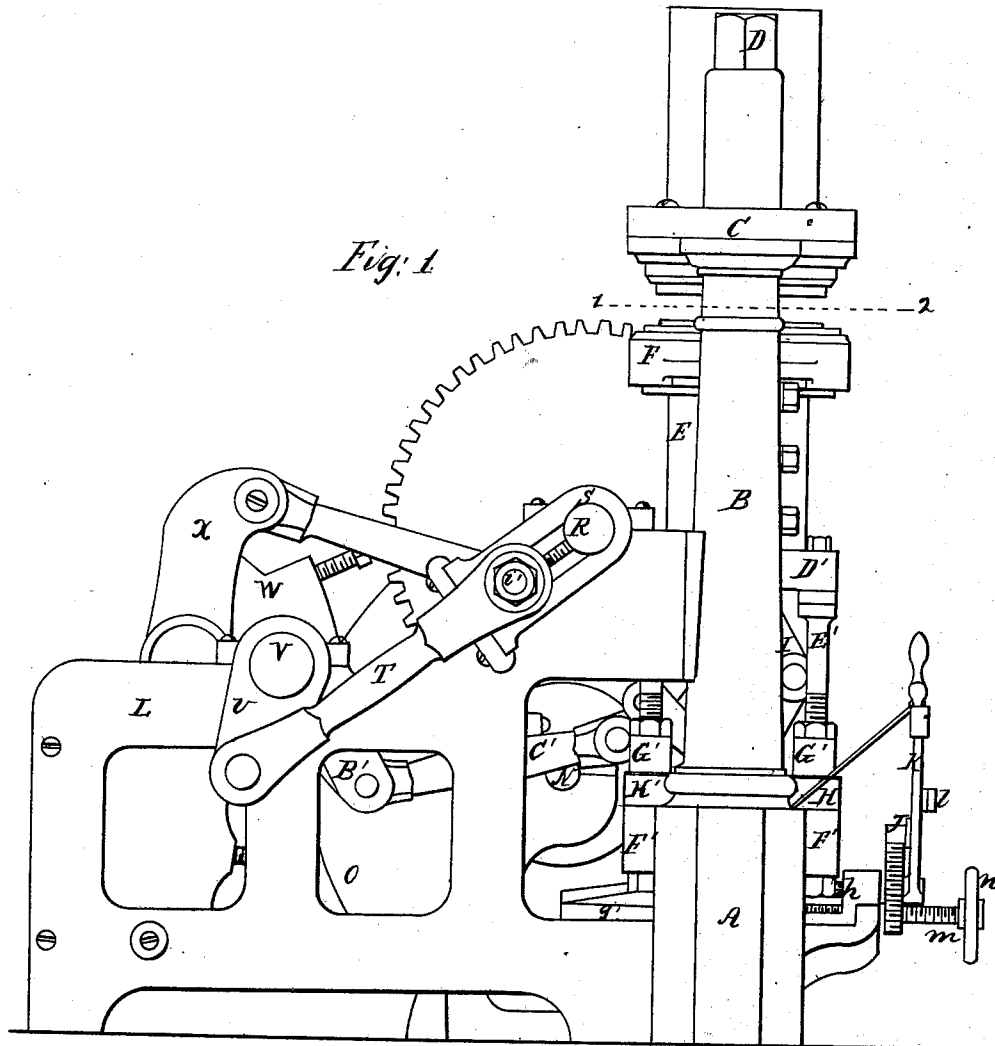


N. C. LOMBARD & M. BRAY.  
MACHINE FOR FORMING SHEET METAL WARE;

No. 78,105.

Patented May 19, 1868.



Witnesses;  
Mellen Bray  
Cly Page jr

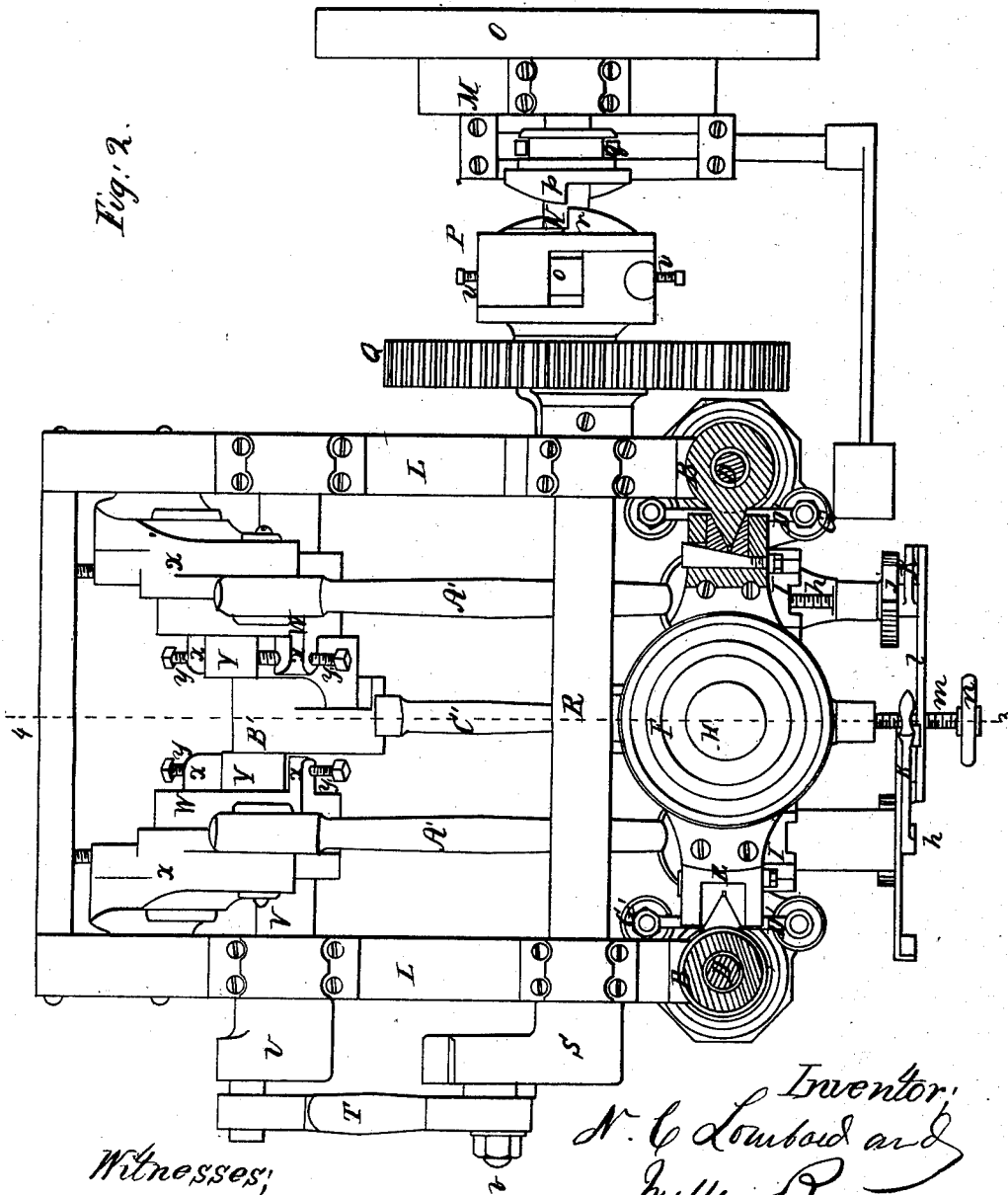
Inventor;  
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by their attorney  
A. Pollock

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Fig. 2.



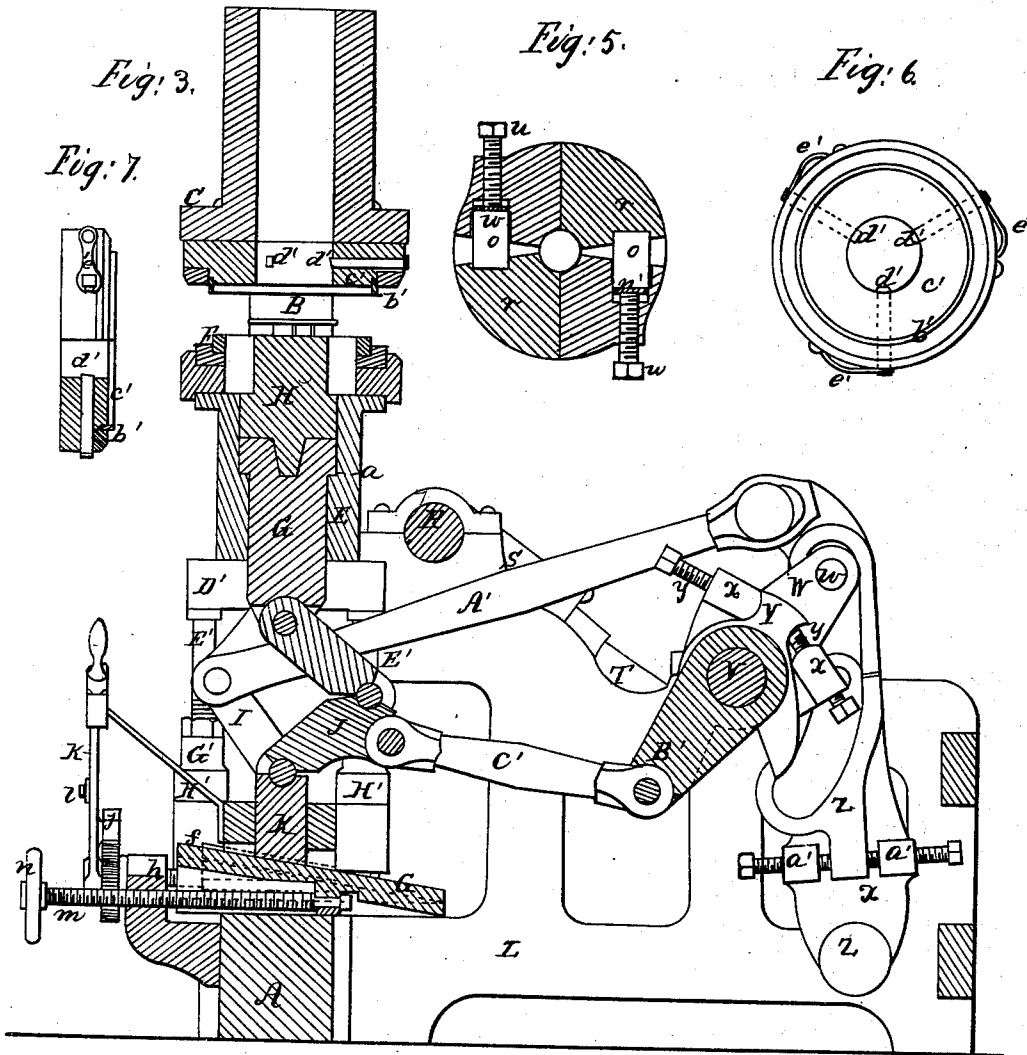
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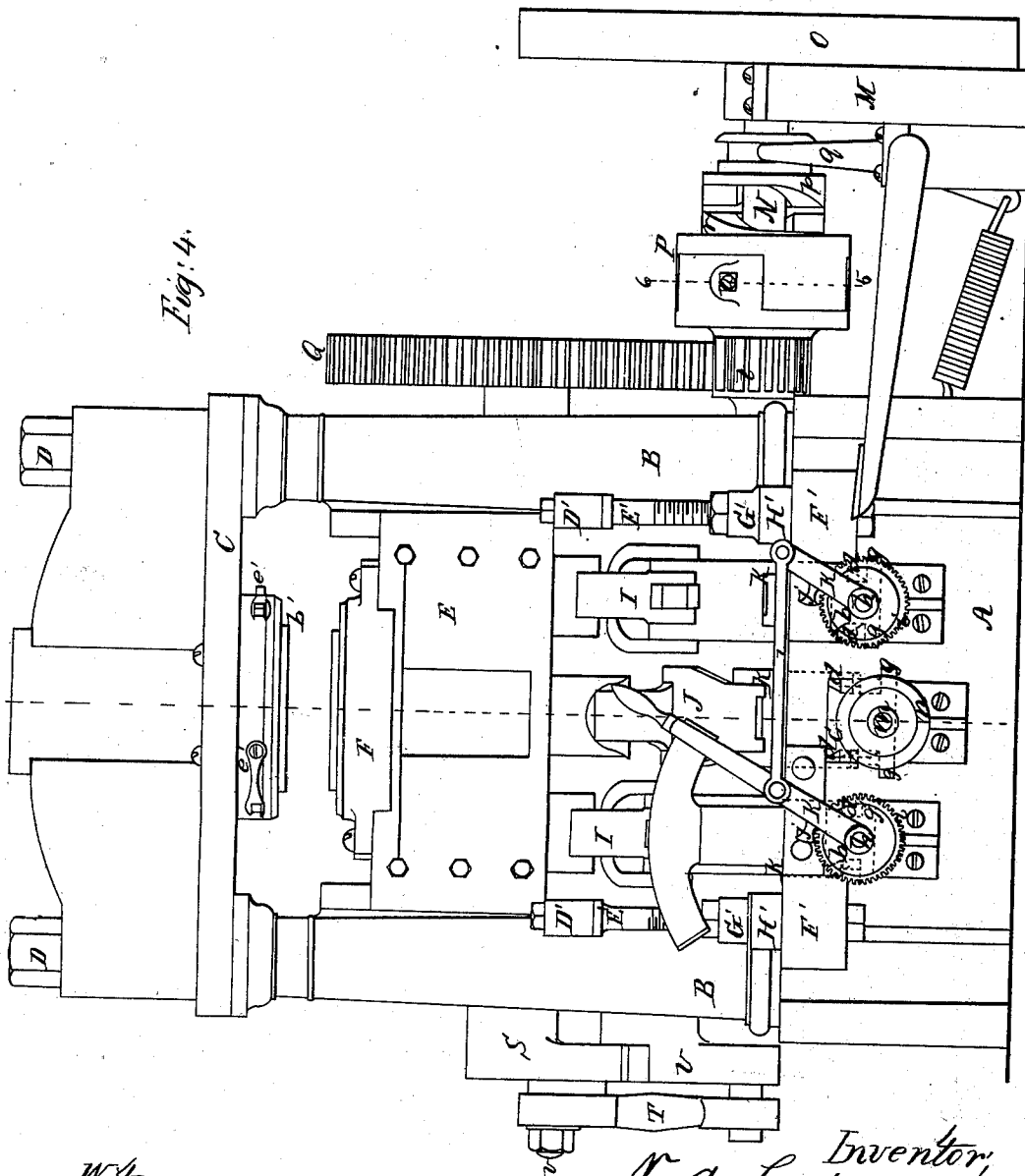
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# United States Patent Office.

N. C. LOMBARD AND MELLEN BRAY, OF BOSTON, MASSACHUSETTS, ASSIGN-  
ORS TO MELLEN BRAY.

*Letters Patent No. 78,105, dated May 19, 1868.*

## IMPROVED MACHINE FOR FORMING SHEET-METAL WARE.

The Schedule referred to in these Letters Patent and making part of the same.

### TO ALL WHOM IT MAY CONCERN:

Be it known that we, N. C. LOMBARD and MELLEN BRAY, of Boston, in the county of Suffolk, and State of Massachusetts, have invented new and useful Improvements in Machines for Forming Sheet-Metal Ware, the same being improvements on a machine invented by MELLEN BRAY, for which Letters Patent were granted to him, December 12, 1865, and numbered 51,421; and we do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings making a part of this specification, in which—

Figure 1 is a side elevation of a machine embodying our improvements.

Figure 2 is a sectional plan, the cutting-plane being on line 1 2, on fig. 1.

Figure 3 is a vertical section on line 3 4, on fig. 2.

Figure 4 is a front elevation.

Figure 5 is a transverse section through clutch on line 5 6, on fig. 4.

Figures 6 and 7 are details, showing the construction of the female die for forming boxes and other articles having vertical sides.

The subject-matter of our invention relates, in the first place, to the mechanism by which the dies are operated and controlled, and consists—

First, in the use, in connection with a vibrating-shaft, of one or more cranks, keyed or otherwise made fast to said vibrating-shaft, so as to vibrate in unison with it, and carrying on their outer ends friction-trucks, working in slots in side-levers, said levers being attached to the frame of the machine below the vibrating-shaft by means of fulcrum-pins at their lower ends, while the upper ends of said levers are connected, by means of connecting-rods and wrist-pins, to the side toggles that work the shell. Said levers are made in two pieces, the secondary one being pivoted to the principal piece near the middle of its length, and provided with a groove or path, extending nearly the whole length of the lever, in such a manner that about one-half of the path shall be made in the metal of the principal piece, while the other half, more or less, as the case may be, shall be made in the metal of the movable piece, and the two shall be so connected as to make one continuous path or groove, of a length sufficient to allow the friction-truck to travel the whole distance necessary for forming the deepest dish, while at the same time one portion of the path may be adjusted so as to alter the shape of the path, and consequently vary the movement of the toggles that control the movement of the shell. It does not follow that the path must be made of just such a form as is represented in the drawings, but it is evident that it may be made straight, in the form of an arc of a circle, or curved in any form required to give the necessary movement to the toggles, without at all affecting the principle.

It also consists, in the second place, in the application of adjustable dogs to the said vibrating-shaft, and working in conjunction with the vibrating-cranks above mentioned, for the purpose of operating the central crank, which is fitted to said shaft in such a manner as to be free to move independently of said shaft except when acted upon by one or the other of said dogs.

Thirdly, in the use, in connection with the above mechanism, of a crank on the main gear-shaft, having an adjustable crank-pin, the purpose of which is to enable us to regulate the movement of the dies, and proportion their movements according to the depth of the dish, by increasing or diminishing the amount of the vibration given to the shaft.

Fourthly, in the application of adjustable wedges to the under sides of the blocks, to which the lower ends of the toggles are attached, in such a manner that, while the wedges are free to be moved out or in, they are so attached to the base of the machine in which they move, and also to the blocks to which the toggles are attached, that the blocks are prevented from being lifted by the action of the toggles, the purpose of said wedges being to regulate the pressure of the dies, and also, in the case of the central one, to be used, in conjunction with the adjustable crank-pin above mentioned, to regulate the motion of the plunger and forming-die.

Fifthly, in so constructing the plunger that operates the forming-dies, and so fitting it to the shell, that when the shell is in its lowest position the plunger shall rest upon the shell, and when the shell is moved up by the operation of the side toggles the plunger shall move with it, so that the top of the male forming-die attached to the plunger, and the top of the holding-die, attached to the shell, shall bear the same relation to each other till the upward movement of the shell has ceased, and the blank is firmly held between the holding-surfaces.

Sixthly, in a peculiar construction of clutch, by which it is made comparatively elastic or yielding, by which the concussion caused by throwing the clutch into gear is greatly reduced.

The subject-matter of our invention relates, in the second place, to a device for relieving the toggles from a portion of the strain and shock attending the downward movement of the shell and plunger, and consists in placing under each end of the shell a stop-bar, resting on powerful springs, so arranged that the height of the bar may be varied to adapt it to the varying movement of the shell, when the same is varied to adapt it to the depth of dish to be formed.

Our invention relates, in the third place, to a die for forming such articles as have vertical sides, such, for instance, as blacking and pill-boxes, and consists in the inserting in the female die of a series of spring-catches, arranged radially around the opening in the die in such a manner that their inner ends shall project slightly into the opening, but so made that while they shall present no impediment to the upward movement of the male die, they shall act to prevent the dish from being drawn down again with the male die, and hold it in suspension till the next operation of the machine.

In the drawings, A is the base, B the columns, and C the cross-head, all bolted firmly together by the tie-bolts D, and forming the arch, within which the work of forming the dish is performed. E is the shell, which carries the male cutting and lower holding-die F. G is the plunger, carrying the male forming-die H. I I are the side toggles, that operate the shell, and J is the central toggle, that operates the plunger G. The upper portion of the plunger G is made larger in diameter than the lower portion, so as to form a shoulder at *a*, and the shell is bored out to fit the two diameters of the plunger, and so that the shoulder *a* of the plunger shall rest on a corresponding shoulder formed in the shell, so that when the shell is moving up to cut and hold the metal the plunger shall be moved up with it.

K K K are the blocks, to which the lower ends of the toggles are attached, and which are connected to the wedges *b*, *b*, and *c*, by means of lips, *d d*, fitting to dove-tailed grooves in the upper corners of the wedges, as shown in dotted lines at *d*, in fig. 4, and at *f*, in fig. 3. The wedges *b*, *b*, and *c* are also provided with lips, *g g*, on their lower corners, which fit in corresponding grooves in the base, A, by which means they are prevented from being lifted up by the movement of the toggles. *h h* are the screws, for adjusting the wedges *b b*, and are operated in unison by means of the ratchet-wheels *i i*, the pawls *j j*, levers *k k*, and the link *l*. *m* is the screw for adjusting the centre-wedge *c*, and is operated by the hand-wheel *n*.

L L are the side-frames of the machine, on which are the bearings for the shafts. M is an independent stand, forming the outer bearings of the pinion or driving-shaft N, the inner bearing of which is on one of the side-frames of the machine. O is the fly-wheel and driving-pulley. P is the clutch and pinion, made in three parts, with powerful springs interposed between two of the parts, as shown at *o* in figs. 2 and 5, in such a manner that when that portion, *p*, which is splined to the shaft in the usual manner, and is clasped by the shipper-fork *q*, is thrown into gear with the portion *r* which is next to it on the shaft, the springs *o o* will be compressed, and cause the pinion *t* to be started more gradually, and thereby greatly diminish the strain on the teeth of the gears, and other parts of the mechanism, occasioned by throwing into gear a perfectly rigid and unyielding clutch.

The tension of the springs may be adjusted by means of the set-screws *u u* acting on the washers *u' u'*, inserted in the recess back of the springs. Q is the large gear, mounted on the shaft R, on the opposite end of which is the crank, S, carrying an adjustable crank-pin, *v*. T is a connecting-rod, by means of which, and the crank, U, motion is transmitted from the rotary shaft R to the vibrating-shaft V. W W are two cranks, keyed firmly to the shaft V, and provided with friction-trucks, *w w*, on their outer ends, to work in the paths or grooves in the oscillating side-levers X X, and also provided with the lugs *x x* and set-screws *y y*, by means of which the dogs Y Y, fitted to said shaft by the side of the cranks W W, are adjusted to the required position, and then made to move in unison with the said cranks, as though they were a part of the same casting. X X are two oscillating side-levers, each made in two pieces, the principal of which is attached to the frame of the machine by means of the fulcrum-pin *z*, on which it is free to oscillate, as it is operated upon by the friction-trucks *w w*, on the cranks W W.

At or near the middle of the levers X X are pivoted to the same the secondary pieces Z Z, in such a manner that the opposite end is free to move when acted upon by the set-screws *z z*, working in the lugs *a' a'*, cast on the principal pieces X X, so that they may be adjusted at the pleasure of the operator, as the circumstances of the case may require.

Said oscillating-levers are each provided with a groove or path extending about equal distances above and below the centre line of the vibrating-shaft V, and of sufficient length to allow sufficient scope or throw to the vibrating-cranks W W, to give the required throw to form the deepest dish.

Said path may be made of various forms, differing from those shown in the drawing, as, for instance, that portion which is cast in the principal portion of the lever, and which we have represented as being straight in the drawings, may be made an arc of a circle, or in the form of an increasing or diminishing curve, according to the taste of the builder, or to adapt it to any peculiar movement that he wishes to obtain. Also that portion of the path contained in the adjustable pieces Z Z may be made of a different form from that represented in the drawings; if it is found necessary to have the relief act more abruptly at any point while the dish is being formed.

To that end of the levers *XX*, opposite to the fulcrum-pin, on which they oscillate, is attached one end of the connecting-rods *A' A'*, through which the motion of the oscillating-levers *XX* is transmitted to the side toggles *I I*, to straighten them and move the shell and lower cutting and holding-dies up to the blank, and hold it firmly between the holding-dies.

*B'* is the central crank, so fitted to the vibrating-shaft that it is free to move independently of the movement of the shaft, except when controlled by the dogs *Y Y*, and connected to the central toggle by means of the connecting-rod *C'*. *D' D'* are the stop-bars, placed one under each end of the shell, and resting on the uprights *E' E'*, which have bearings in the lugs or ears *F' F'*, cast on the base, *A*, which serves to keep them in an upright position. *G' G'* are collars, fitted to the uprights *E' E'* by means of a screw-thread, so that they may be adjusted to any required height. Between the collars *G' G'* and the lugs or ears *F' F'* are placed the powerful springs *H' H'*.

The collars *G' G'* are to be adjusted so that when the spring is expanded, the top of the stop-bars shall be slightly above the line to which the bottom of the shell should come when it is moved down by the action of the toggles upon it, so that a large portion of the shock that would otherwise be received by the toggles shall be transferred from the toggles to the springs *H' H'*.

In figs. 6 and 7 is shown the manner of constructing the female cutting and forming-die when the article to be made has vertical sides. *b'* is the cutting-die; *o'*, the holding-surface; *d'*, the fingers that pick the dish off of the male die, and hold it in suspension while the male die recedes; *e' e'* are the springs which hold the fingers to their work.

The operation of our improved machine is as follows: The machine being at rest, with the shell and plunger in their lowest position, the metal to be operated upon is placed upon the surface of the cutting and holding-die. If the foot be now placed upon the treadle, and the clutch thrown into gear, the pinion, acting upon the large gear, revolves its shaft, and the crank, with the adjustable crank-pin, having a rotation given to it, transmits its motion to the longer crank on the outer end of the shaft *V*, and gives to said shaft a vibratory motion of greater or less extent, according as the adjustable crank pin is nearer to or farther from the centre of the gear-shaft.

When the shaft *V* begins to vibrate, and while the trucks on the outer ends of the cranks *W W* are travelling in that portion of the path cast in the principal piece *XX* of the oscillating-levers, their upper ends are thrown back farther from the shaft *V*, and, drawing upon the connecting-rods *A' A'*, straighten the toggles *I I*, and raise the shell and male cutting-die until the blank is cut and firmly held between the holding-dies.

In raising the shell by this operation, the plunger has also been raised the same distance, partially straightening the toggles to which it is attached, and also acting through the connecting-rod *A'* to move the crank *B'*. Just at this point, when the friction-trucks on the cranks *W W* have arrived at the point where the adjustable pieces, *Z Z*, are pivoted to the oscillating-levers *XX*, and the shell has arrived at its extreme upward position, the dog *Y* comes in contact with the surface on the central crank *B'*, provided for the purpose, and shown in dotted lines at *f'*, and compels it to travel with the shaft until the motion of the shaft in that direction ceases, which motion straightens the central toggles and forces the plunger upward, and, forcing the male forming-die, with the metal, into the female forming-die, forms the dish or other article to be made.

In this process, if the metal were held rigidly by the holding-dies without any relief, the metal would be torn asunder on account of the tendency to gather into wrinkles while being formed, which tendency causes the metal to become thicker at the edge, and thereby increases the pressure; but just when the plunger commences to move upward independently of the movement of the shell, the friction-trucks on the cranks *W W* pass into the adjustable portion of the slot or grooves in which they travel, and as they are so adjusted as to be a little eccentric to the shaft, when the trucks have arrived at this point, the continuation of the movement causes the levers *XX* to be thrown still farther back, and breaking the toggles from a straight line, allow the shell, with the lower holding-die, to drop enough to relieve the pressure and allow the metal to draw in, and thus prevent its breaking.

When it becomes necessary to adjust the machine for forming a dish of less depth, the adjustable crank-pin is moved in its crank toward the centre of the shaft *R* until its throw will give just sufficient vibration to the shaft *V*, so that the movement of the cranks *W W* from their upper position to a horizontal position, shall give a motion to the shell equal to the depth of the dish, plus the amount of space that it is desirable to have for clearance in removing the dish from the dies.

The wedge under the toggle that operates the plunger should now be drawn out, by means of its screw and hand-wheel, a sufficient distance to drop the block to which the lower end of the toggle is attached a distance just equal to the difference between the depth of the dish previously formed and the depth of the one that it is now desirable to form.

Then turn the machine around until the cranks *W W* have arrived at their lowest position, and their movement in that direction ceases; then stop the motion of the machine and adjust the dog *Y* on the shaft, by means of the set-screws on the cranks *W W*, until it raises the central crank *B'*, until the centre of the shaft *V* and the centre of the pins by which the connecting-rod *A'* is attached to the central toggle and to the central crank, are in line, when the machine is ready for operation.

The advantages claimed for this arrangement of mechanism for operating and controlling the dies over that used in the machine patented by MELLE BRAY, as above referred to, are, first, it is cheaper; second, it works smoother; and thirdly, its adaptability to longer throws; or, in other words, with this arrangement we are enabled to get throw enough to the dies to make the deepest dish, while with that it would be impossible to make a very deep dish without making an enormously large machine on account of the limited amount of throw that can be obtained by means of the cams and carriage as used in that machine.

Having thus described our improvements, and explained their operation, what we claim as new, and wish to secure by Letters Patent, is—

1. Imparting the motion of the vibrating-shaft V to the side-toggles that operate and control the motion of the cutting and holding-dies by means of the vibrating-cranks W W and the oscillating slotted levers X X, substantially as described.

2. So constructing the oscillating-levers X X that a portion of the slot or path may be adjusted, substantially as described.

3. The combination of the vibrating-cranks W W with the central crank B' by means of adjustable dogs or stops Y Y, substantially as described.

4. The yielding stop-bars, for arresting the downward motion of the shell and plunger, substantially as described.

5. The spring-fingers d', or their equivalents, for removing the dish from the male forming-die, substantially as described.

6. We do not claim, broadly, wedges placed under toggles for adjusting the same, for we are aware that such have been used before; but what we claim is the use of wedges under toggles for adjusting the pressure of the same when they are so attached to the toggles, and to the base in which they slide, that they may be freely moved out or in, while at the same time they hold the toggles firmly in their proper relation to the base, and prevent them from being disconnected from the same.

7. Fitting the plunger G to the shell E in such a manner that the plunger shall rest upon the shell, and be moved with it when the shell is moved up by the action of the side-toggles, substantially as described.

In testimony whereof, we have signed our names to this specification before two subscribing witnesses.

N. C. LOMBARD,  
MELLEN BRAY.

Witnesses:

CHAS. A. JORDAN,  
DAVID PRAY.