J. E. OGDEN AND J. KENNEDY.

METAL WORKING MACHINE.

APPLICATION FILED MAY 5, 1919.

1,424,671.

Patented Aug. 1, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

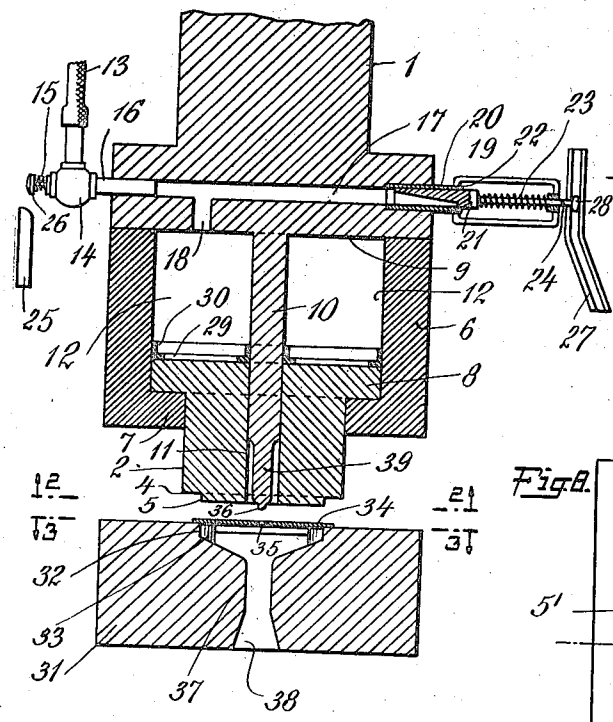


Fig. 2.

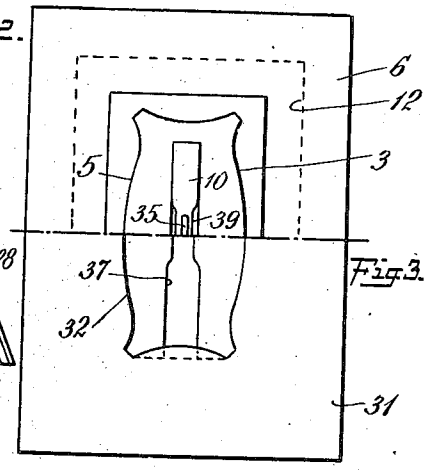


Fig. 3.

Fig. 8.

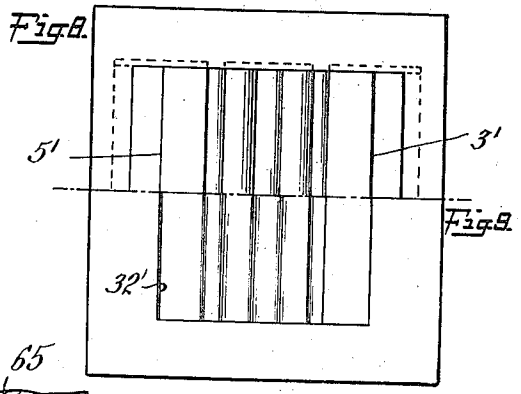
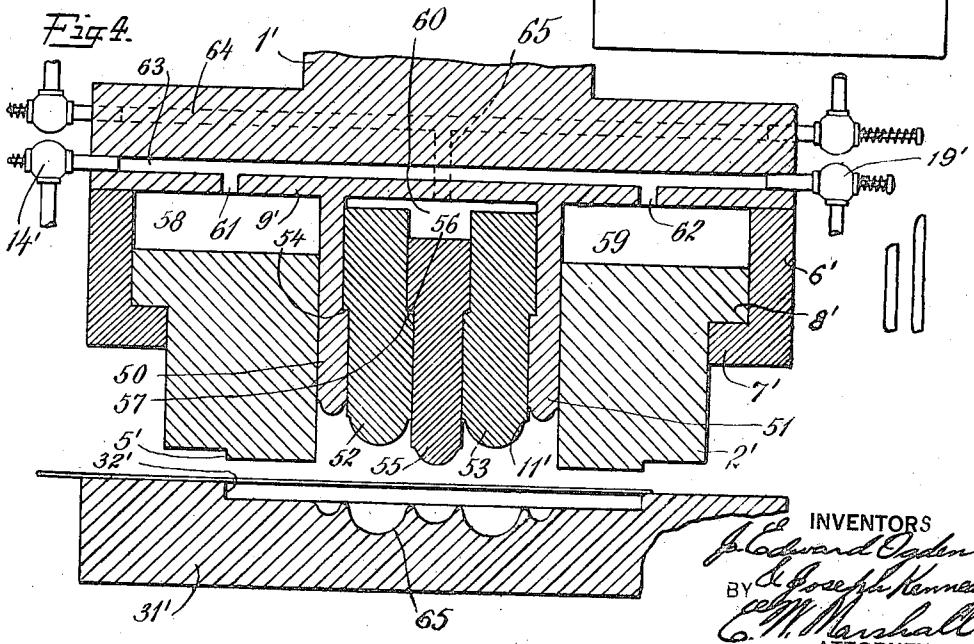


Fig. 9.

Fig. 4.



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2 SHEETS—SHEET 2.

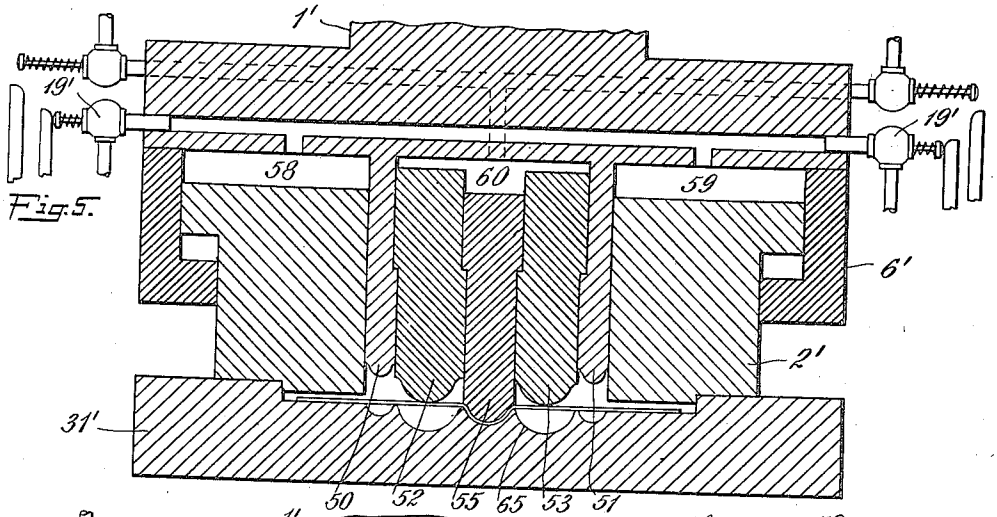


Fig. 5.

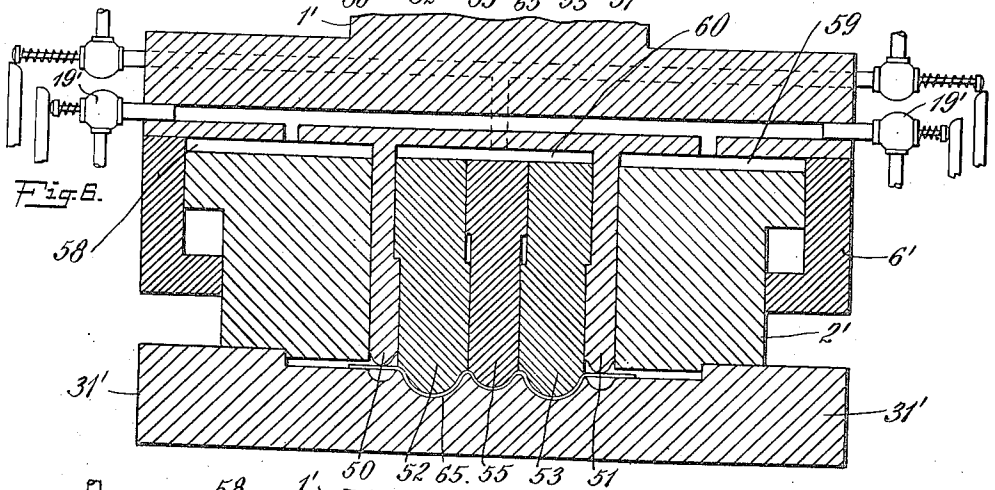


Fig. 6.

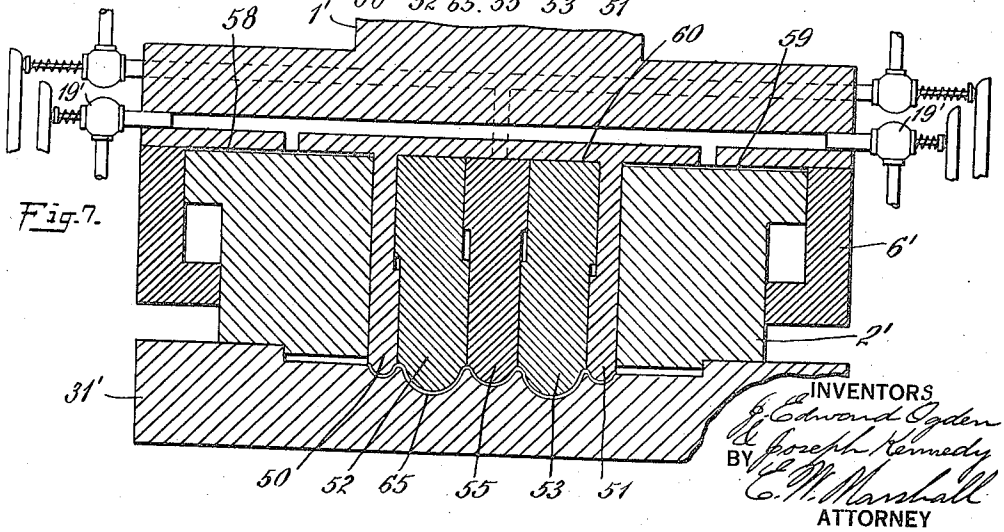


Fig. 7.

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METAL-WORKING MACHINE.

1,424,671. Specification of Letters Patent. Patented Aug. 1, 1922.

Application filed May 5, 1919. Serial No. 294,785.

To all whom it may concern:

Be it known that we, JOHN EDWARD OGDEN, residing at Mountainville, town of Cornwall, county of Orange, and State of New York, and JOSEPH KENNEDY, residing at Richmond Hill, Queens County, and State of New York, have invented certain new and useful Improvements in Metal-Working Machines, of which the following is a full, clear, and exact description.

Our invention relates to new and useful improvements in metal working machines and more specifically to machines for cutting or shaping blanks.

One of the objects of the invention is to provide a machine of the above type, which is simple and efficient and which shall require little attention to maintain it in operative condition.

Another object is to provide apparatus of this type, which shall have little vibration, which shall be adaptable to operate on blanks of different character and which shall in each case expeditiously turn out an accurately formed product.

Other objects of our invention will appear in the following specification. The invention consists in the features of construction, combinations of elements and arrangement of parts, which are exemplified in the construction hereinafter set forth and the novel features of which will be set forth in appended claims.

Referring to the drawings:

Figure 1 is a view in longitudinal cross-section, showing one embodiment of the invention.

Figure 2 is a fragmentary plan view of the punch element.

Figure 3 is a similar plan view of the die element.

Figure 4 is a view similar to Figure 1, of another embodiment of the invention.

Figures 5, 6 and 7 are views of the apparatus shown in Figure 4 in successive stages of operation.

Figure 8 is a fragmentary view on a reduced scale of the punch of Figures 4 to 7, and

Figure 9 is a similar view of the die of the species shown in Figures 4 to 7.

Like characters of reference designate corresponding parts in all of the figures of the drawings.

Referring now to Figures 1, 2 and 3 of the drawings, there is shown the operating head 1 preferably of the sliding type, of a punching machine. This head carries a tool such as a punching element, and comprises in the apparatus shown, a cutting or blanking punch 2, adapted to cut a blank of metal of the outline, one-half of which is shown at 3 in Figure 2 of the drawings. The punching element 2 has a flat shoulder 4, and the contour of a reduced portion 5 extending below said shoulder constitutes the operative cutting edge 3.

The punch 2 is preferably connected to the sliding head 1, and operated therefrom by means now to be described:

Rigid on the sliding head 1, there is formed a housing 6 having an inturned flange 7 near its bottom.

The punch member 2 has an outstanding flange 8, adapted to rest upon the flange 7 of the housing, the flange 8 fitting snugly within the walls of the housing.

Integrally with the flat lower surface 9 of the head 1, we provide a shaping punch element 10, which extends through an opening 11 in the punch element 2.

The thrust of the head 1 is preferably transmitted to the punch element 2, through a pneumatic cushion formed by compressed air within the chamber 12, formed between the top of the punch element 2, the lower surface 9 of the head and the inner walls of the housing 6. For this purpose, we preferably provide an air reservoir (not shown) connected by a flexible tube 13 to a valve 14 normally biased to open position by a spring 15 or the like. This valve is connected as at

16, to a duct 17, extending transversely through the head 1, said duct being connected as at 18 with the chamber 12. The end of the duct 17 opposite valve 14 is provided with a valve 19, biased to closed position as shown. This valve comprises a cylinder member 20, a piston member 21 fitting therein, and having an inclined surface 22 at its inner end, a spring 23 surrounding the shank 24 of the valve, to maintain it in seated position.

A stationary cam 25 is provided by way of example to co-operate with the knob 26 on the valve 14 for the purpose of closing the valve and shutting off the supply of air at a predetermined time, preferably immediately after the punch 2 has performed its function. Another stationary cam 27 co-acts with the knob 28 on valve stem 24 to gradually draw the inclined surface 22 of the valve out of cylinder 20 at about the same time valve 14 is closed, thus allowing for gradual escape of the air contained in chamber 12.

To avoid leakage from the chamber 12, a washer 29, is mounted on the top of flange 8 which has an upturned rim as at 30, to prevent egress of air at any of the sliding joints.

The blanking punch 2 and the shaping punch 10, are preferably aligned to co-operate with a die 31. This has a depression 32 of about the same size and shape as contour 3 of the punch, extending to a point 33 at a depth somewhat in excess of the height of extension 3.

Merely by way of example, we have shown a die intended to operate upon a specific form of blank 34, provided with a previously-formed opening 35. The end of the punch 10 has a tip 36 adapted to enter this. The blanking depression in the die 31 leads to a constricted forming channel 37 which in turn communicates with a somewhat widened opening 38 which extends through the bottom of the die. The lower portion of the shaping punch 10 is diminished in width as at 39, to such an extent as to enter channel 37 in the die with the blank bent up about portion 39.

In operation, the machine being assumed connected to some source of power and a blank 34 being assumed to be laid upon the die 31, valve 14 is open and valve 19 closed, air is contained under pressure within the chamber 12. The sliding head 1 is now actuated to descend, until the tip 36 enters the opening 35 in the blank and extension 5 impinges the top of said blank. The punch now begins to encounter material resistance, and its blanking or shearing operation takes place by transmission of the pressure from the head through the air cushion 12 to the punch 2.

The punch 2 is thus actuated through the pneumatic cushion to cut out the blank, whereupon the shoulder 4 is arrested by the top of the die 31, and further movement of the punch 2 cannot take place. The cut blank now rests freely upon the die in readiness for the next operation.

When this stage is reached, the knobs 26 and 28 of the valves 14 and 19 respectively, come into co-action with cams 25 and 27 either simultaneously or successively. Thus the supply of air to the chamber 12 will be shut off, and valve 19 will gradually open in an obvious manner to allow the air to gradually escape as the head 1 is further lowered to move the surface 9 into proximity with the top of punch 2.

By this latter movement, as is obvious, the end 39 of the shaping punch 10 moves into the channel 37 in the die, shaping the metal in the desired manner and ejecting it when the operation is completed, through opening 38.

In Figures 4 to 9 of the drawings, we have shown a further development of our invention.

Referring more particularly to Figure 4, we have shown a sliding head 1, having rigid or integral therewith, a cylindrical extension 6′ with an inturned flange 7′ upon which rests the outturned flange 8′ of the blanking punch element 2′. This latter element has a reduced extension 5′, a part of the contour of which is shown at 3′, having the shape, of the blank to be cut. The blanking punch 2′, as in Figure 1, co-acts with a depression 32′ of the same size and shape as extension 5′, but of greater depth.

Extending into a central opening 11′, in the blanking punch 2′, three distinct sets of shaping punches are provided. These comprise a pair of symmetrically disposed punches 50 and 51, having a snug fit against the walls of opening 11′, the punches being preferably formed integral with the lower wall 9′ of the head 1′.

The second set of symmetrically disposed punches 52 and 53 are respectively in contact with the innermost surfaces of punches 50 and 51, there being co-operating ledges 54 on these punches to prevent punches 52 and 53 from descending with respect to punches 50 and 51, when the parts are in the positions shown in Figure 4.

There is also a central shaping punching element 55, provided with ledges 56 resting on co-operating ledges 57 on the contiguous surface of punches 52 and 53.

By this arrangement three air chambers are provided,—a chamber 58 between punches 2′ and 50 and the surface 9′, a chamber 59 between the punches 2′ and 51 and the surface 9′ and a chamber 60 between the top of the five punches, 50, 52, 55, 53 and 51 and the surface 9′.

The chambers 58 and 59 operate in paral-

lel to transmit the thrust to the punch 2'. For this purpose they communicate by leads 61 and 62 respectively with a duct 63 connected to an intake valve 14' at one end and at its opposite end to an exhaust valve 19'. Further detailed description of the valves and their controlling means is dispensed with, as this may be identical with that fully described in connection with Figures 2 and 3, above.

A separate duct 64 extending through the head 1', is preferably connected to a separate source of compressed air and is connected by a lead 65 to the chamber 60. The construction of the intake and exhaust valves controlling the pressure in chamber 60, is preferably also identical with that shown in Figures 1, 2 and 3, and need therefore not be described.

Depending upon the character of operations to be performed, chamber 60 may be supplied with air at a higher, lower or the same pressure as chambers 58 and 59.

The die 31' is provided with a series of shaping depressions 65, for co-operation with the shaping ends of the various shaping punches all as more fully described hereinafter.

In the operation of the species shown in Figures 4 to 9, assuming the piece of sheet metal to be treated as laid upon the die and the machine to be connected to a proper source of power, the air chambers 58—59—60 will be filled with compressed air at the proper pressure, owing to the fact that the controlling intake valves are normally open. When the head 1' begins to descend, the tip of the central punch 55 will contact the work at approximately the same time as does extension 5' on punch 2', thus acting to hold the piece while blanking takes place. The blanking operation continues with the entry of extension 5' into the corresponding die depression 52', this action being cushioned, as is obvious, by the compressed air in the chambers 58—59. When the blanking operation is complete, the intake valve 14' is closed and the exhaust valve 19 opened in the manner described in connection with the operations of the apparatus of Figures 1, 2 and 3, and the air within chambers 58 and 59 is allowed to escape gradually as the operation proceeds further.

Owing to the fact that the extension 5' is not as high as the depth of the corresponding die depression, the blank will lie freely within the depression after the blanking operation is completed, as in the other case.

As the head 1' continues to descend, the blanking punch 2' being limited against further movement, the air from chambers 58 and 59 will be forced out through the open exhaust valve. In the further operation, chamber 60, however, acts as a cushion to transmit the thrust from the head 1' to the shaping punches 52—53—55. The shaping end of punch 55 extends below punches 52 and 53 so that it will enter the corresponding die depression, shaping the metal accordingly, as clearly shown in Figure 5; this action taking place readily and without undesired distortion of the blank as the same is nowhere held except at the punch 55 then operating. Punches 52 and 53 have not as yet come into operation, as they are held in a limited position relative to the head 1' by co-operating ledges 54. As the downward movement of head 1' proceeds, both cutting punch 2' and shaping punch 55 are limited against further descent. Punches 52 and 53 continue to move downwardly with head 1', cushioned by the pneumatic pressure in chamber 60 until they have completed their shaping operation, as clearly shown in Figure 6.

At this stage, the stationary cams co-operating with the controlling valves for chamber 60, are actuated to shut off the supply of air to said chamber and to permit exhaust of air therefrom.

As the sliding head 1' descends still further, blanking punch 2' and shaping punches 52, 53, 55 are limited against further descent. At this stage of the operation, shaping punches 50 and 51, which are rigid with the sliding head, perform the final shaping operation, as shown in Figure 7. In this operation, the final pressure is transmitted uncushioned through all the forming punches 50, 52, 55, 53 and 51, to the entire blank, thus giving it the final and uniform set desired.

The sliding head 1' will then be raised in the usual manner not shown, and the punches will drop to the position shown in Figure 4, whereupon the operation may be repeated.

The springs heretofore used, instead of the pneumatic cushioning means disclosed in this application, lose their resiliency after a relatively short period of operation, due to the constant vibration of the machine. As a consequence the pressure upon the die varies, which results in an increased rag on the edge of the blank, with decrease of the strength of the spring. When the spring which controls the blanking punch loses its resiliency an insufficient pressure is transmitted to force the punch through the metal, and as a consequence the shaping punch engages the sheet before the blank is cut out of it and if not strong enough to carry the uncut sheet through the die, the shaping punch may be broken with the likelihood of destroying the die. Another advantage of the use of the air cushion is that the air pressure may be regulated at will. In a multiple stamping operation it is sometimes desirable to use different pressures at different parts of the operation and to vary these pressures at times. It is

obvious that this may be easily effected by merely adjusting or varying the air pressure.

It is distinctly to be understood that the specific embodiments of our invention disclosed in the drawings and described above, are merely illustrative and that any simple blanking or shaping operation, or operations combining blanking and shaping, employing few or many dies and punches, or operations of a different character may be performed by apparatus within the scope of our present invention.

The specified forms and arrangements of punches and dies, disclosed, constitute but two of numerous possible practical applications to which our invention is adapted.

Thus it will be seen that there is herein described, apparatus in which the several features of this invention are embodied, and which apparatus in its action attains the various objects of the invention and is well suited to meet the requirements of practical use.

As many changes can be made in the construction and arrangement of parts and many widely different embodiments of this invention can be made without departing from the scope thereof, it is intended that all matter contained in the description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. We therefore intend no limitations other than those imposed by the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a metal working machine, in combination, a movable punch head, a punch movable therewith and therein, a stationary die and an air cushion arranged to transmit the movement of the head to the punch to move the punch through a blank interposed between the punch and the die and automatically operable means for releasing air from said cushion.

2. In a metal working machine, in combination, a die, and a cooperating punch arranged to be moved together by external power transmitting mechanism, and means including a pneumatic cushion for affecting the relative movement between said members to cause operation on a blank interposed therebetween and means responsive to the movement of the punch for deflating said cushion.

3. In a metal working machine, in combination, a stationary die, a punch, means for actuating said punch, said means including external power transmission mechanism and a pneumatic cushion, and a source of compressed air connected to said cushion while said punch operates on the work and means operable at a predetermined point in the operation of said punch for releasing air from said cushion.

4. In a metal working machine, in combination, a reciprocable operating head, a punch carried thereby, an air chamber interposed between said head and said punch for transmitting the thrust from the former to the latter, and a die cooperating with said punch and means for automatically releasing air from said chamber at a predetermined point in the movement of the punch.

5. In a metal working machine, in combination, an operating head, a tool carried thereby, one of said latter members having a cylindrical chamber, snugly enclosing a part of the other member to form an air chamber, for yieldingly transmitting the thrust from said head to said tool and automatically operable means for releasing air from said chamber.

6. In a metal working machine, in combination, an operating head, a cylinder connected thereto, a punch member having a portion snugly fitting within said cylinder, to form an air chamber in said cylinder back of said punch, and means for admitting air under pressure to said chamber while the punch operates on the work.

7. In a metal working machine, in combination, an operating head, a cylinder rigid with the bottom thereof, said cylinder having an inwardly extending flange near its bottom, a punch having an outwardly extending flange near its rear end normally resting on said first flange, said punch flange fitting snugly within said cylinder, and means for admitting air under pressure to said cylinder.

8. In a metal working machine, in combination, a die, a reciprocable operating head arranged to be actuated by external power transmission mechanism, a cylinder rigid therewith, a piston in said cylinder, a punch rigid with said piston, means for admitting air under pressure to said cylinder to pneumatically cushion said punch while it coacts with said die and means responsive to the movement of the punch for releasing air from said cylinder.

9. In a metal working machine, in combination, a tool, a cooperating anvil-like member, a pneumatic cushion backing one of said members, and means responsive to the movement of said tool for causing the air to be exhausted from said cushion, after said tool has completed its cushioned operation.

10. In a metal working machine, in combination, a punch, a cooperating die, a sliding head, a pneumatic cushion interposed between said head and said punch a normally closed exhaust for said cushion, and means actuated by said head after said punch has completed its function, for opening said exhaust.

11. In a metal working machine, in com-

bination, a punch, a cooperating die, a sliding head, a pneumatic cushion interposed between said head and said punch a normally closed exhaust for said cushion, and means actuated by said head after said punch has completed its function, for gradually opening said exhaust.

12. In a metal working machine, in combination, a tool, a cooperating anvil-like member, a pneumatic cushion backing said member, a normally open intake duct through which said cushion is kept under a predetermined pressure, a normally closed exhaust for said cushion, and means responsive to the movement of said tool for closing said intake duct, and opening said exhaust, after said tool has completed its cushioned operation.

13. In a metal working machine, in combination, a plurality of punches, cooperating die elements, pneumatic cushions, one for each of said punches, and adjustable means for maintaining each of said cushions during operation of said die under a selected pressure corresponding to its function.

14. In a metal working machine, in combination, a plurality of punches, cooperating die elements, pneumatic cushions, one for each of said punches, a normally open intake for each said cushion to maintain each during operation at a selected pressure, an exhaust for each said cushion, means for automatically causing operation of said dies in a predetermined order and means automatically responsive to the completion of the operation of each die to close the corresponding intake and open the corresponding exhaust.

15. In a metal working machine, in combination, a working tool, means for pneumatically cushioning said tool during one operation, adjustable means automatically actuated upon completion of said operation to exhaust said cushion, and means for then bringing about another operation of said tool upon its work.

16. In a metal working machine, in combination, a shaping punch, means for pneumatically cushioning said punch, during its shaping operation, means automatically actuated upon completion of said operation to gradually exhaust said cushion, and means for then causing said punch to exert a compressing action upon the shaped blank.

17. In a blank working machine, in combination, a plurality of tools, means for pneumatically cushioning the action of one of said tools, and solid means for operating another of said tools and means for releasing the fluid from the cushion after the tool operative by said solid means is set in motion.

18. In a metal working machine, in combination, an operating head, a plurality of tools connected thereto, a pneumatic cushion between said head and one of said tools, and a solid connection between said head and another of said tools and means for releasing the fluid from said cushion after the tool operated by the solid connection has been actuated.

19. In a metal working machine, in combination, an operating head, a plurality of tools connected thereto, a pneumatic cushion between said head and one said tool, and a solid connection between said head and another said tool, and means whereby said tools are automatically caused to operate in a predetermined order.

20. In a metal working machine, in combination, an operating head, a plurality of tools, solid means connecting one said tool to said head, connections between the remainder of said tools and said head, said latter connections including a pneumatic cushion, and means whereby said tools are automatically caused to operate in a predetermined order with said first named tool operating last.

21. In a metal working machine, in combination, a plurality of punches, cooperating die elements, pneumatic cushions one for each of said punches, means for automatically causing said punches to operate in a predetermined order, and means for causing some of said punches to exert a final uncushioned action on the work.

22. In a metal working machine, in combination, a blanking punch, a plurality of forming punches, pneumatic cushions one for each of said punches, means for automatically causing said punches to operate in a predetermined order, means for exhausting each cushion as its associated punch completes its cushioned operation, and means causing all said forming punches simultaneously to exert a final compression on the work.

23. In a metal working machine, in combination, a blanking punch, a plurality of forming punches, an operating head for actuating all of said punches, a first pneumatic cushion interposed between said head and said blanking punch, a second pneumatic cushion between said head and said forming punches, means for causing operation of said blanking punch, exhaust of said first cushion, operation in a predetermined order of said forming punches, gradual exhaust of said second cushion, and finally a compression action on the work by all said forming punches.

24. In a metal working machine, in combination, an operating head, a plurality of cylinders on the bottom thereof, a plurality of punches one for each cylinder, having an air tight sliding fit therein, a plurality of air inlet valves one for each cylinder, a plurality of exhausts, one for each cylinder, means for causing said punches to be oper-

ated in a predetermined order through movement of said head, means for automatically closing the corresponding air inlet and opening the corresponding exhaust as each punch completes its cushioned operation, and means for causing a further uncushioned operation of some of said punches.

25. In a metal working machine, in combination, a die, having a blanking depression a forming depression therebelow communicating with an opening at the bottom of said die, an operating head, a forming punch rigidly connected thereto, a blanking punch, a pneumatic cushion interposed between said head and said latter punch, means for automatically exhausting said cushion after said blanking punch has completed its function, said forming punch serving to eject the work through said opening after completion of the forming operation.

In witness whereof, we have hereunto set our hands this 22nd day of April, 1919.

J. EDWARD OGDEN.
JOSEPH KENNEDY.

Witness:
I. B. MOORE.