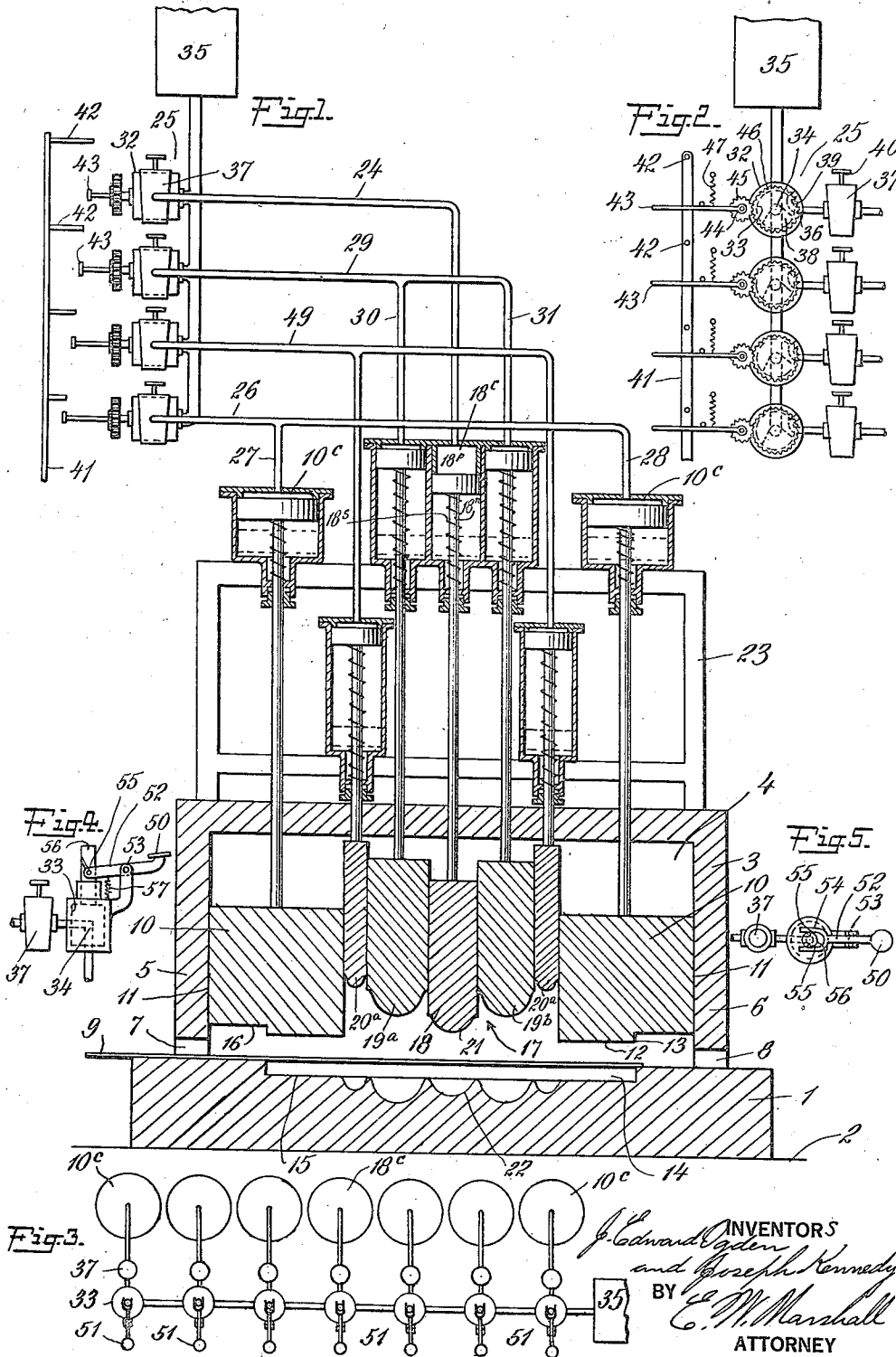


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METAL WORKING MACHINE.
APPLICATION FILED MAY 8, 1919.

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METAL-WORKING MACHINE.

Application filed May 8, 1919. Serial No. 295,587.

To all whom it may concern:

Be it known that we, both citizens of the United States, JOHN EDWARD OGDEN, residing in Cornwall, in the county of Orange and State of New York, and JOSEPH KENNEDY, residing at Richmond Hill, in the county of Queens 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, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to apparatus for operating on metal or the like, and with regard to its more specific features to machines for cutting or shaping blanks.

One of the objects of the invention is to provide a machine of the above type which shall operate positively and yet have little vibration, and which shall be relatively noiseless in action.

Another object is to provide apparatus of the type last set forth susceptible of operation upon a given blank in any of a variety of different ways depending on the result attempted to be accomplished.

Another object is to provide apparatus of the above type which shall be adapted to accurate working of blanks of different thickness and of different materials.

Other objects will be in part obvious, in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangements of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings wherein are shown one or more of various possible embodiments of the several features of this invention, Figure 1 is a view of my apparatus in longitudinal section, Figure 2 is a diagrammatic view showing the control of air to the cylinders, Figure 3 is a diagrammatic view of a modified form of control, Figure 4 is a view in longitudinal section of one of the valves of Figure 3 and Figure 5 is a top view of Figure 4.

Similar reference characters refer to simi-

lar parts throughout the different views of the drawings.

Referring now to the drawings there is shown a stationary die 1 mounted upon a base 2. Preferably mounted upon the same base 2 we provide supports 5, 6, which are integral with a head 3 at the top thereof, there being thus a cavity 4 between head 3 and die 1. The opposite supports or side walls 5, 6 of said head are provided with slots 7 and 8 to permit entry and removal of the sheet of metal 9 to be operated upon.

By way of example we have shown slidably mounted between the walls 5 and 6 a blanking punch member 10 whose sides contact the inner surface of said walls as at 11. The blanking punch 10 is provided with a reduced extension 12 whose edge 13 is of the shape of the blank desired to be cut. The die 1 has a depression 14 which will snugly accommodate the blanking edge 13 in the manner common in dies. Said depression is however somewhat deeper than the thickness of extension 12 whereby the cut blank may rest upon the bottom 15 of the depression 14 the surface 16 of the blanking punch being arrested against the further movement by the top of the die 1.

Centrally in the punch 10 I provide by the way of example a longitudinal opening 17, within which opening are slidably mounted a plurality of forming or shaping punches.

In the specific embodiment shown there are provided a central punch 18 a pair of punches 19^a and 19^b one on each side of punch 18, and a further pair of punches 20^a and 20^b fitted respectively against the outer faces of punches 19^a and 19^b and having their outer faces in contact with walls of opening 17.

Each forming punch has an operative surface on its bottom as shown for instance at 21, adapted to pass into a similarly shaped die depression 22 in registry therewith and extending below the surface 15 of the die 1.

Pneumatic means is provided for operating each of the punches a preferred embodiment of this means being shown in the drawings.

This means includes a pressure cylinder 18^c in alignment with punch 18 and sup-

ported on a stationary base 23. Within the cylinder is a piston 18^p connected by a piston rod 18^r to the top of the punch 18, the said rod extending through an opening in the base 3. Encircling the portion of the rod 18^r within the cylinder there is preferably provided a coil spring 18^s adapted to be compressed when the piston 18^p reaches the end of its working stroke into a reduced extension 18^e at the bottom of the cylinder.

The piston rod 18^r is preferably made of a length to cause the punch 18 to reach the end of its operative stroke when the piston 18^p is in proximity of its head 18^h.

An actuator comprising, a cylinder, a piston and other parts similar to those just described is provided for each of the forming dies, the parts of each actuator bearing the reference numerals of the punch which it operates, with the literal exponent of corresponding parts of the actuator for punch 18.

The blanking punch 10 is preferably provided with two actuating cylinders 10^c at symmetrically disposed parts thereof.

A pipe 24 leads from a valve mechanism 25 described more fully below to conduct air from a source of pressure 35 into cylinder 18^c.

A similar pipe 26 is similarly arranged to actuate the blanking punch 10, the said pipe, however, feeding air to the two cylinders 10^c in parallel through the ducts 27 and 28.

The punches 19^a and 19^b being by way of example intended to operate under the same pressure, a pipe 29 is provided with two ducts 30 and 31 to convey air from one source of pressure respectively to the left and right hand cylinder 19^c.

A similar arrangement is provided for connecting a pipe 49 with the pair of punches 20^a and 20^b.

Referring now to Figure 2 the valve mechanism 25 is shown by way of example, to comprise a valve casing 32 containing a cylindrical two-way valve 33 communicating through a central longitudinal opening 34 with any desired source of compressed gas or air 35. The valve casing 32 has an opening 36 communicating preferably through a reducing valve 37 with the cylinder 18^c.

The valve 33 has a sector opening 38 adapted to connect the source of compressed air to the cylinder when said opening 38 is in registry with opening 36.

There is also provided a notch 39 in the periphery in valve 33 which notch when in registry with opening 36 will permit the air within cylinder 18^c to escape.

The valve just described is merely illustrative and its details are no part of my invention as numerous other types of valves may be employed to good effect.

The details of the reducing valve 37 are not shown, but it may briefly be noted that this valve is of the well known variety in-

tended to convert compressed air or the like from a constant or variable pressure source to actuate a tool or the like at a substantially constant pressure other than that of the source.

The reducing valve is provided with an adjusting screw or the like 40 by which the pressure at the delivery end of the said valve may be set at any desired value.

A plurality of pairs of rotary and reducing valves similar to those just described similarly connects the source of pressure 35, one to each of the pipes 26, 29 and 49.

The setting of each reducing valve is adjusted to produce the pressure that may be desired in the cylinder or cylinders to be supplied therefrom. These pressures may differ widely for the different cylinders according to requirements.

Instead of providing the desired pressure for each cylinder from a single source and converting through different reducing valves, we may of course provide a plurality of sources of fluid under different pressures connected according to requirements without the use of reducing valves. I have indicated by way of example, for operating the valve mechanisms 35 in a predetermined order by a single operation, an operating rod 41 having a plurality of tappets as at 42 of different lengths, each tappet being adapted to operate a rocker arm 43 rigidly connected at its pivot 44 to a pinion 45. The said pinion meshes with a gear 46 rigidly connected to the valve 33. The rocker arm 43 is biased by a spring 47 or the like to place the valve in exhaust position.

The tappets 42 are of such length and so spaced as to cause the operation of the valves in the desired order and at the desired intervals.

In operation, the various reducing valves 37 are first adjusted so that the corresponding punch or punches will be actuated by the pressure at which they are intended to operate upon the particular piece of material treated.

The source of compressed air being then operatively connected, the operator pulls on rod 41. This causes tappet 42 to rotate rocker arm 43 about its pivot 44 turning the pinion 45 through an angle and thereby turning gear 46 and with it valve 33 to shift the sector 38 into registry with opening 36.

The compressed air then passes from the source 35 through passages 34, 38 and 36 into the reducing valve 37. Being delivered from the valve at the proper pressure, the air then enters pipe 26 and through ducts 27 and 28 it passes into the two cylinders 10^c. The pistons 10^p are thereby actuated to push the blanking die 10 downwardly at the desired pressure to cut the blank, whereupon the punch 10 is limited by the die against

further downward movement, allowing the blank to rest freely on base 15 for subsequent operations.

In the operation just described the piston comes into close proximity to the lower cylinder head as shown in dotted lines, and the spring 10^b is compressed within the extension 10^c when the punch 10 is at the end of its operating stroke.

As the rod 41 is moved further the other tappets come into operation to successively operate punch 18 the pair of punches 19^a and 19^b and the pair of punches 20^a and 20^b, said punch 18 and each of said pairs of punches being thus actuated at the proper time and at the proper pressure.

When the rod 41 is returned to home position the springs 47 return each rocker arm 43 to its original position shutting off the source of air supply and placing the exhaust notch 39 into registry with opening 36.

The springs 10^c, 18^c, etc., are then free to expand, raising the pistons within the cylinders together with the associated punches and forcing the air out through the exhaust passage 36—39. This completes a cycle of operation of the machine.

If desired, the order of operation and the timing of the valves may be controlled at will by the operator.

For this purpose we preferably provide the valve control arrangement shown in Figures 3, 4 and 5.

We have shown in Figure 3 a set of valves, one of which is shown in longitudinal section in Figure 4. These valves are preferably of the same construction and corresponding parts bear the same reference numeral as the mechanisms 25 shown and described in connection with Figures 1 and 2.

For convenience of operation the valve is associated with a key as at 50, all the keys of the set being arranged on a key board 51. Each key is connected to its valve 33 through a lever 52, pivoted as at 53. The lever 53 terminates in a yoke 54 having a pair of pins 55, fitting in a screw thread 56 on the prolonged axis of the valve. A spring 57 biases each lever 52 to place its key in uppermost position.

In the operation of any valve, the key is depressed moving yoke 54 about pivot 53. The pins of the yoke as is readily understood will rotate the valve by reason of their cooperation with screw threads 56, until the valve makes an operative connection between the source of compressed air and the cylinder. The key may be kept depressed as long as needed to complete the operation. As soon as it is released, spring 57 causes return of the lever and consequent return of the valve to exhaust position, the latter step by reason of the cooperation of pins 55 and thread 56.

In the use of the machine the operator

actuates the keyboard broadly in the manner of an organ keyboard, depressing the keys in whatever order may be desired, and maintaining each key depressed for the period desired to bring about actuation of the punches in the order and at the intervals desired.

If the individual punches were actuated by springs or the like instead of by compressed air, the constant vibration in use would after a time result in the loss of resiliency of the springs with consequent varying pressure on the punches bringing about an increased rag on the blank as the strength of the springs decreases. If springs were employed instead of pneumatic pressure, as the spring resiliency is lost an insufficient pressure might be exerted to force the blanking punch through the sheet. If a forming punch were thereupon operated to engage the sheet before the blank was cut out of it, this punch might break with a possibility of destroying the entire die.

By our invention the pressure is reliably transmitted to the punches without any undesired losses or likelihood of damage to the die. If minor leaks should occur in any of the cylinders these may readily be compensated for until repaired by setting the corresponding reducing valve to deliver a slightly higher pressure.

It is further to be noted that by the use of our pneumatically actuated punches, we are enabled to control treatment of the metal and the sequence of operation in a manner which can be only accomplished with great difficulty by the use of springs.

Our invention, it is distinctly to be noted is not confined in its applicability to the specific combination of blanking and forming dies disclosed, nor is it in any way limited to any particular order of steps.

Obviously the principle of the specific machines described and shown may be embodied with a wide variety of arrangement of tools of various kinds for various purposes and operable in various orders when more than one tool is employed. It is therefore to be understood that the principles of our invention are broadly applicable regardless of the number or type of tools to be actuated, and that the specific set of blankings and forming dies has been merely illustratively shown, though this specific arrangement possess specific utility.

It will thus be seen that there is herein 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 could be made in the above construction, and many apparently widely different embodiments of this inven-

tion could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

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

10 1. In a metal working machine, in combination, a punch, a cooperating die, a cylinder, a piston therein, a stem rigidly connecting said piston to said punch, a source of compressed air adapted to be connected to
15 said cylinder to pneumatically operate said punch, a coil spring encircling said stem to bias said punch to inoperative position, and an extension chamber in said cylinder to accommodate said spring when the piston is
20 at the end of its working stroke.

2. In a metal working machine, in combination, a stationary punch head, a cylinder mounted therein, a piston in said cylinder, a piston rod extending through a passage in
25 said head, a punch directly connected to said rod, a source of air, and an adjustable reducing valve connected thereto, said reducing valve communicating with said cylinder at the pressure end thereof.

30 3. In a metal working machine, in combination, a stationary head, a plurality of punches mounted for longitudinal movement in the same direction relative to said head, and an individual pneumatic actuator for
35 each said punch.

4. In a metal working machine, in combination, a stationary head, a plurality of tools mounted for longitudinal movement in the same direction in said head, a plurality of
40 cylinders, one associated with each tool, a plurality of pistons, one for each cylinder, and connected to the corresponding tool, and means for admitting operating fluid to any cylinder at any desired pressure.

45 5. In a metal working machine, in combination, a stationary head, a plurality of

punches mounted for longitudinal movement in the same direction in said head, an individual pneumatic actuator for each said punch, a single source of compressed air, and
50 a plurality of reducing valves interposed between each actuator and said source, each said valve being independently adjustable.

6. In a metal working machine, in combination, a plurality of slidable punches,
55 guiding means therefor, an individual pneumatic actuator for each said punch, and means for setting actuators in operation in any desired order.

7. In a metal working machine, in combination, a plurality of slidable punches,
60 guiding means therefor, an individual pneumatic actuator for each said punch, means for regulating the pressure of each said actuator, and means for setting said actuators
65 in operation in any desired order.

8. In a metal working machine, in combination, a plurality of punches, a separate pneumatic actuator for each punch, means to control the order of operation of said
70 punches, means to set each actuator for operation at any desired pressure, and means for shutting off the supply of fluid from each actuator after it has performed its function.

9. In a metal working machine, in combination, a stationary die, a stationary head resting thereon, a chamber in said head, a passage for admission into said chamber of material to be worked, a blanking punch
75 slidably related to the walls of said chamber, a plurality of forming punches slidably related to a cavity within said blanking punch, a distinct pneumatic actuator for each said punches, and means to set said actuators into
80 operation in any desired order.

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

J. EDWARD OGDEN,
JOSEPH KENNEDY.

Witness:
I. B. MOORE.