April 19, 1927. 1,625,215

W. A. LACKE

SPACING TABLE

Filed Sept. 12, 1923 4 Sheets-Sheet 1

Fig. 1.

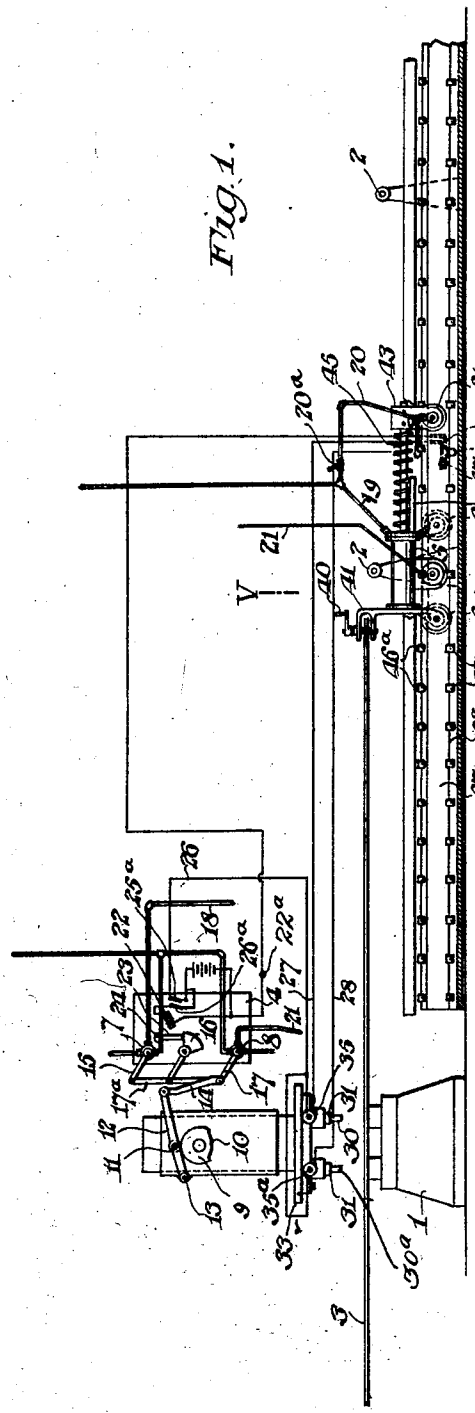
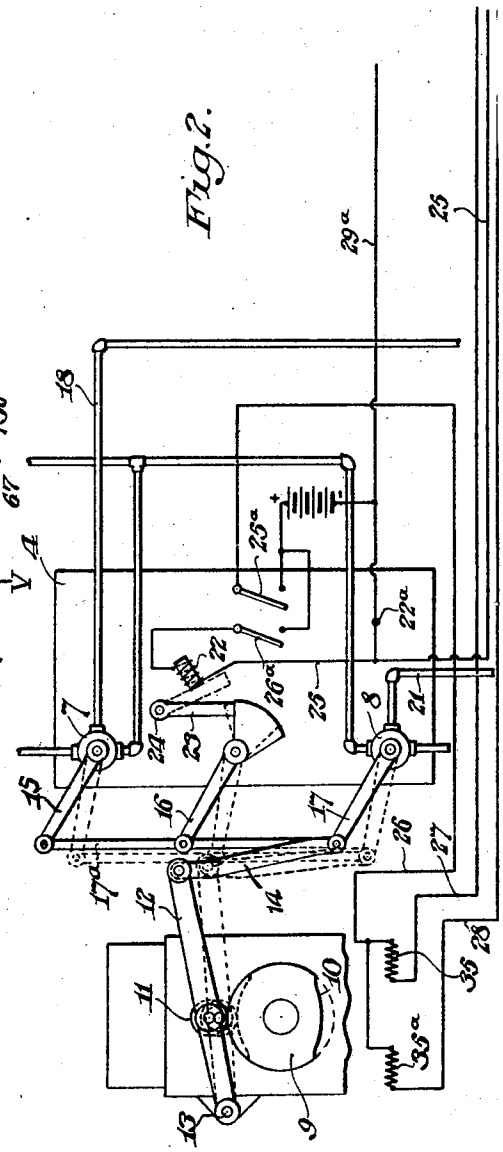


Fig. 2.



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SPACING TABLE

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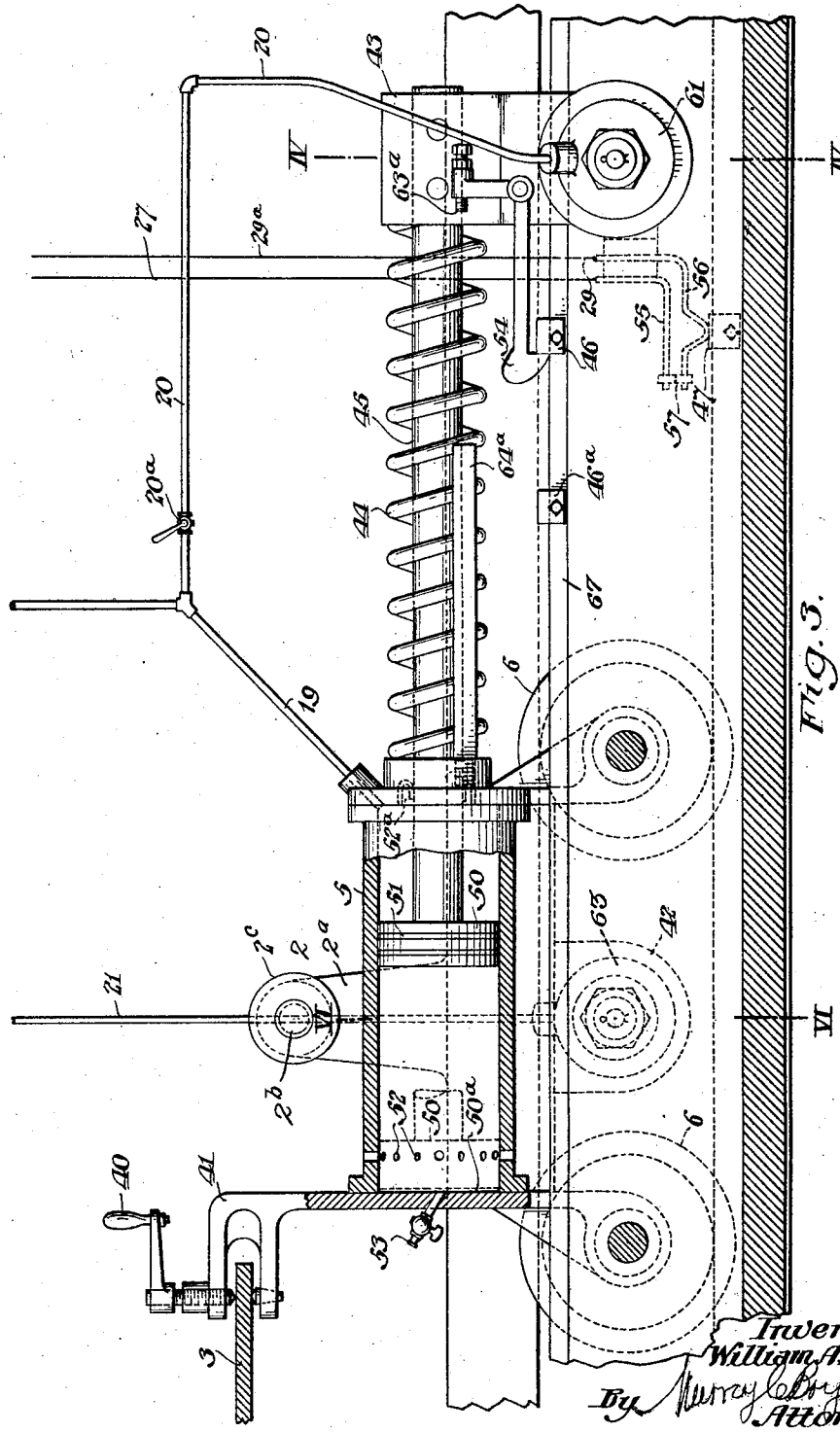


Fig. 3.

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April 19, 1927. 1,625,215

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SPACING TABLE

Filed Sept. 12, 1923 4 Sheets-Sheet 3

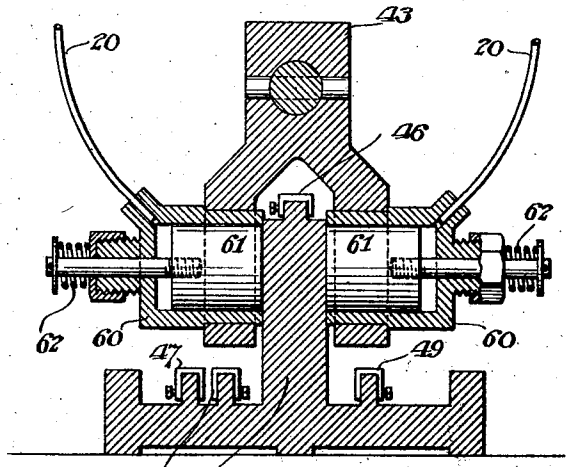


Fig. 4.

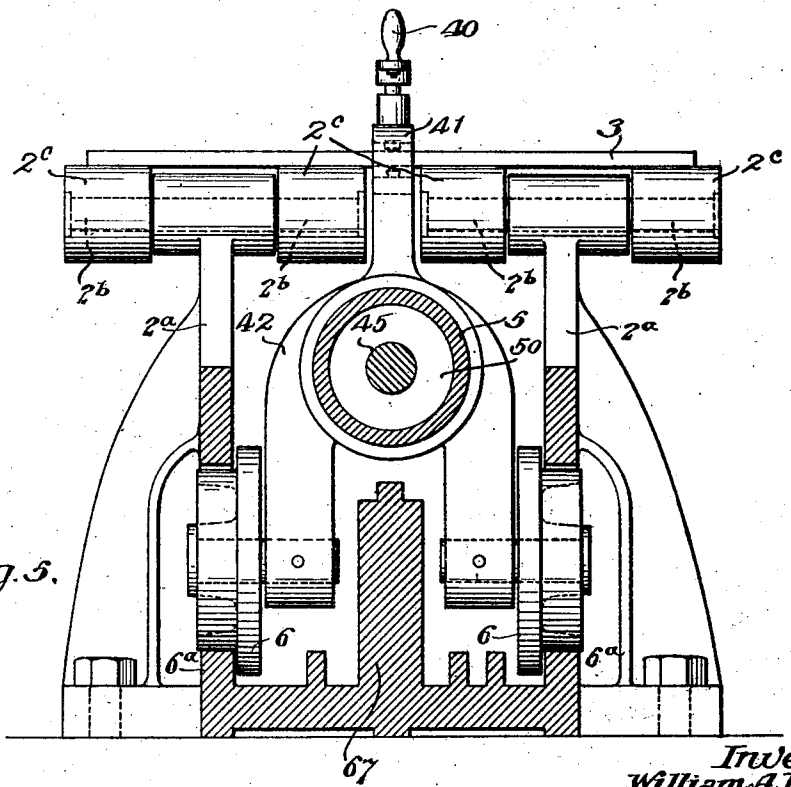


Fig. 3.

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April 19, 1927. 1,625,215

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SPACING TABLE

Filed Sept. 12, 1923 4 Sheets-Sheet 4

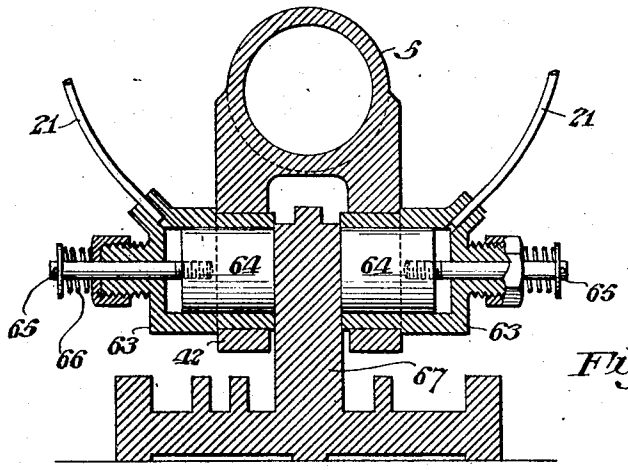


Fig. 6.

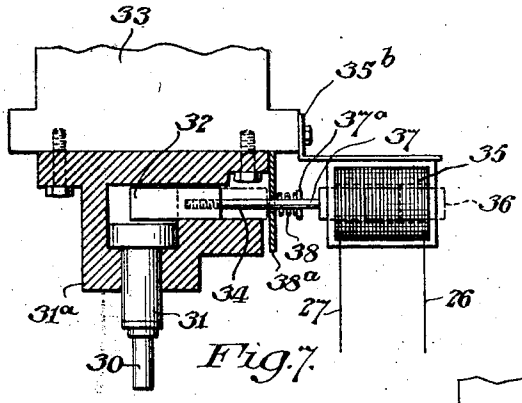


Fig. 7.

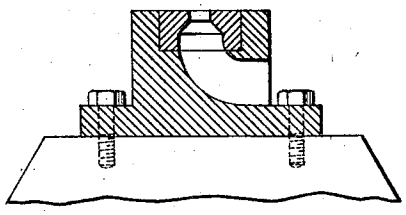


Fig. 8

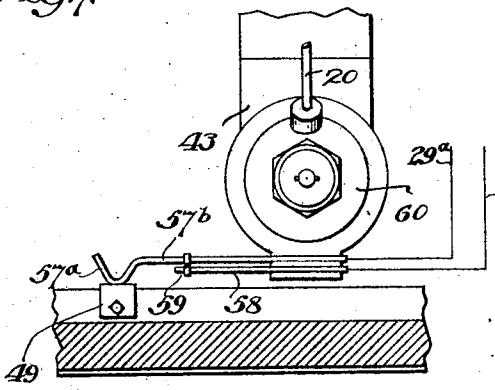


Fig. 9.

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Patented Apr. 19, 1927. 1,625,215

UNITED STATES PATENT OFFICE.

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SPACING TABLE.

Application filed September 12, 1923. Serial No. 662,186.

My invention relates to mechanism for automatically punching holes in sheets or bars of metal where the holes are of the same or various sizes and where spacings are the same or of different dimensions.

One object of my invention is to provide simple and accurate spacing means of any dimension applicable to spacing tables in present use.

A further object of my invention is to space the position of the holes more rapidly than spacing is accomplished with the use of devices in present use.

A further object of my invention is to accomplish this spacing, no matter what the dimensions may be, more accurately than heretofore.

A further object of my invention is to provide a non-recoil shock absorbing cushion at the end of each stroke of the spacing mechanism, so that high speed can be obtained and the shock upon stopping at the end of each spacing stroke is eliminated.

A further object of my invention is to eliminate the strain upon the stops common in other forms of spacing devices.

A further object of my invention is to provide a full automatic spacing device that will select the length of space between holes, the size of punch, and the position of the punch, and one that may be readily set up for operation.

A further object of my invention is to provide a full automatic spacing device that can be cheaply made and one which the operator can readily observe in action.

My invention comprises mechanism for effecting the foregoing and other objects, all of which is more fully set forth in the following specification.

Although I have shown an automatic spacing device operated by air or other fluid, and electric means for operating the gags, it will be understood that in some cases the spacing device may be electrically operated and the gags may be operated by air or other fluid.

In the accompanying drawings:

Figure 1, shows my improved device applied to a punch press having two sizes of punch tools.

Fig. 2, shows diagrammatically the control board, which is automatically operated from the main shaft of the punch.

Fig. 3, is a longitudinal sectional view of the air or other fluid cylinder controlling the spacing operation.

Fig. 4, is a cross sectional view of the gripping device, taken on the line IV—IV, Fig. 3.

Fig. 5, is a cross sectional view of the table supporting the plate being punched, which also affords a trackway upon which the spacing device may run, taken on the line V—V, Fig. 1.

Fig. 6, is a cross sectional view of the holding device, taken on the line VI—VI, Fig. 3.

Fig. 7, illustrates the manner of operating the gags for the punch tools by electric solenoids.

Fig. 8, is a sectional view of the die holder for the punch tool, and

Fig. 9, is a diagrammatic view of a detail of my invention, showing the contact for stopping the spacing.

Referring to Fig. 1 of the drawings, 1 represents a punch press of any suitable character, operated in the usual manner, the driving shaft of the same, which may be provided with a suitable clutch (not shown), serving to effect up and down movement of a head which carries, in the present instance, a pair of punching tools, indicated at 30 and 30ª. It will be understood, of course, that a single tool may be employed. A bed plate carrying the usual dies cooperating with the punching tools is disposed below the same, and beyond the punch press, I provide a series of roller tables, 2, 2, 2, for supporting the plate 3, to be punched. Between these tables, I have mounted a suitable structure serving as a trackway for the mechanism hereinafter described, and employed for moving the plate to effect the positioning of the same in the desired spaced relation with respect to the punching tool or tools.

4 represents a control board to support valves and operating devices hereinafter described. 5 is an air cylinder which may be supported by wheels 6, adapted to travel on the tracks 6ª. The valves mounted on the control board are indicated at 7 and 8, and 9 is a cam attached to the main driving shaft of the punch press so that each time the punch head makes a complete movement, the cam turns over once so as to bring a notch 10

formed in the same, momentarily under the roller 11, carried by a lever arm 12, fulcrumed at 13. When the notch 10 of the cam 9 permits the roller 11 and lever arm 12 to take a downward movement, the latter effects operation of the valve 7 and 8, as hereinafter described.

The valves 7 and 8 are provided with arms 15 and 17, connected together by rod 17ª so that movement imparted to the latter will be transmitted to both arms, and such movement may be effected through the link connection 14, between the lever arm 12 and the arm 17.

The control board 4 is provided with a solenoid 22, which holds a latch 23 out of engagement with an arm 16, also pivotally attached to the connecting rod 17ª, so that when said coil 22 is deenergized, said latch 23 will prevent the arm 16 and the arm 12 from operating. As the valve arms 15 and 17 are also connected to this rod 17ª, they also will be prevented from operating.

On the control board 4 are mounted switches 25ª and 26ª. When the switch 26ª is open, the gags 32, (indicated in Fig. 7), are out, so that should a punch tool be operated, the tool post 31 will be free to rise in its holder 31ª without punching a hole in the sheet 3. When the switch 25ª is open, the coil 22 is deenergized and the latch 23 renders the valves 7 and 8 inoperative. The position of the gags 32, with respect to the punches 30 and 30ª, is controlled by solenoids 35 and 35ª.

The cylinder 5 is provided at each end with yoke members 42, carrying wheels 6, adapted to the rails 6ª, and this cylinder contains a piston 50, which may have suitable piston rings 51. Connected to the piston 50 is a rod 45 which is held to the right by the action of a spring 44 encircling the same, and the outer end of this rod 45 is provided with a yoke 43, as shown in Fig. 4, carrying two cylinders 60, in which are mounted clamping pistons 61, which pistons are held away from a bar 67, which also carries the tracks 6ª, by the springs 62. The cylinders 60 may be supplied with air or other fluid pressure from the hose 20, from any suitable source. The yoke 43 carries a hook 54 adapted to engage a stop block 46, carried by the bar 67.

The cylinder 5 has exhaust ports 52 located in the forward end of the same or to the left, as illustrated in Fig. 3, of the drawings, which ports are so located that when the cylinder is moved with respect to the piston and the latter is brought to the end of the cylinder, these ports are covered up and the only exhaust for the air is through a pet cock 53, whose opening can be adjusted to provide the desired cushion. The air cylinder also carries the jaw 41, with clamp screw 40 whereby the plate 3 may be secured thereto.

The stops 46 may be spaced as desired along the bar 67. These stops regulate the length of each stroke of the air cylinder with respect to the piston 50, the action being more fully described later.

The yoke 43 also carries contacts 55, 56 and 57, and these contacts are operated by blocks 47, 48 and 49, carried by the rail 67. In this particular case, there are two sets of contacts like 55, 56 and 57, carried by the yoke 43 for the purpose of operating the gag operating coils 45, and another set of contacts 57ᵇ, 58 and 59, carried by the yoke 43, is illustrated in Fig. 9 for the purpose of operating the solenoid 22, illustrated in Fig. 2. That is to say, blocks 47 and 48 control the operation of the gags, and block 49 controls the operation of the solenoid 22.

Carried by the hook 54, is a set screw 63, which engages the lifting pin or rod 64ª, carried by the cylinder 5. This set screw may be adjusted so that when the cylinder 5 is at the end of the stroke with respect to the piston 50, or to the right, the hook 54 is raised up to clear the stop 46.

In Fig. 5, I have shown a cross section through one of the supporting tables for the plate, illustrating a typical way in which such roller table can be arranged, the brackets 2ª supporting bearings for short shafts 2ᵇ upon which rollers 2ᶜ are mounted, so as to leave a space between the inner rollers for the passage of the clamping member 41 in engagement with the plate.

In Fig. 6, I have shown a cross sectional view on the line VI—VI, Fig. 3, showing a pair of piston grippers 64, in engagement with the rail 67. The object of this is to hold the work in place while being punched, and allow the grippers shown at 61, Fig. 4, to move to a new position while preventing movement of the work in the meanwhile.

The operation of the respective punches 30 and 30ª, is under the control of suitable electrically actuated gags, and in Fig. 7 I have shown a detail of an electrical device for operating one of these gags, in which 30 is the punch tool, 31 the tool post, and 32 a slidable block or gag against which the tool post rests when the work is to be punched. The solenoid 35, contains a plunger 36, connected to the slidable block 32, by a rod 37. 38 represents a spring against which a plate 38ª pushes; this spring also pushes against the pin 37ª fastened to the rod 37. Thus the normal position of the block 32 is out, as shown by the dotted line position, where it is held by the action of the spring 38 and the punch post is free to move up and down without punching. The solenoid 35 is held rigid with the punch head 33 by a bracket 35ᵇ and when such solenoid is energized, the plunger 36 causes the block 32 to act as a stop against the punch post, thus putting the tool in position for

punching a hole. The solenoid 35 is energized whenever the contact 57, Fig. 3, is closed by the action of one of the stops 47, and the solenoid 35ª is operated whenever a contact similar to 57 is operated by one of the stops 48, shown in Fig. 4.

It will be noted that unless the contact 59 is closed, no hole can be punched as the gag will not go in. The contact must stop at the exact spot. This is a valuable feature as it prevents the hole being punched in the wrong location.

In Fig. 9, I have shown means whereby the stop contact 57ᵇ can be arranged. This contact is set so that it will be operated by the stop illustrated at 49, in Fig. 4, and such contact is attached to the yoke 43. 57ᵇ is a contact spring, normally engaged with the spring 58, so as to make contact at 59. When the stop engages the portion of the spring 57ᵇ marked at 57ª, then the contact 59 is opened and the coil 22, Fig. 2, is deenergized, thus stopping the action of the arm 12 and rendering the spacing device inoperative. 67 indicates the gripper bar or rail, and 64 the clamping pistons within the cylinders 63, which pistons are normally held out of contact with the bar 67 by the action of the spring 66. The cylinders 63 get their air or other fluid pressure from the hose 21, which is controlled by the valve 8, illustrated in Fig. 2.

Having described in detail my improved mechanism, I will now describe the action of the entire device.

Assume that it is desired to punch a row of holes in the plate 3 and that there are holes of two different sizes in the row. The punch tool 30 is employed for one size hole, and the punch tool 30ª for the other. The operator then sets the stops 46 along the bar 67 so that each stop is in the desired position for the proper space or distance between the holes; the first stop being for the first hole, the second stop for the second hole, and so on. These stops can be set by a rule, template or the like, and it will be noted that a missetting of one stop does not necessarily mean that all the spaces following would be wrong, that is to say, by this method of spacing a mistake is not necessarily carried on through the sequence of holes.

After the operator has the spacing stops set he must then determine which size hole he wishes to punch at each space and then set a punch selector block to effect engagement with the contacts 57 at each space. In this case, either a block 47 or 48 would be set to close the contacts 57. Then the operator would determine at which point he wanted the machine to stop and he would then set a block 49 so that spring contact 57ª, Fig. 9, would engage the same, thus opening the current thru the solenoid coil 22, and stopping the spacing operation. It is also evident that he could stop the spacing and the punching by disengaging the clutch connecting the driving mechanism with the punching head carrying the tools 30 and 30ª.

It will here be noted that whenever the punch is stopped by disengaging the clutch, the work is in position for punching the next hole. In other words, the operator can feel his way along on the first piece by operating the clutch on the punch and each time the punch stops, the work will be spaced so that he can "check" just before punching, and if the stops are not properly set he can then correct his error without first punching the hole in the wrong place.

After the operator has set the stops as stated above, he then places the plate 3 in the jaw 41 and clamps it thereto by the screw 40. This secures the plate to the cylinder 5 so that movement of the latter while thus engaged will effect movement of the plate. As indicated in Fig. 1 of the drawings, the plate is too far to the left, so that the first movement of the plate will be for the purpose of placing it in proper position for the first hole. This will be done automatically as hereinafter brought out.

After the machine is set up as noted above, the operator throws in the clutch on the punch operating shaft, (clutch not shown) which causes the punch head 33 to move up and down and with it the tools 30 and 30ª. He then throws in the switches 25ª and 26ª. Throwing in switch 26ª causes the coil 22 to be energized through the following circuit: positive, 26ª, coil 22, line 25 to 25ᵇ Fig. 9, contacts 58, 59, 57, line 29, 29ª to negative. This energizes the coil 22, which causes the latch 23 to take the dotted position and allow the arm 16 to move down when the roller 11 is opposite the recess 10, in the cam 9. Link 17ª connects the valve operating arms 15 and 16 so that valves 7 and 8 are moved as indicated by the dotted lines upon each revolution of the cam 9. The valve 8 as shown in full is in exhaust position, so that the pistons 64, shown in Fig. 6 are out of engagement with the rail 67, and with the valve 7 as shown in the full lines, air or other motive fluid being admitted to the cylinder 5 and the clamping cylinders 60, via the pipes 19 and 20, respectively. Motive fluid admitted to the cylinders 60 causes the pistons 61 to grip the rail 67 and hold the yoke 43 rigid, and as air or other motive fluid is also being admitted to the cylinder 5, this cylinder will be drawn onto the piston 50 until the piston rests against the cylinder head 50ª, where it will stop. The motion of the cylinder over the piston will be rapid until the exhaust holes 52 in the cylinder 5 are covered by the piston, when the balance of the stroke will be completed and compress the air against the head

50ª, thus gently retarding or checking the movement of the cylinder. The amount of cushion can be regulated by adjusting the opening in the pet cock 53.

It will here be noted that the yoke 43 has to withstand a "pull" and then a "push". The action of the spring 44 is overcome by this movement of the cylinder, and the plate 3 is also moved a distance equal to the amount the piston rod was allowed to travel to the right out of the cylinder under the action of the spring the previous part of the cycle. Then as the cam 9 turns to allow lever arm 12 to place the valves 7 and 8 in the position they will assume when the arms 16 and 17 are in the dotted line position, their action is reversed. The air is exhausted from the cylinder 5 and cylinders 60 so that the gripping pistons 61 are released and the piston 50 then travels to the right by the action of the spring 44, until the hook 54 engages the stop 46.

The cylinders 63 are now getting air thru the valve 8 via pipe 21, putting the clamping pistons 64 into action so that the work is rigidly held while being punched and while the spacing mechanism is selecting a new space. Should there be no stop for the hook 54 to engage, the piston 50 will travel the complete length of the cylinder or until it strikes the head 52ª. Then when the air or other pressure is again directed to the cylinders 5 and 60, the work will again move a space equal to the distance the spring 44 pushed the piston 50, away from head 50ª.

When the piston 50 is against the head 50ª, the rod 64ª engages the set screw 63ª and causes the hook 54 to lift over the stop 46, so that each time the air is turned off the cylinder 5, the spring 44 returns the piston to a new stopping position, or the end of the cylinder.

Attached to the yoke 43 and traveling with it are two contacts 57 which operate the punch gag coils 35 and 35ª, whenever a stop 47 or 48, is set at certain spaces. The circuit is established as follows: positive, switch 25ª, wire 26, coil 35, wire 27, contacts 55, 57 and 56, wire 29ª, back to negative. That is, whenever a stop 48 or 49 is set to close the contact 57ª a hole is punched in the plate, but if no contact is set the device will space but not punch. Should it be desired to test the spacing without punching the holes, the switch 25ª can be left out.

Also carried by the yoke 43 is a stop contact 59, Fig. 9. Whenever this contact is open, the solenoid 22 allows the latch 23 to stop the action of the valves. This coil is actuated thru the following circuit: positive 26ª, wire 25, contacts 58, 59, 57ᵇ, wire 29, 29ª, back to negative. By placing a stop 49 at any desired point on the rail 67, the contact 59 is opened; thus stopping the spacing. Should it be desired, the switch 26ª can be opened by hand and the spacing stopped. There is also provided a push button 22ª which can close the circuit if the contact 59 is open.

When it is desired to return the jaw 41 to engage a fresh plate, the 3-way air valve 20ª in pipe 20 supplying pressure to the gripper cylinders 60 is turned off so that the gripping pistons 61 are released. This leaves the device free to move in either direction by hand. When the cylinder 5 is moving with respect to the piston 50, and the head 50ª approaches the same, the air or other motive fluid is readily exhausted thru the ports 52, but when the piston 50 covers these holes, the only remaining outlet for the air is the pet cock 53, which is set to regulate such outlet and form a non-recoil cushion for the shock incident to the stopping of the cylinder. The connections to the cylinder 5 and the cylinders 60 and 63, are by a suitable flexible hose. The wiring to the contacts carried by the yoke 47 is also flexible. That is to say, the hose and wiring are carried along with the cylinder 5, and in practice would come up between the rollers 2ᵇ of the table 2.

It will be understood, of course, that in some cases it may be desired to move the rail 67 instead of the cylinder 5. In such instances, the screw clamp 41 could be attached to said rail 67, and this rail arranged to move instead of the clyinder 5.

I claim:

1. In combination with a punch press, a spacing device comprising a cylinder, a piston therein, means for effecting movement of the piston and cylinder relatively to each other and in the same direction, and plate gripping means carried by one of said movable members.

2. In combination with a punch press, a spacing device comprising a cylinder, a piston therein, means for effecting movement of the piston and cylinder relatively to each other and in the same direction, plate gripping means carried by one of said movable members whereby movement of the same will effect the desired spacing of the article to be punched, and means for cushioning such movement at the end of the stroke.

3. In combination with a punch press, a spacing device comprising a cylinder, a piston within said cylinder, fluid pressure means for moving one of said elements with respect to the other, means for effecting independent movement of the other member and in the same direction, and cushioning means for the end of each stroke.

4. In combination with a punch press, a spacing device comprising a cylinder, a piston within said cylinder, fluid pressure means for moving one of said elements with

respect to the other, and a spring for effecting independent movement of the other element.

5. In combination with a punch press, a spacing device comprising a cylinder, a piston within said cylinder, both cylinder and piston being movable and in the same direction, fluid pressure means for moving one of elements with respect to the other, cushioning means for the end of the strokes, and means for holding either the cylinder or the piston during each of said strokes.

6. In combination, a punch press, a plate gripping member, a cylinder to which said plate gripping member is attached, a piston relatively fixed with respect to said cylinder, both cylinder and piston being movable, means for moving each of said members with respect to the other and in the same direction, and means for cushioning such movement at the end of each stroke.

7. In combination, a punch press, a plate gripping member, a cylinder to which said plate gripping member is attached, a piston relatively fixed with respect to said cylinder, said cylinder and piston being movable alternately in the same direction, fluid pressure means for moving one of said members with respect to the other, a spring for effecting movement of the other member with respect to the first-mentioned member, and means providing an air cushion at the end of the stroke.

8. In combination with a punch press, spacing mechanism comprising a rail mounted with respect to said press in the line of the spacing, a carriage movable with respect to said rail, two sets of clamping elements operatively connected to said carriage for alternate engagement with the rail, a cylinder mounted on said carriage, a piston operatively mounted with respect to said cylinder, means for moving the piston and cylinder relatively to each other; one of said sets of clamping elements being out of action when such movement occurs, means for automatically stopping such movement, and means for cushioning the stroke.

9. In combination with a punch press, a rail in alignment therewith, spacing mechanism operatively connected to an article to be punched comprising a carriage movable on said rail, two sets of clamping elements operatively connected to said carriage for alternate engagement with the rail, a cylinder mounted on said carriage, a piston operatively mounted with respect to said cylinder, means for moving the cylinder and piston relatively to each other comprising a source of fluid pressure for effecting movement of one of said elements in one direction and a spring for effecting movement of the other element in the same direction; one of said sets of clamping elements being out of action when each of such movements occurs, automatically operating means for stooping such movements, and means for cushioning the movements at the ends of the strokes.

10. In combination, a punch press, a rail in alignment with the punching operation, stops mounted on said rail, a plate gripping member, a cylinder carrying the same, a carriage for the cylinder, a piston in operative relation to the cylinder and held against movement while the cylinder is moving, means for holding the cylinder against longitudinal movement at the end of each stroke, means for moving the piston while the cylinder is held, and means cooperating with said stops for arresting the movement of the piston and holding the same in such arrested position.

11. In combination, a punch press, spacing mechanism including a rail, a carriage movable on said rail and including a piston and a cylinder both of which are movable with respect to each other, stops for limiting the movement of said members, and gripping means for alternate engagement with the rail whereby the cylinder may be moved while the piston is at rest and the piston may be moved while the cylinder is at rest.

12. In combination, a punch press, spacing mechanism including a rail mounted in the line of the punching operation, a piston and a cylinder both of which are movable with respect to each other and to the rail, stops for limiting the movement of the cylinder and piston, fluid pressure means for effecting movement of the cylinder, a spring for effecting movement of the piston, gripping means for alternate engagement with the rail whereby the cylinder may be moved while the piston is at rest and the piston may be moved while the cylinder is at rest, and means for cushioning the end of the stroke effected by the fluid pressure means.

13. In combination, a punch press, a rail mounted in the line of the punching operation, spacing mechanism comprising an object gripping member, a movable cylinder carrying the same, a piston operatively mounted with respect to said cylinder, means for holding the cylinder while the piston moves, means for holding the piston while the cylinder moves, fluid pressure means for effecting movement of the cylinder, a spring for effecting movement of the piston, and a latch for holding the piston after it has reached the limit of its movement.

14. In combination, a punch press, a rail mounted in the line of the punching operation, spacing mechanism comprising an object gripping member, a movable cylinder carrying the same, a piston operatively mounted with respect to said cylinder, means for holding the piston while the cylinder moves comprising fluid operated clamping

pistons, means for holding the cylinder while the piston moves comprising fluid operated clamping pistons, independent fluid pressure means for effecting movement of the cylinder, and a spring for effecting movement of the piston.

15. In combination with a punch press, a spacing device having means for spacing more than one variation of spaces, a cooperating cylinder and piston for effecting such spacing with cushioning means at the end of each stroke, and clamping devices for said cylinder and piston alternately operable between strokes.

16. In combination with a punch press, a spacing device having means for spacing more than one variation of spaces including a cooperating cylinder and piston for effecting such spacing, fluid pressure means for operating the cylinder, a spring for operating the piston, and clamping devices for said cylinder and piston alternately operable between strokes.

17. A spacing device for punch presses and the like having a work moving cylinder, a piston cooperating therewith, a movable hook operatively connected to said piston, stops in the path of travel of said hook, and means for moving the hook away from said stops at certain periods.

18. A spacing device for punch presses, comprising a rail, a carriage movable on said rail: said carriage including a cylinder and a piston operatively mounted with respect to said cylinder and both movable with respect to the rail, means for moving the cylinder while the piston is at rest, means for moving the piston while the cylinder is at rest, and means for automatically determining the length of said strokes.

19. A spacing device for punch presses, comprising a rail, a carriage movable on said rail; said carriage including a cylinder and a piston operatively mounted with respect to said cylinder and both movable with respect to the rail, means for moving the cylinder while the piston is at rest, means for moving the piston while the cylinder is at rest, clamping devices for said cylinder and piston alternately operable between strokes to lock the same to the rail, and means for automatically determining the length of such strokes.

20. A spacing device for punch presses and the like, comprising an article gripping member, a cylinder connected to the same and movable with respect to a relatively fixed piston, means for effecting alternate movements of the cylinder and piston in the same direction, and non-recoil cushioning means operable at the ends of such movements.

21. A spacing device for punch presses and the like, comprising an article gripping member, a cylinder connected to the same and movable with respect to a relatively fixed piston, means for effecting relative movement between said cylinder and piston comprising fluid pressure means for moving the cylinder with respect to the piston while the latter occupies a relatively fixed position and a spring for moving the piston while the cylinder occupies a relatively fixed position, and means for cushioning the end of the cylinder stroke.

22. A spacing device for punch presses and the like, comprising an article gripping member, a cylinder connected to the same, a relatively fixed piston disposed within said cylinder, means for effecting relative movement between said cylinder and piston, means for automatically limiting such movement, and means for cushioning the end of such movement.

23. In a spacing device for punching machines, means including two members movable in the same direction for automatically effecting more than one variation of stroke, and a non-recoil air cushion for the members of the spacing mechanism brought into action at the end of each stroke.

24. In a spacing device for punching machines, means including two members movable in the same direction for automatically effecting strokes of more than one variation, and non-recoil shock-absorbing means brought into action at the end of each stroke.

25. In a spacing device for punch presses, a cylinder, a piston operatively mounted with respect to said cylinder, a series of stops, means for effecting movement of said cylinder and piston relatively to each other, and means carried by one of said members for cooperative engagement with said stops.

26. In a spacing device for punch presses, a punching element, a spacing device movable with respect to the punch press for the purpose of bringing the work into position with respect to the punching element, a punch gag cooperating with said punching element, means for automatically stopping the spacing device, and electrically operated means for controlling the punch gag in coordination with the spacing movements.

27. In a spacing device for punch presses, a spacing device movable with respect to the punch press for the purpose of bringing the work into position with respect to a punching element, means for automatically stopping the spacing device, means for locking the spacing device against movement while the punching operation is effected, and means for controlling the punch gags in coordination with the spacing movements.

28. In combination with a punch press, a spacing device including two members movable in the same direction and arranged to travel with respect to the punch press

and bring the work into punching position during such travel, means for moving the members of such spacing device, means for stopping the same at predetermined intervals, and means for cushioning such movements with a non-recoil device.

29. In combination with a punch press, a spacing device arranged to travel away from the punch press and bring the work into punching position during such travel, means for moving said spacing device, means for automatically stopping the same at predetermined intervals, and means for locking the spacing device against movement during the punching operation.

30. In combination with a punch press, a spacing device in fixed engagement with the work and moving the latter into position with respect to the punches, a cylinder and a piston arranged for movement with respect to each other and to the punch press for the purpose of advancing the work with respect to said press, means for halting the spacing device at predetermined intervals, and means for locking the same against movement during the punching operation.

31. The combination, in spacing mechanism for punch presses, of a rail, stops on said rail, a rod for moving the work with respect to said rail, a latch operatively connected to said rod and adapted to engage the stops on the rail; such engagement taking place when the rod is making a return stroke, and means for lifting the latch over the stops at the ends of each work stroke.

32. In combination, a punch press, a rail mounted in the line of the punching operation, spacing stops carried by said rail, spacing mechanism comprising a cylinder and a piston longitudinally movable with respect to said rail, rail gripping devices carried by the cylinder and piston and alternately operable, and a latch operatively connected to the piston; said latch cooperating with the stops carried by the rail whereby movement between the rail and spacing mechanism is obtained.

33. In combination, with a punch press, a spacing device comprising a cylinder, a piston therein, means for effecting movement of the piston and cylinder alternately and in the same direction, and plate gripping means carried by one of said movable members.

34. In combination with a punch press, a spacing device comprising a cylinder, a piston therein, means for effecting independent movement of the piston and cylinder relatively to each other whereby movement of the same will effect more than one variation of spacing of the article to be punched, and plate gripping means carried by one of said movable members.

35. In combination with a punch press, a spacing device for effecting more than one variation of spacing, comprising a cylinder, a piston within said cylinder, fluid pressure means for moving one of said members with respect to the other, means for effecting independent movement of the other member, and cushioning means for the end of each stroke.

36. A spacing device, comprising a work moving member having a work moving stroke and return stroke, a latch carried by said member, a spacing rail, resilient means for moving the member on the return stroke, stops on said rail to engage the latch on the return stroke, and means for disengaging the latch from the stops at certain intervals.

37. A spacing device, comprising a work moving member having a work moving stroke and a spacing stroke, means for effecting such movements, a latch carried by said member; a spacing rail, stops on said rail to engage the latch on the spacing stroke, means for disengaging the latch from the stops at certain intervals, and means for locking the work moving member to the spacing rail during the work stroke.

38. In plate feeding means for punch presses, a spacing rail, stops on the rail, a releasable gripping device to grip the rail during the work moving stroke, a latch movable with the gripping device and engaging the stops on the spacing stroke, means to withdraw the latch from the path of the stops at certain intervals, and power means for moving the gripping device when the latch is released so as to feed the plate to the punch.

39. A spacing device comprising a work moving member, a spacing rail, stops on the rail, a latch to engage said stops, and a locking device to lock the rail and work moving means together during the work moving stroke.

40. In combination with a spacing rail, stops on said rail, and a spacing device having rail gripping means operative during the work moving stroke, of a latch that travels with the gripping device and engages stops on the spacing rail.

41. A spacing device, comprising a rail, spacing stops on said rail, a gripping device movable with respect to said rail, a latch carried by said gripping device which engages stops along its path of travel on said rail, means for moving the latch out of the path of the stops at certain intervals, power means for driving the gripping device during the working stroke, and resilient means for driving the gripping device during the space selecting stroke.

42. In plate feeding means for punch presses, a spacing device comprising a spacing rail, a gripper to engage the rail, means for actuating the gripper to move the work to the punch, means for releasing said gripper at the end of the working stroke, stops

on the spacing rail, a latch operatively connected to the gripper to engage the stops on the spacing stroke, means to release said latch at certain intervals, and means for driving the gripper until stopped by the latch a distance equal to the next desired work stroke.

43. In spacing device, a spacing rail, stops on said rail, a gripper, means for successively advancing said gripper in steps in relation to said spacing rail, and a latch operatively connected to said gripper and arranged to engage stops in its path of travel so that the spacing stroke of the gripper is set to equal the next working stroke.

44. In combination with a punch press, a spacing device having means for spacing more than one variation of spaces, a cooperating cylinder and piston for effecting such spacing with non-recoil cushioning means at the end of each stroke, and clamping devices for said cylinder and piston alternately operable between strokes.

45. A spacing device comprising a work-moving member, a spacing rail, stops on the rail, a latch carried by the work-moving member to engage the stops, a locking device to lock the rail and work-moving member together during the work-moving stroke, means for automatically disengaging the rail and work-moving member during the space-selecting stroke, resilient means for effecting the space-selecting stroke by forcing the latch against the stops, means for moving the latch from the path of the stops at certain intervals, and means for locking the work against movement during the space-selecting stroke.

46. A spacing device comprising a work-moving member, a spacing rail, stops on the rail, a latch carried by the work-moving member to engage the stops, a locking device to lock the rail and work-moving member together during the work-moving stroke, means for automatically disengaging the rail and work-moving member during the space-selecting stroke, resilient means for effecting the space-selecting stroke by forcing the latch against the stops, means for moving the latch from the path of the stops at certain intervals, and means for locking the work against movement during the space-selecting stroke, in combination with a punch press having gagged tools, and controlling means for the gags arranged in line with the stops on the spacing rail.

47. A spacing device having a work-moving stroke and a space-selecting stroke, comprising a work-moving member, a spacing rail, stops on the rail, a latch to engage the stops and normally in line with the same, a locking device to lock the work-moving member and rail together during the work-moving stroke, means for unlocking said rail and work-moving member during the space-selecting stroke, resilient means for forcing the latch and stops together at the end of the space-selecting stroke, and means for throwing the stops and latch out of line with each other at the end of the work-moving stroke.

48. A spacing device having a work-moving stroke and a space-selecting stroke, comprising a work-moving member, a spacing rail, stops on the rail, a latch to engage the stops and normally in line with the same, a locking device to lock the work-moving member and rail together during the work-moving stroke, means for unlocking said rail and work-moving member during the space-selecting stroke, resilient means for forcing the latch and stops together at the end of the space selecting stroke, means for throwing the stops and latch out of line with each other at the end of the space-selecting stroke, means for throwing the stops and latch out of line with each other at the end of the work-moving stroke, and non-recoil shock-absorbing means effective at the end of the said work-moving stroke.

49. A spacing device comprising a spacing rail, work-moving means, a latch carried by said work-moving means co-acting with stops spaced on said spacing rail, means for locking the spacing rail, and work-moving means together during the period of the work-moving stroke and until the work has come to rest, means for locking the work during the period of punching and during the period of the spacing stroke, and means for throwing the latch out of the path of the stops at the beginning of the spacing stroke and replacing it in the path of travel before the finish of the spacing stroke.

50. A punch press having gagged tools, movable gags cooperating therewith, step-by-step spacing means including a spacing rail for automatically feeding work through the press, automatic power means for operating the gags, and control stations spaced along the path of travel of the spacing means to control the gags, said spacing means engaging the spacing rail during the work moving stroke.

51. A punch press having gagged tools, movable gags cooperating therewith, step-by-step spacing means including a spacing rail, and stops on said spacing rail for feeding work through the press, automatic power means for operating the gags, and control stations arranged to co-act with the spacing means and arranged parallel with the stops on said rail; said spacing means engaging the spacing rail during the work feeding stroke.

52. A punch press having automatically operated gagged tools, movable gags cooperating therewith, and automatically operated spacing means including a spacing rail, a row of stops on said spacing rail, and another row of control stations for controlling

the gags spaced parallel with the said bar and spaced according to the stops and so that the gag is operated after the spacing means has made the correct space; said spacing means and said rail being engaged during the work moving stroke.

53. A punch press having automatically operated gagged tools, movable gags cooperating therewith, and automatically operated spacing means including a spacing rail, a row of stops on said spacing rail, and another row of control stations for controlling the gags spaced parallel with the said bar and spaced according to the stops, said spacing means having a space selecting stroke and a work moving stroke.

In witness whereof I have signed this specification.

WILLIAM A. LACKE.