

Aug. 18, 1936.

J. J. DILKS, JR

2,051,031

PUNCHING MACHINE

Filed April 19, 1935

5 Sheets-Sheet 1

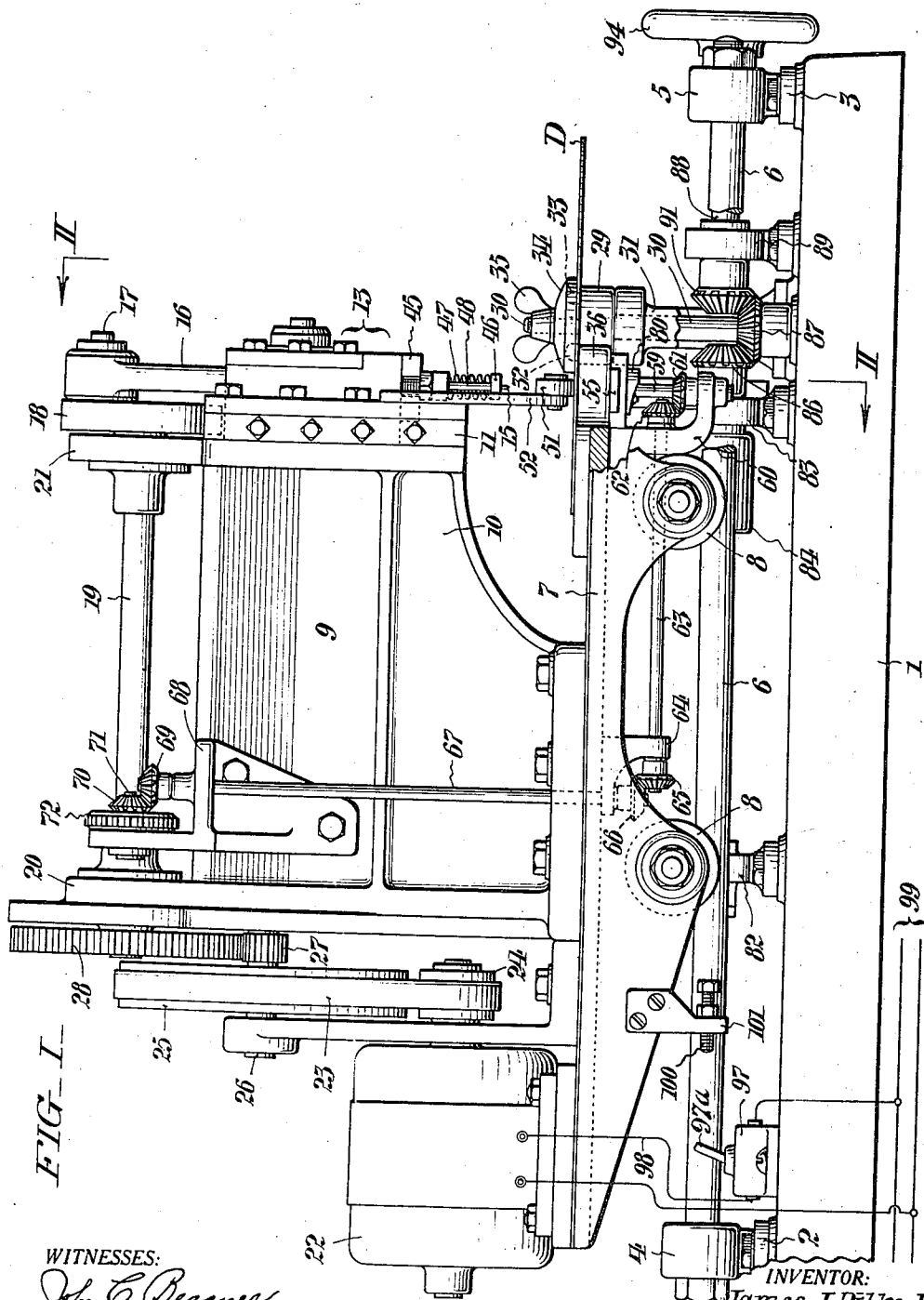


FIG. I

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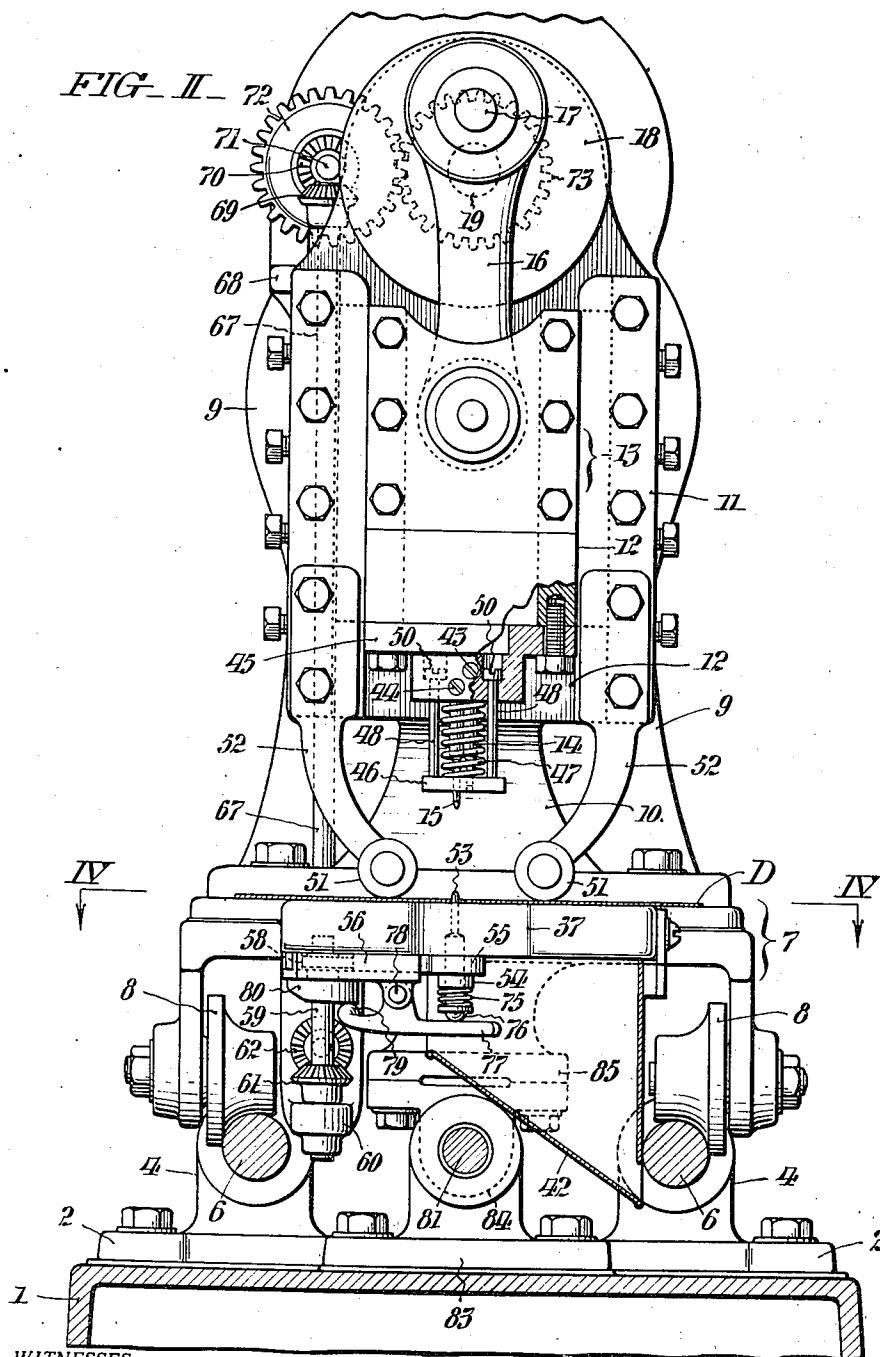
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PUNCHING MACHINE

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5 Sheets-Sheet 2



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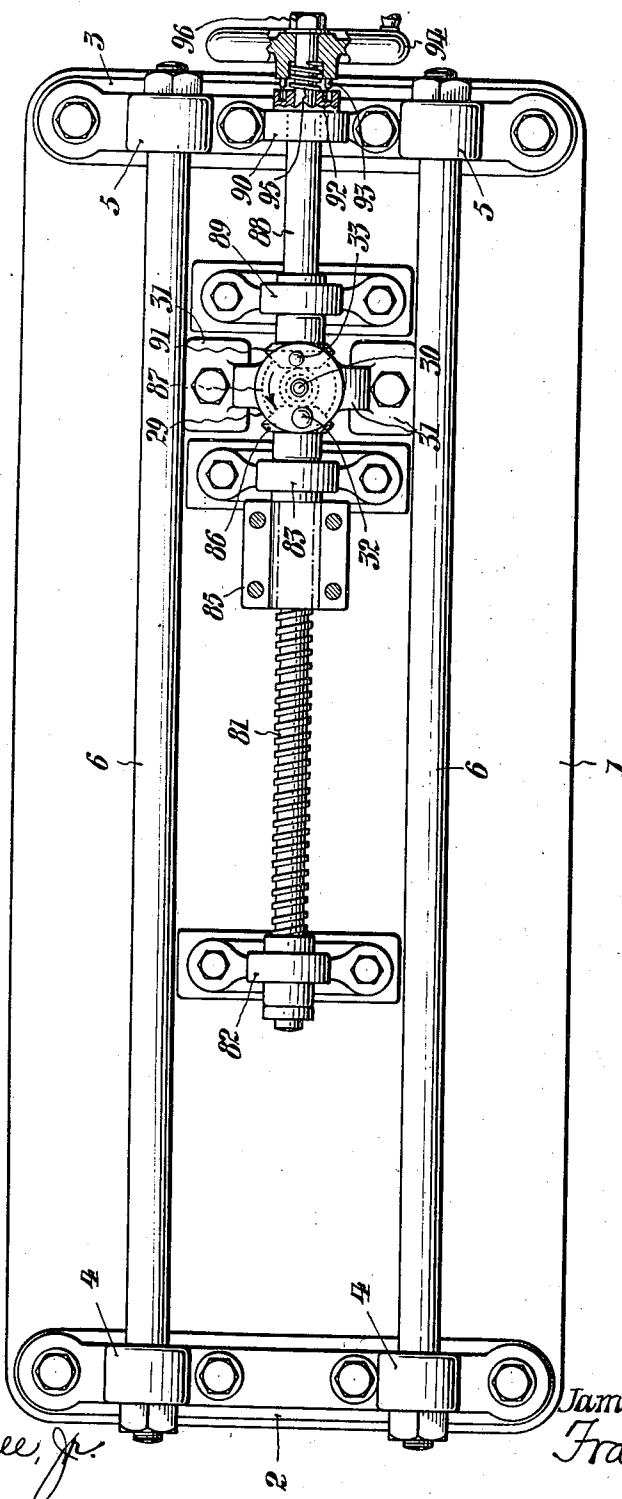
2,051,031

PUNCHING MACHINE

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5 Sheets-Sheet 3

FIG. III



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5 Sheets-Sheet 4

FIG. IV

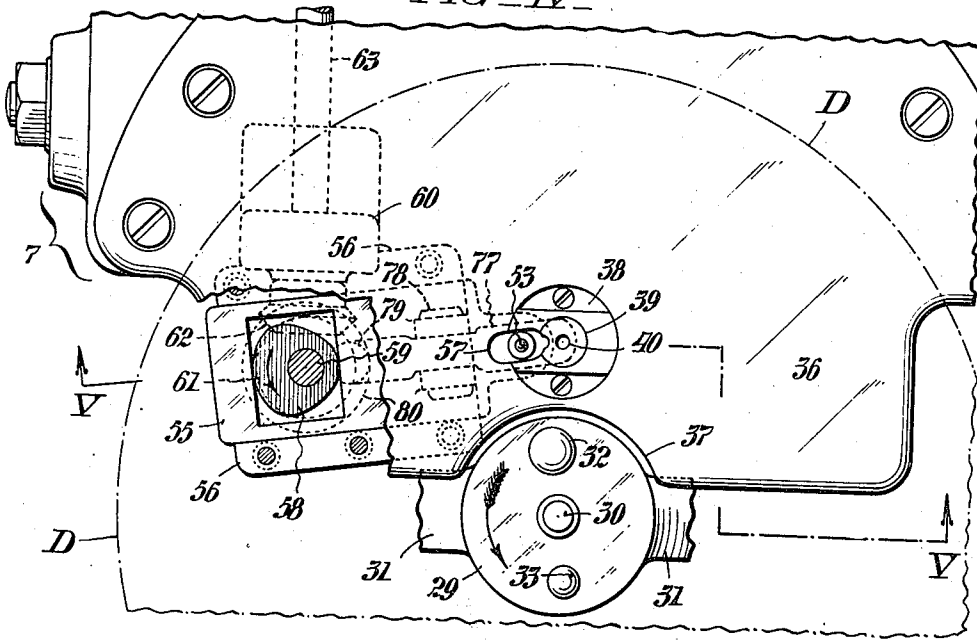
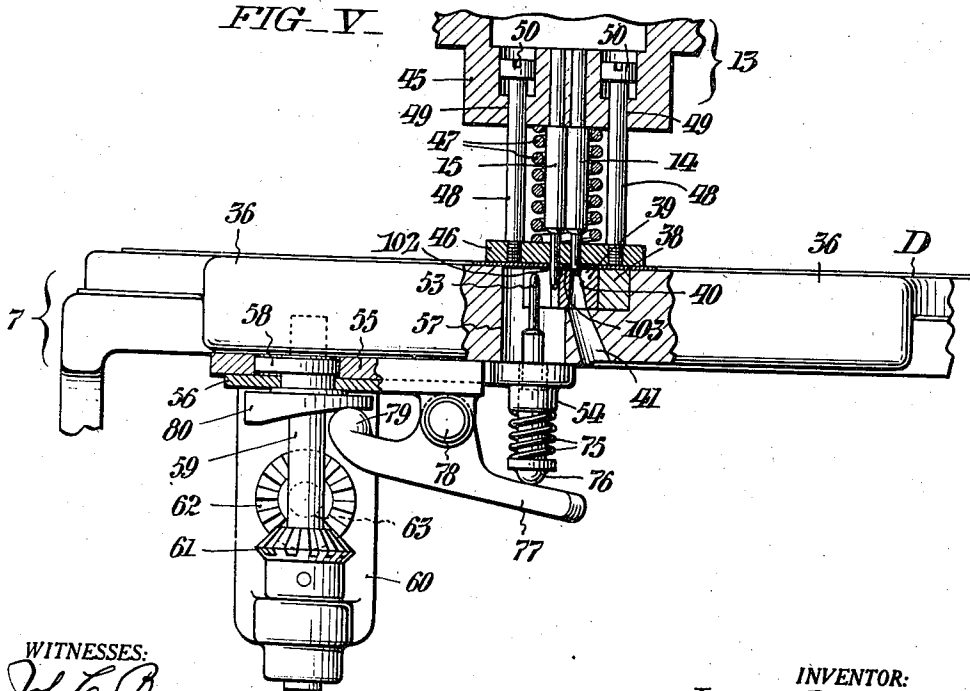


FIG. V



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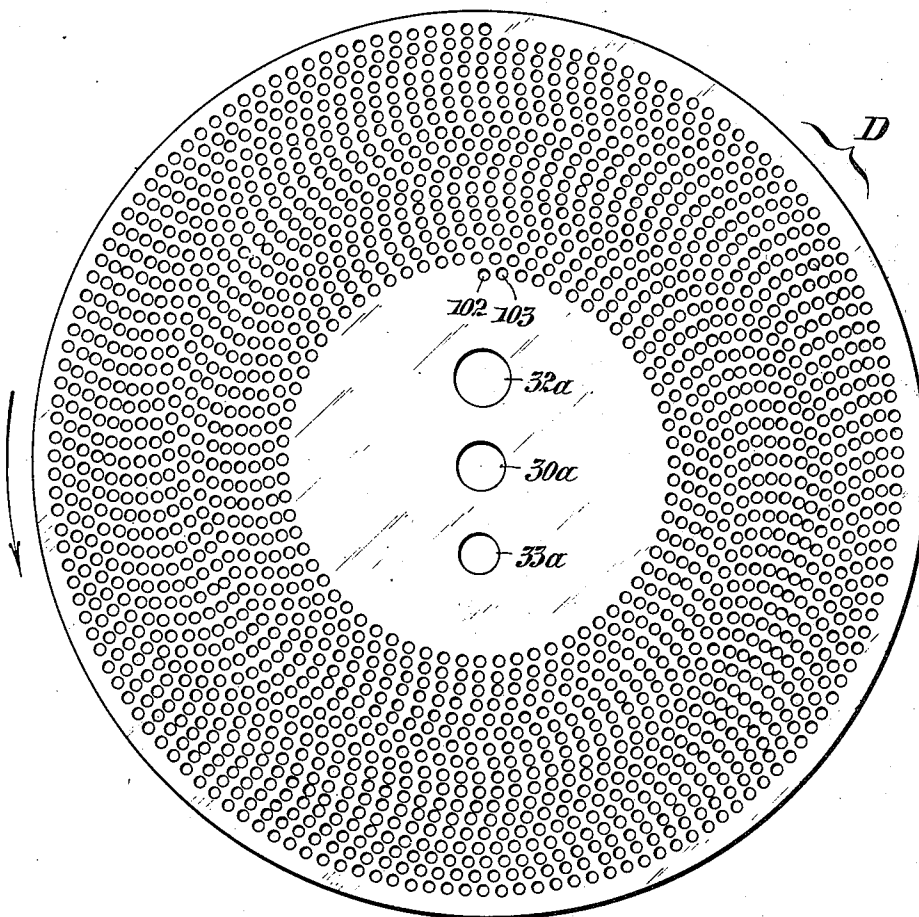
2,051,031

PUNCHING MACHINE

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5 Sheets-Sheet 5

FIG. VI -



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## UNITED STATES PATENT OFFICE

2,051,031

## PUNCHING MACHINE

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Application April 19, 1935, Serial No. 17,168

14 Claims. (Cl. 164—87)

This invention relates to machines for punching and perforating sheet metal or the like.

In connection with machines of the kind referred to, I aim to afford simple and reliable mechanism for positionally shifting an intermittently-actuated punching or perforating tool, and a sheet metal disk relatively in such a manner that new blank portions of the disk surface are successively presented to the tool in alternation with the actuations of the latter, by equal increments along a spiral path of uniform pitch.

Another object of my invention is to provide regulatable means for automatically stopping the machine after a predetermined number of actuations of the punching or perforating tool.

A machine having the aforescribed attributes is especially advantageous in the production of disks useful as driving elements in disk motion picture cameras and projectors such as featured in my co-pending applications, Serial Numbers 7,560 and 7,562, filed February 21, 1935, where it is absolutely essential that the holes in the driving disks be very closely and equally spaced, with absolute accuracy, along the spiral as well as radially of said disks.

The machine of my invention may also be advantageously employed for example in punching out washers, or in blanking coins, medallions and the like from blank sheet metal disks, with a minimum wastage of the metal.

Other objects and attendant advantages of this invention will be manifest from the detailed description following of the drawings, wherein Fig. I is a side elevation of a punching machine conveniently embodying the present improvements, portions of the machine being broken out and others sectioned for better illustration of important details.

Fig. II is a view, partly in end elevation and partly in cross section, taken as indicated by the arrows II—II in Fig. I.

Fig. III is a plan view of the machine with certain parts removed and with portions broken out and sectioned.

Fig. IV is a fragmentary plan sectional view taken as indicated by the arrows IV—IV in Fig. II.

Fig. V is a fragmentary view, partly in elevation and partly in section, taken as indicated by the arrows V—V in Fig. IV; and

Fig. VI shows a face view of a disk perforated with the machine.

As herein delineated, my improved punching machine comprises an oblong base 1 to the top of

which are bolted, crosswise of its opposite ends, brackets 2 and 3 respectively having aligned upstanding bosses 4 and 5 for the rigid support of a pair of laterally spaced horizontal track rods 6. Movable on the base 1 is a carriage 7 having flanged wheels 8 at opposite sides thereof which run on the track rods 6. Centrally mounted on the carriage 7 is a standard 9 having a forwardly projecting overhang arm 10, said arm terminating in a head 11 with a guideway 12 for a vertically reciprocating slide 13 which carries a punching tool 14 and a pilot pin 15 in definite laterally spaced relation. As shown in Figs. II and IV, the punching tool 14 lies in the longitudinal axis of the machine with the pilot pin 15 disposed at the left thereof in the aforesaid figures. Up and down movement is imparted to the slide 13 through a pitman 16 connected to an eccentric pin 17 on a crank disk 18 at the right hand end (Fig. I) of a horizontal shaft 19, which latter is journaled in bearings 20 and 21 at the top of the standard 9. As shown, the shaft 19 is driven from an electric motor 22 supported on the carriage 7 at its rear end, through speed reducing drive connections including a belt 23 (Fig. I) which coordinates a small pulley 24 on the motor shaft with a larger pulley 25 on a counter-shaft 26, and a spur pinion 27 on said counter-shaft in mesh with a gear wheel 28 on the rear or left hand end of said shaft 19. The disk D which is to be punched out or perforated, is mounted on a head 29 at the upper end of a vertical spindle which, like the punching tool, lies in the longitudinal axis of the machine. The spindle 30 is journaled in an upright bearing bracket 31 bolted to the top of the base 1 at the forward end of the latter in the interval between the track rods 6. Upstanding from the collar 29 is a pair of diametral studs 32 and 33 which are of different diameters, see Figs. I and IV, and which are symmetrically spaced with respect to the protruding upper end of the spindle 30. The studs 32 and 33 and the upper end of the spindle 30 are adapted to be engaged by corresponding preformed apertures 30a, 32a and 33a (Fig. VI) in the disk D. After placement of the disk D on the head 29, it is secured by a cap 34 and a winged clamp nut 35, of which the latter engages screw threads on the upper end of the spindle 30. During the perforating operation, the disk D is supported in part by a forwardly projecting shelf 36 rigidly secured to the top of the carriage 7. As shown in Figs. I and IV, the shelf reaches into close proximity to the head 29 on the spindle 30

and is provided in its frontal edge with a concentric arcuate recess 37 to clear said head.

Recessed into the top of the shelf 36 (Fig. V) is a holder 38 for a die 39 having a vertical opening 40 therethrough adapted to receive the lower diametrically-reduced end of the punching tool 14 on the vertical reciprocating slide 13. As shown, the opening 40 flares downwardly and registers with a passage 41 in the lower part of the shelf 36, through which opening the punchings fall into a gravity chute 42 (Fig. II) from whence they are deflected laterally into a suitable collecting receptacle, (not illustrated) placed on the base 2. The punching tool 14 and the pilot pin 15 (see Figs. II and V) are respectively secured, by means of screws 43 and 44 in a holder 45 bolted to the bottom of the slide 13. The lower reduced ends of the tool 14 and the pilot pin 15, which, it will be observed are of like diameter, pass through correspondingly spaced openings in a stripper plate 46. This stripper plate 46 is subject to a compression spring 47 which surrounds the punching tool 14 and the pilot pin 15, and which is confined to up and down movement by a pair of shank members 48 having sliding guidance in openings 49 of the holder 45, heads 50 at the top of the shank members serving to limit the downward movement of the stripper plate 46 relative to the slide 13 under the action of the spring 47. The function of the stripper plate 46 is to hold the disk D down on the shelf 36 as the perforating tool 14 and the pilot pin 15 are withdrawn after each punching operation. In this function, the stripper plate 46 is assisted by a pair of rollers 51 on arms 52 bolted to the forward end of the standard 9.

During the operation of the machine, the disk D is intermittently rotated by means of a picker having the form of a pin 53 which is of the same diameter as the tool 14 and the pilot pin 15 and which successively enters the holes previously formed in said disk by the punching tool 14. As shown in Figs. II and V this picker pin 53 has capacity for axial movement in the boss 54 of a slide 55 which is guided for reciprocative movement in a guide 56 bolted to the bottom face of the shelf 36, said picker pin extending upwardly through a slot 57 in the shelf 36. Movement is imparted to the slide 55, with dwells in its advanced and retracted positions, by means of a rotary cam 58 on a constantly rotating vertical shaft 59 journaled in a bracket 60 pendant from the carriage 7. The connections for driving the shaft 59 include a miter pinion 61 thereon in mesh with a companion miter pinion 62 on a horizontal shaft 63, which, at one end, is journaled in the bracket 60 and at the other end in a supplemental bracket 64 bolted to the bottom of the carriage 7. The horizontal shaft 63 receives motion in turn through another pair of miter gears 65 and 66 from a vertical shaft 67 which, at its lower end, has journal support in the bracket 64 and at its upper end in a bearing bracket 68 bolted to one side of the standard 9. A miter pinion 69 at the top of the vertical shaft 67 meshes with a companion miter 70 on a horizontal stub shaft 71 also having journal support in the bracket 68 and carrying a spur gear 72 that meshes with a corresponding spur gear 73 on the horizontal shaft 19. Thus for each rotation of the horizontal shaft 19, the slide 55 is given one complete reciprocation, the eccentric 58 being so proportioned that the movement imparted to the disk D corresponds exactly to the spacing of the punching tool 14 and the pilot pin

15, whereby, at each movement, a new blank space on the disk surface is presented to said punching tool as later on more fully explained. The picker 53 is withdrawn from the disk D during each of its operative cycles by a spring 75 in compression between the bottom end of the boss 54 of the slide 55 and a flange 76 at the bottom end of said picker, which latter is rounded as shown to engage a lever 77 fulcrumed at 78 to the guide 56. From Figs. II and V it will be noted that the lever 77 is formed with a finger 79 which engages a rotary cam 80 on the vertical shaft 59. This cam 80 is so positioned on the shaft 59 that the picker 53 is moved upward into each newly punched hole when the slide 55 reaches its fully advanced position.

Concurrently with each pick of the picker 53, the carriage 7 is shifted rearward on its tracks 6, also as more fully explained later, through a partial rotation of a horizontal feed screw 81 whereof the opposite ends are journaled in bearings 82, 83 secured to the top of the base 1 of the machine, said screw engaging an internally threaded boss 84 of a pendant bracket 85 on said carriage, see Figs. I and III. Intermittent rotative movements are imparted to the feed screw 81 through a miter pinion 86 thereon which meshes with a miter pinion 87 on the vertical spindle 30 whereby the disk D is supported.

As a means for setting the machine for starting I have provided a supplemental shaft 88 in alignment with the screw spindle 81, said shaft being journaled in bearings 89 and 90 respectively secured to the base 1 and to the bracket 3 at the forward end of the latter, see Fig. III. At its inner end the supplemental shaft 88 carries a bevel gear 91 which meshes with the bevel gear 87 on the vertical spindle 30. Forward of the bearing 90, the supplemental shaft 88 is provided with a clutch collar 92 adapted to be engaged by clutch pins 93 on a hand wheel 94. A spring 95 normally urges the hand wheel 94 against a head 96 at the outer end of the supplemental shaft 88 with the pins 93 withdrawn from the apertures in the clutch collar 92.

Stoppage of the machine is automatically effected by throwing of a snap switch 97 interposed in one of the leads 98 from a power line 99 to the motor 22, the toggle lever 97a of said switch being engaged and thrown by an abutment in the form of a screw bolt 100 adjustable in a bracket 101 on the carriage 7.

The operation of the machine is as follows: The hand wheel 94 is pressed inward to clutch the collar 92 on the supplemental shaft 88, and rotated clockwise to turn the feed screw 81 until the bracket 84 on the carriage 7 abuts the fixed bearing 83 on the base 1, with the studs 32 and 33 on the mounting head 29 at the top of the vertical spindle 30 positioned as shown in Figs. II and IV. A blank disk D is then placed on the mounting head 29 and made fast by the cap 34 and the wing nut 35, with a preformed starting hole 102 in said disk (Fig. VI) axially beneath the pilot pin 15. The motor switch 97 is thereupon manually thrown to the "on" position shown in Fig. I and the machine thereby set in motion. Immediately, the slide 13 moves downward from the position shown in Fig. II incident to which the stripper 46 makes advance contact with the disk D. As the descent of the slide 13 continues, the pilot pin 15 enters the starting hole 102 in the disk D to hold the latter against accidental displacement, while the tool 14, in following, punches the first hole 103 in the disk

rightward of said starting hole. During the subsequent rise of the tool 14 and the pilot pin 15, the slide 55 is advanced, i. e. moved to the right in Figs. IV and V by action of the rotary cam 58 on the vertical shaft 59, and the picker pin 53 elevated by action of the other rotary cam 80 on the shaft 59 incident to a momentary dwell of said slide in its advanced position, into the hole 102 just vacated by the pilot pin. By a subsequent receding movement of the slide 55 to the left in Fig. IV under the influence of the cam 58, a rotative shift is imparted to the disk D by the picker 53 in the direction of the arrow in Fig. IV to an extent corresponding to the spacing of the punching tool 14 and pilot pin 15. As a result of this shift, a new blank portion of the surface of the disk D is presented for punching during the next descent of the tool 14. The cycle just described is continuously repeated; and concurrently with each rotational shift of the disk D, movement is imparted to the feed screw 81 from the vertical spindle 30 through the miter gears 86 and 87 with the result that the carriage 7 is caused to recede, i. e. shift leftward in Fig. I by a definite amount. By such concurrent rotational shifting of the disk D, and radial shifting of the carriage 7, in respect thereto, the new blank spaces of the disk surface are successively presented to the tool 14 along a spiral path. Since the throw of the picker 53 and the movement imparted to the carriage 7 at each actuation are both constant, the holes punched in the disk D by the tool 14 will be evenly spaced accurately along a spiral having a uniform pitch as shown in Fig. VI. The machine continues in operation until the switch 97 is automatically thrown to "off" position by engagement of the adjustable abutment 100 with the toggle lever 97a of said switch, when the motor 22 will be stopped after a predetermined number of actuations of the tool 14 and the punching of a corresponding number of holes in the disk.

Obviously, by proper design of the parts, the spacing of the holes and the pitch of the spiral may be made to any required dimensions, the disk illustrated in Fig. VI having its holes very closely spaced both circumferentially and radially. Moreover, by employing punching tools 14 of larger diameter and providing for correspondingly increased relative movements of the disk and the tool, my improved punching machine may be adapted, as already mentioned, for stamping out washers, blanking coins, medallions, etc. with a minimum wastage of metal.

The two uses which have been described are of course to be considered as suggestive of others to which the machine may be put in practice.

Having thus described my invention, I claim:

1. A punching machine comprising a rotatable mounting for a disk of sheet metal or the like; an intermittently-actuated punching tool; a reciprocating picker operative in alternation with the actuations of the tool to engage a previously formed hole in the disk to rotatively advance the disk by a definite amount; and a pilot pin adapted to engage another previously formed hole in the disk to preclude accidental shifting of the latter during each punching operation.

2. A punching machine comprising a reciprocating punching tool; a support for a blank of sheet metal or the like beneath the tool; means operative in alternation with the tool to progressively advance the blank for presentation of new blank portions of its surface to said tool; and a pilot pin associated with the punching tool

and adapted to engage a previously formed hole in the blank to hold the latter against accidental shifting during the punching movement of the tool.

3. A punching machine comprising a rotatable mounting for a disk of sheet metal or the like; a carriage guided for movement radially of the disk; an intermittently-actuated punching tool reciprocative in the carriage; a picker element on the carriage operative in alternation with the actuations of the punching tool to engage a previously formed hole in the disk and to rotatively shift the latter by a definite amount each time; and means deriving movement from the rotatable mounting for the disk to progressively shift the carriage concurrently on its guide.

4. A punching machine comprising a rotatable mounting for a disk of sheet metal or the like; a carriage guided for movement radially of the disk; an intermittently-actuated punching tool reciprocative in the carriage; a picker element on the carriage operative in alternation with the actuations of the tool to engage a previously formed hole in the disk and to rotatively shift the latter a definite amount each time; and a feed screw deriving intermittent movement from the rotatable mounting of the disk to concurrently shift the carriage on its guide.

5. A punching machine comprising a rotatable mounting for a disk of sheet metal or the like; an intermittently actuated punching tool; a carriage for the tool guided for movement radially of the disk; and means for intermittently rotating the disk mounting and for progressively shifting the carriage in alternation with the actuations of the tool including an electric motor for driving the machine; a switch in circuit with the motor; and a regulatable abutment on the carriage adapted to trip the switch and stop the machine after a predetermined number of actuations of the punching tool.

6. A punching machine comprising an intermittently actuated tool for punching holes in a disk of sheet metal or the like, picker means for successively engaging the punched holes to rotatively shift the disk for presentation of new blank portions of the disk surface to the tool; and means for concurrently shifting the tool and the disk relatively so that the holes are formed along a spiral.

7. A punching machine comprising an intermittently actuated tool for punching holes in a disk of sheet metal or the like; picker means for successively engaging the punched holes to rotatively shift the disk for presentation of new blank portions of the disk surface to the tool; and means for concurrently shifting the punch radially of the disk so that the holes are formed along a spiral.

8. A punching machine comprising an intermittently actuated punching tool; means for positionally shifting the tool and a disk of sheet material relatively, step by step, in alternation with the actuations of the tool for successive presentation of new blank portions of the disk surface to the tool along a spiral path; and regulatable means for automatically stopping the machine after a predetermined number of actuations of the punching tool.

9. A punching machine comprising a rotatable mounting for a disk of sheet metal or the like; an intermittently actuated punching tool; a carriage for the tool guided for movement radially of the disk; picker mechanism operative in alternation with the tool for successively engag-

ing holes punched in the disk to intermittently rotate the disk mounting; and means deriving movement from the disk mounting for progressively shifting the carriage concurrently.

- 5 10. A punching machine comprising a rotatable mounting for a disk of sheet metal or the like; an intermittently actuated punching tool; a carriage for the tool guided for movement radially of the disk; picker mechanism operative  
10 in alternation with the tool for successively engaging holes punched in the disk to intermittently rotate the disk mounting; and a feed screw deriving movement from the disk mounting for progressively shifting the carriage concurrently  
15 so that the holes are punched in the disk along a spiral.

11. A punching machine comprising a rotatable mounting for a disk of sheet metal or the like; an intermittently actuated punching tool;  
20 a carriage guided for movement radially of the disk; a slide having guidance for reciprocation in the carriage and supporting the tool; and means for intermittently rotating the disk mounting and for progressively shifting the carriage in alternation with the actuations of the  
25 tool.

12. A punching machine comprising a rotatable support for a disk of sheet metal and the like; an intermittently actuated punching tool  
30 guided for movement radially of the disk; means operative in alternation with the actuations of the tool for engaging previously punched

holes in the disk to rotatively shift the latter for presentation of a new blank portion of the disk surface to the tool and means for concurrently shifting the tool support relative to the disk.

13. A punching machine comprising a rotatable support for a disk of sheet metal or the like; an intermittently actuated punching tool; a support for the tool guided for movement radially of the disk; a reciprocating picker with a fixed throw operative in alternation with the  
10 actuations of the tool for engaging previously punched holes in the disk to rotatively shift the latter for presentation of new blank portions of the disk surface to the tool; and means for concurrently shifting the tool support relative to  
15 the disk so that the holes are formed along a spiral.

14. A punching machine comprising a rotatable mounting for a disk of sheet metal or the like; an intermittently actuated punching tool;  
20 a carriage for the tool guided for movement radially of the disk; means for intermittently rotating the disk mounting and for progressively shifting the carriage in alternation with the actuations of the tool; an electric motor for driving the machine; a spring in circuit with the  
25 motor; and a regulatable abutment on the carriage adapted to trip the switch and stop the machine after a predetermined number of actuations of the punching tool. 30

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