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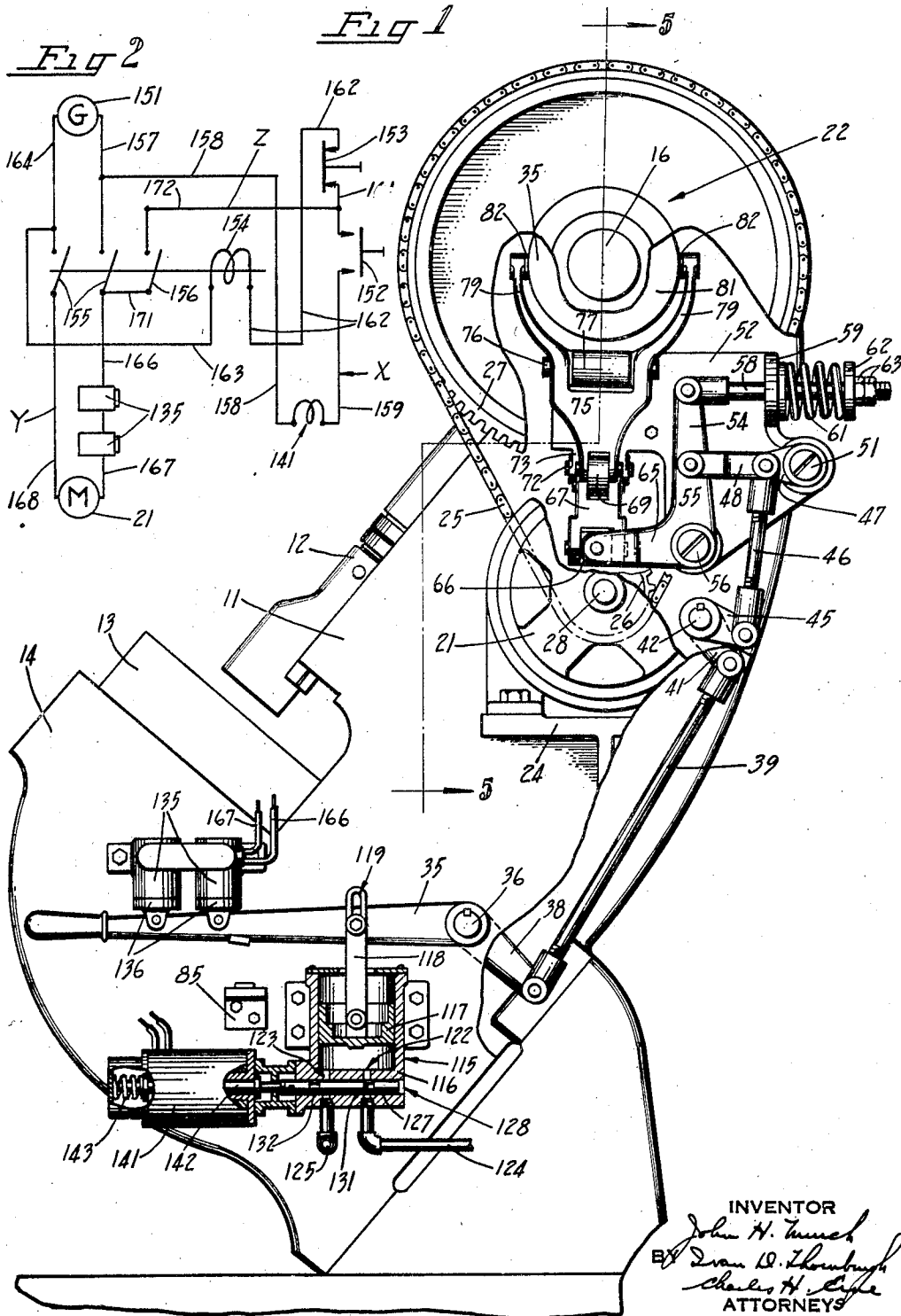
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2,311,682

AUTOMATIC DIE PRESS

Filed Dec. 21, 1939

5 Sheets-Sheet 1



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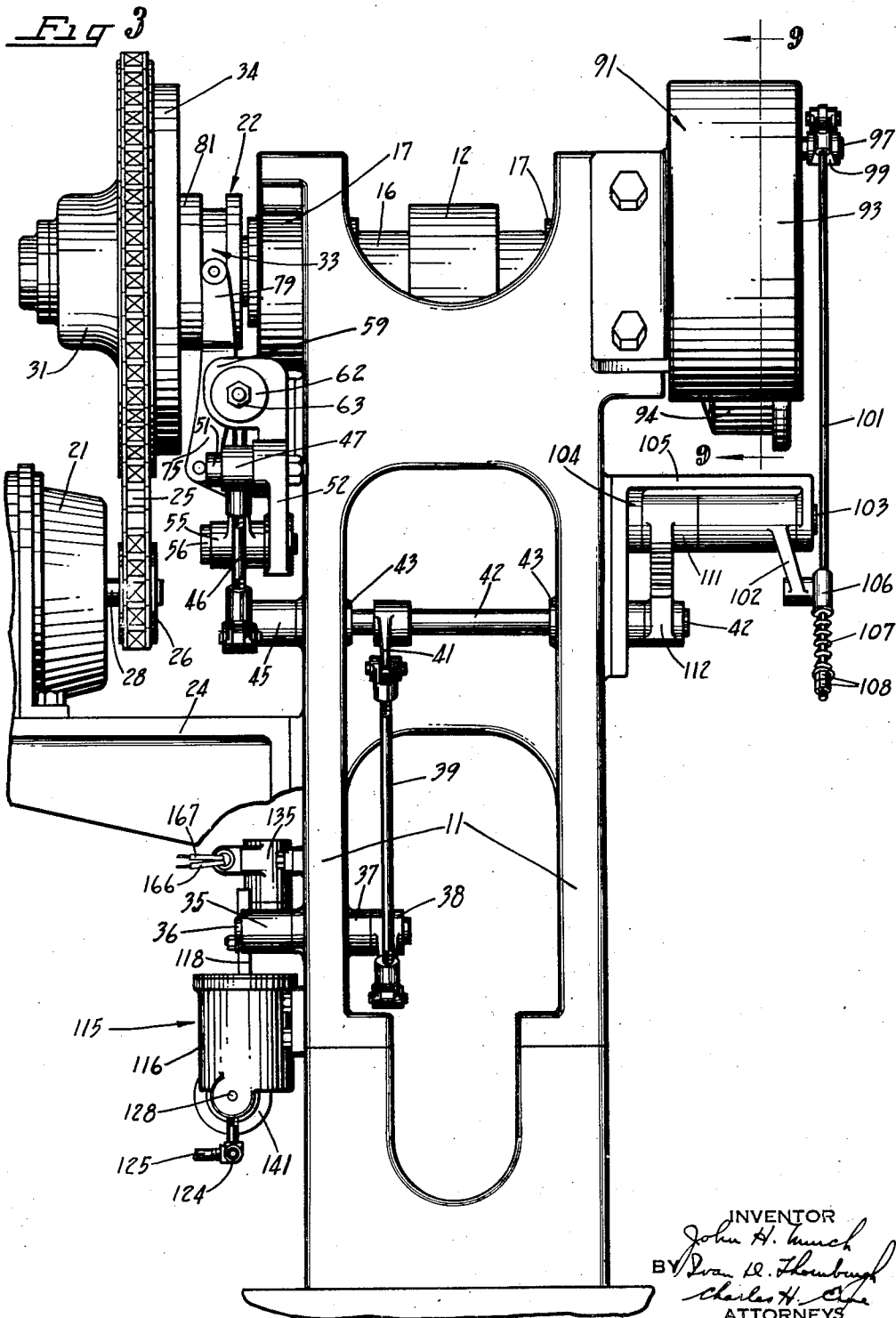
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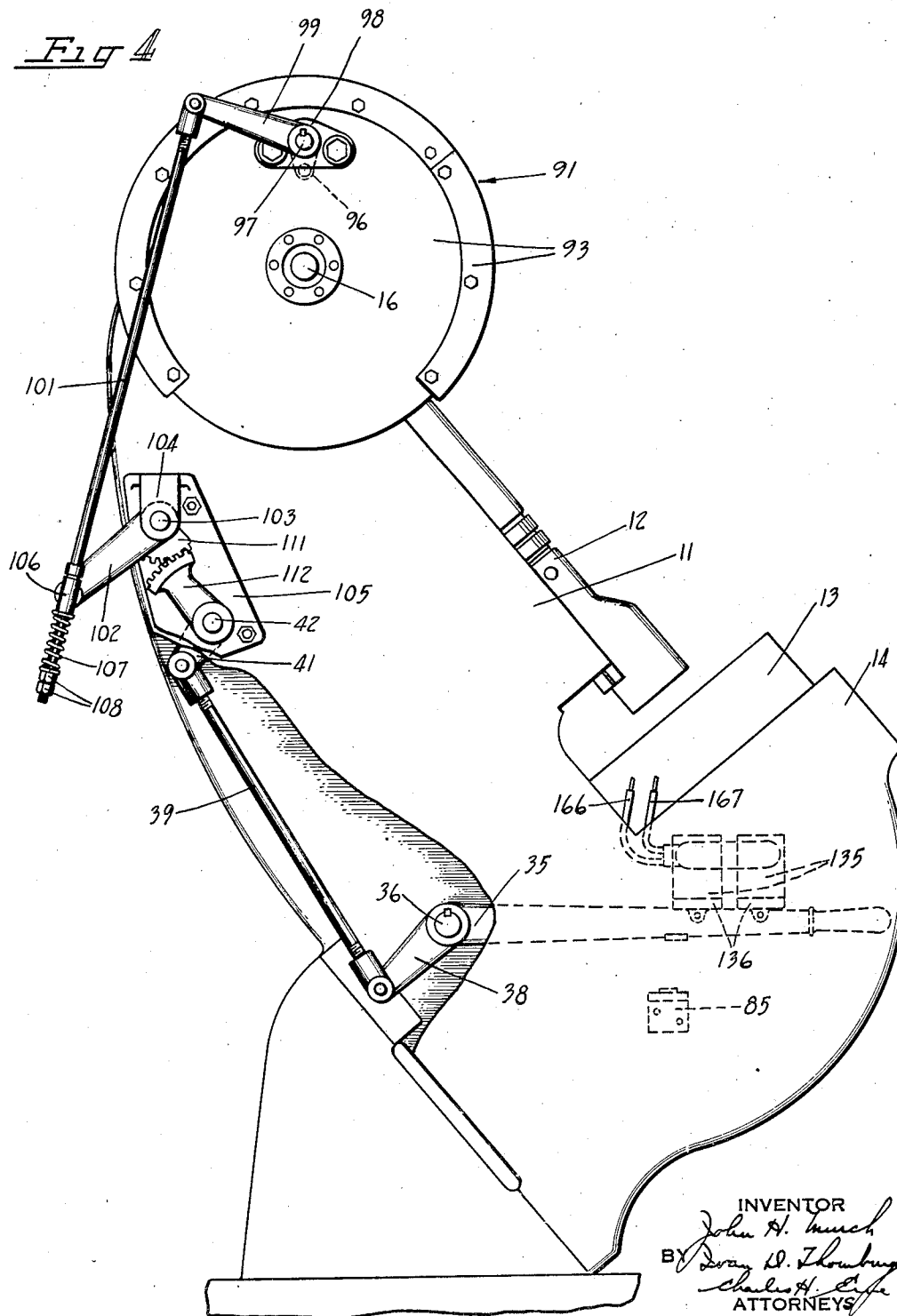
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Fig 4



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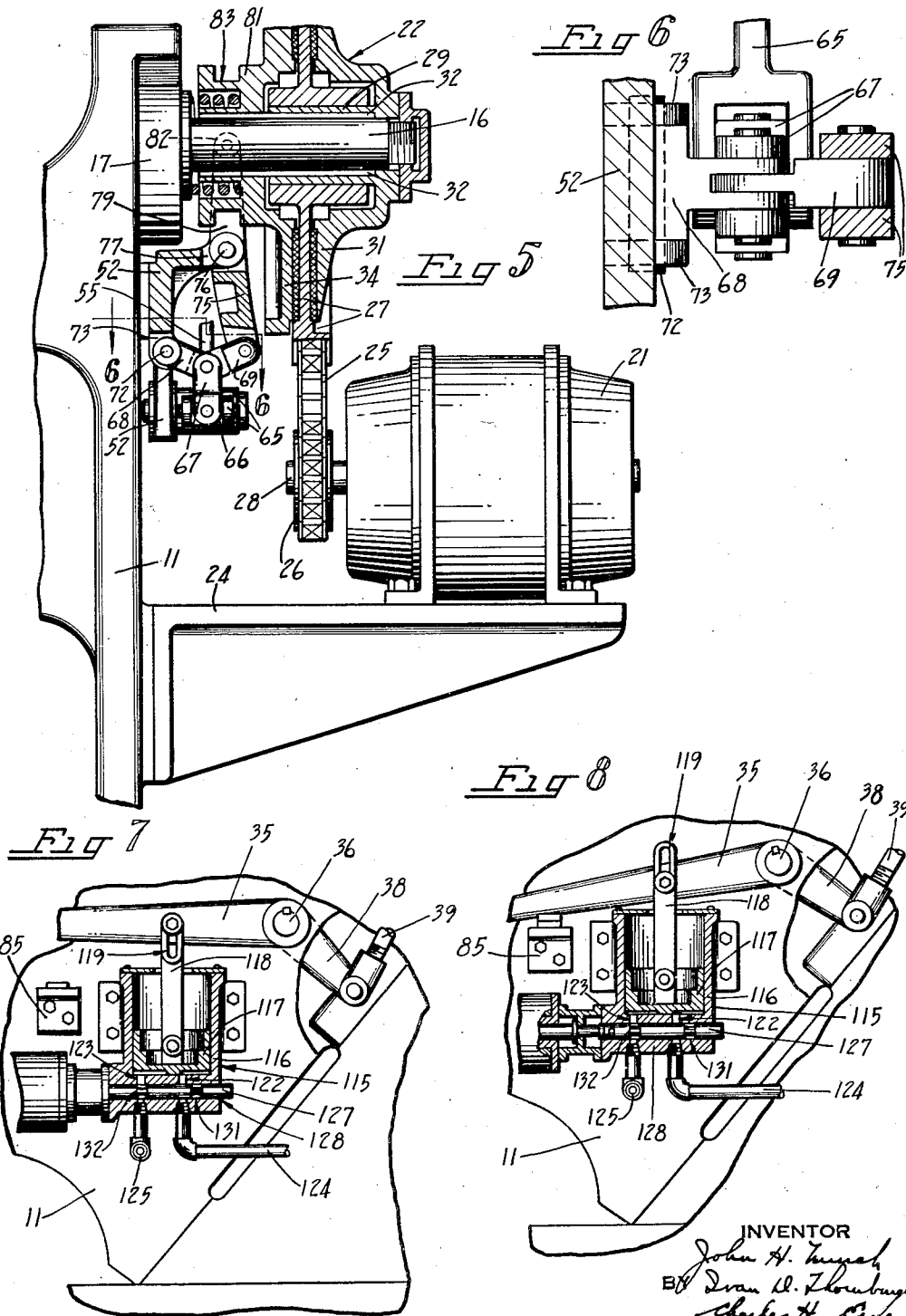
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Fig 9

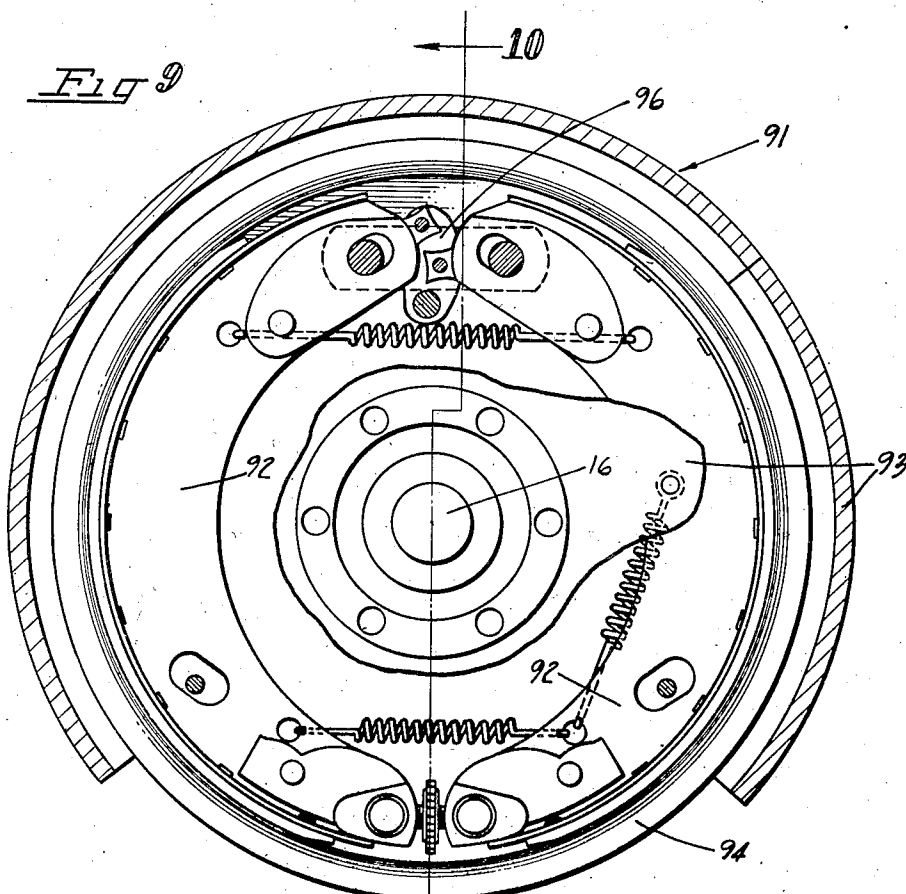
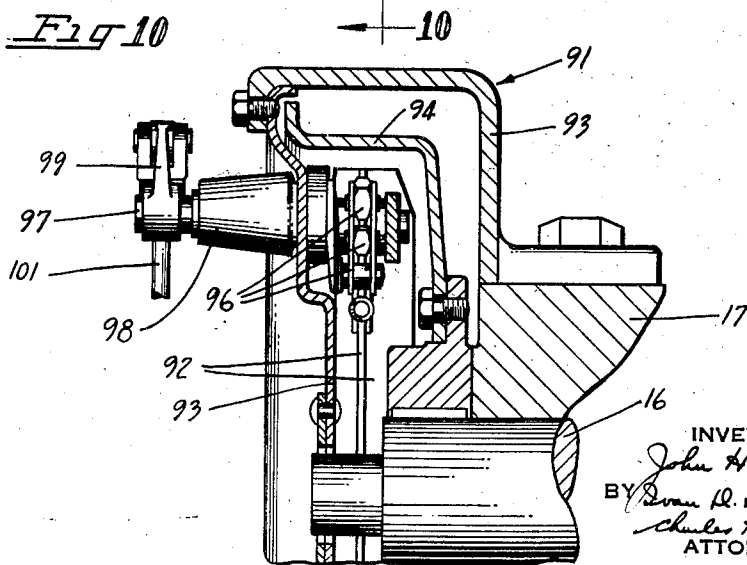


Fig 10



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UNITED STATES PATENT OFFICE

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AUTOMATIC DIE PRESS

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Application December 21, 1939, Serial No. 310,475

7 Claims. (Cl. 192—.02)

The present invention relates to automatic die presses and the like machines and has particular reference to devices for shifting the press starting handle into starting position and to braking the press.

In the container or can manufacturing industry automatic die presses are extensively used for cutting out and forming can parts from metallic sheet material. In recent years such machines have been made more automatic than ever and have been built in greatly enlarged and heavy sizes. In some cases these machines have so many heavy operating parts which are connected to or are shifted by the machine starting lever that considerable difficulty is experienced, particularly by female operators, in moving the starting lever into machine starting position.

The present invention contemplates overcoming this difficulty by an electro-pneumatic starting device which swings the machine starting lever into machine starting position when an electric switch is closed.

An object, therefore, of the invention is the provision in an automatic die press of a starting device connected with the starting handle of the machine and operable to swing the handle into machine starting position so that manual manipulation of the handle and the numerous heavy machine parts connected therewith will be unnecessary.

Another object is the provision of such a starting device wherein the device leaves the handle in machine operating position and immediately returns to re-starting conditions after a starting operation so that it will be in readiness for a subsequent starting operation when such is necessary.

Another object is the provision of a starting device of this character wherein control of the device is effected by way of electro-pneumatic elements co-ordinated in such manner as to exert tremendous power through the mere closing of an electric switch so that the heavy machine parts may be readily shifted into machine starting position.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a side elevation of a die press embodying the instant invention, with parts broken away and parts shown in section;

Fig. 2 is a wiring diagram of the electric apparatus used in the machine;

Fig. 3 is a rear elevation of the machine, with parts broken away;

Fig. 4 is a side elevation opposite to that shown in Fig. 1, with parts broken away;

Fig. 5 is an enlarged sectional view taken substantially along the broken line 5—5 in Fig. 1, with parts broken away;

Fig. 6 is an enlarged sectional view taken substantially along the broken line 6—6 in Fig. 5, with parts broken away;

Figs. 7 and 8 are fragmentary detail views of the lower portion of the machine shown in Fig. 1, with parts shown in different positions and with other parts shown in section;

Fig. 9 is an enlarged sectional view taken substantially along the line 9—9 in Fig. 3; and

Fig. 10 is a sectional view taken substantially along the broken line 10—10 in Fig. 9.

As a preferred embodiment of the instant invention the drawings illustrate principal parts of an automatic die press used for cutting out and forming can parts from strips of sheet metal such as tin plate and the like. The machine shown is preferably of the character disclosed in United States Patent 1,515,774, issued November 18, 1924, to L. L. Jones on Method of and apparatus for automatically stopping automatic presses.

Such a machine includes a main frame 11 which supports a reciprocating die head or punch 12 (Figs. 1, 3 and 4). The punch cooperates with the die in a die block 13 in cutting out and forming the can parts from the sheet material placed between them. The die block is carried on a bed 14 formed as a part of the main frame 11.

Reciprocation of the die head 12 is preferably brought about by a crank shaft or main power shaft 16 to which the upper end of the die head is connected. This shaft is carried in bearings 17 formed in the frame. The shaft is rotated by an electric motor 21 (see also Fig. 5) through a disc clutch device generally indicated by the numeral 22.

The electric motor 21 is supported on a bracket 24 which is bolted to a side of the press frame 11. The driving connection between the motor and the power shaft includes an endless chain 25 which operates over a driving sprocket 26 and a driven sprocket 27. The driving sprocket is carried on a rotor shaft 28 of the motor 21 while the driven sprocket is free on a hub 29 (Fig. 5) of an outer plate element 31 of the clutch 22. This plate element is fixed to the power shaft by a pair of keys 32. The clutch 22 also includes a

movable or inner plate element 34 which is carried on the power shaft to which it is secured by feather extensions of the keys 32 and is slidable along the shaft and the feathers.

When the inner plate element 34 of the clutch is shifted toward the right as viewed in Fig. 5 it engages against the side of the driven sprocket 27 and forces the latter into frictional engagement with the outer plate element 31. The sprocket is thus frictionally clamped between the two plate elements and hence through this engagement the sprocket rotates the power shaft when the electric motor 21 is in operation. When the inner plate element is shifted toward the left as viewed in the same figure, the driven sprocket is released and although the motor continues to operate, the sprocket will rotate freely on the plate hub 29 and the power shaft will remain stationary.

Shifting of the inner plate element 31 of the clutch is effected by way of a train of links and levers which connect with a machine starting handle 35 (Fig. 1) as will now be explained. The starting handle is secured to the outer end of a pivot shaft 36 carried in a bearing 37 (Fig. 3) formed in the main frame 11. The inner end of the pivot shaft carries a lever arm 38 which is connected by a link 39 to an inner lever arm 41.

The inner lever arm 41 is mounted on a cross shaft 42 carried in a pair of spaced bearings 43 formed in the frame 11. The ends of the shaft extend beyond the frame and at the left, as viewed in Fig. 3, this shaft carries an outer lever arm 45. Arm 45 is connected by a link 46 to a pair of toggle links 47, 48. Link 47 is carried on a pivot pin 51 threadedly secured in a bracket 52 bolted to the frame 11. Link 48 connects with an upright arm 54 of a bell crank 55 carried on a pivot stud 56 threadedly secured in the bracket 52.

The upright arm 54 of the bell crank 55 is connected to a tension bolt 58 which extends through a boss 59 formed on the bracket 52. Beyond the boss a compression spring 61 is held in place on the bolt by a washer 62 and lock nuts 63. The nuts are threadedly engaged on the bolt and serve as elements for adjusting the compression in the spring. The springs tends to hold the starting handle down or in non-operating position.

The bell crank 55 is also formed with a horizontal arm 65 (see also Fig. 6) which is connected to a universal joint 66 provided on the lower end of a vertical link 67 (Fig. 5). The upper end of link 67 is secured to a pair of outwardly extending toggle links 68, 69. The outer end of link 69 is mounted on a pivot pin 72 which is carried in a pair of spaced lugs 73 formed on the bracket 52. The outer end of link 69 is connected to the lower end of a clutch yoke 75.

The yoke 75 is carried on a pivot pin 76 secured in a lug 77 formed on the bracket 52 and disposed on the side of the inner clutch plate 34 on the power shaft. The upper portion of the yoke 75 is formed with a pair of curved arms 79. These two arms extend up on opposite sides of a hub 81 formed on the inner clutch plate. The free ends of the curved arms carry clutch rollers 82 which operate in an annular groove 83 formed in the clutch plate hub 81.

Hence when the starting handle 35 is moved from and into machine starting or stopping position, the various links and levers connected therewith shift the clutch yoke 75 in the proper direction for engaging or disengaging the clutch members. The normal position of the starting handle 35 as when the machine is stopped or

idle, is down as shown in Fig. 8. In this position the handle rests on a stop bracket 85 which is secured to the side of the frame 11.

Hence to start the machine the handle 35 is raised into the position shown in Fig. 1. This raising of the handle draws down on the links 39, 46 and thus draws the toggle links 47, 48 down into the position shown in Fig. 1. This rocks the bell crank 55 counter-clockwise. The bell crank draws the clutch toggle links 68, 69 downwardly and hence rocks the clutch yoke 75 in the proper direction (clockwise in Fig. 5) to force the inner clutch plate 34 against the driven sprocket 27 as hereinbefore explained.

Provision is made for braking the rotation of the power shaft 16 when the machine is stopped so that the power shaft will be brought to rest when the die head 12 is in a raised position and entirely clear of the die 13. This braking action is brought about by a brake device generally indicated by the numeral 91 (Figs. 3, 4, 9 and 10) and connected, through a train of links and levers, with the starting handle 35. Thus releasing and braking of the power shaft is effected simultaneously with the clutching or unclutching of the clutch device 22 which is initiated by movement of the starting handle.

In the instant invention the brake used is preferably of the "Bendix" type such as disclosed in United States Patent 1,705,855, issued March 19, 1929, to A. Y. Dodge on Brake construction. Such a brake briefly includes a pair of expandable brake arms 92 (Figs. 9 and 10) carried in a stationary housing 93 which is bolted to the press frame 11 adjacent one of the power shaft bearings 17. The arms are adapted to engage against the inner surface of a brake drum 94 when the brake is applied. This brake drum is disposed within the housing and is keyed to the outer end of the power shaft.

Expanding of the brake arms 92 is effected by a cam 96 which is secured to the inner end of a pivot pin 97 carried in a boss 98 formed in the housing 93. The pin extends outside the housing and carries a lever arm 99. This arm is connected by a rod 101 to an arm 102 which is keyed to a short shaft 103 carried in bearings 104 of a bracket 105 bolted to the side of the press frame 11. The connecting rod 101 extends through a swivel 106 carried in the outer end of the arm 102. A compression spring 107 interposed between the swivel and a pair of lock nuts 108 on the end of the rod provides a flexible connection between the rod and the arm 102.

The short shaft 103 also carries a segment gear 111 which meshes with another segment gear 112 secured to the cross shaft 42 operated by the starting handle 35. It is this connection which releases the brake when the starting handle 35 is raised into machine starting position as hereinbefore explained.

Raising of the starting handle is preferably brought about by an electro-pneumatic starting device generally indicated by the numeral 115 (Fig. 1). This device includes a vertically disposed compressed air cylinder 116 in which a piston 117 operates. The piston is connected to a link 118. The upper end of this link is formed with an elongated slot 119 and is connected with the starting handle 35 by a large head screw. The screw extends through the slot and is threaded into the handle.

The piston 117 is adapted to be raised or lowered in its cylinder 116 by admitting compressed air into the cylinder or by permitting it to escape

to atmosphere. For this purpose there is provided a compressed air inlet port 122 and an outlet or atmosphere port 123 both located in the bottom wall section of the cylinder. The inlet port 122 leads into a pipe line 124 of a suitable compressed air supply. The outlet port 123 leads into a pipe 125 the outer end of which is open to the atmosphere.

These ports 122, 123 are adapted to be opened and closed by a rod slide valve 127 which is movable longitudinally in a horizontal bore 128 formed in the bottom wall section of the cylinder. The bore crosses the ports 122, 123 and the slide valve is formed with a pair of spaced annular grooves or recesses 131, 132 which serve as port opening connections.

Thus when the slide valve 127 is shifted into the position shown in Fig. 1, the valve recess 131 registers with the inlet port 122 and hence compressed air from the pipe line 124 enters the interior of the cylinder 116. When the valve is in this position its recess 132 is out of register with the outlet port 123 and accordingly this port is blocked off as shown in Fig. 1.

The compressed air entering the cylinder 116 pushes the piston 117 upwardly. This action raises the link 118 and the starting handle 35 connected therewith and thus shifts the handle into machine starting position which is the position shown in Fig. 1. The handle is retained in this machine starting position by a pair of electro-magnets 135 which are engaged by magnet pads 136 secured to the handle. The operation of these magnets will be more fully described hereinafter in connection with the wiring diagram in Fig. 2.

When the starting handle 35 reaches its full starting position, the slide valve 127 immediately shifts toward the right into the position of Fig. 7. In this position the valve recess 131 is out of register with the compressed air port 122 and the recess 132 is in register with the atmosphere port 123. Communication between the interior of the cylinder and the compressed air supply is now cut off and the cylinder is open to the outside atmosphere.

Hence the air in the cylinder escapes and the piston 117 following down by gravity returns to the bottom of the cylinder. Return of the piston draws the connecting link 118 down but because of the elongated slot 119, the starting handle 35 remains in its raised position and the machine continues to operate. It is only when the handle is released from the magnets that the compression spring 61 on the bell crank 55 is permitted to return the handle to its lower or machine stopping position, as shown in Fig. 8. The elongated slot 119 in the connecting link 118 permits this independent movement of the handle, without affecting the position of the piston 117.

Actuation of the slide valve 127 is preferably brought about by an electric solenoid 141 (Fig. 1). This solenoid is provided with a movable core 142 which is formed as a part of the slide valve. A compression spring 143 presses against the outer end of the core and normally keeps it in the atmosphere position of Figs. 7 and 8. When the solenoid is energized the core is drawn against the resistance of the spring, as in Fig. 1. This slide valve movement obtains only when starting the machine and prevails only as long as the starting switch in the wiring diagram remains closed, as will now be explained.

Control of the starting and stopping of the

machine and the actuation of the starting handle 35 is effected through a plurality of electric circuits receiving electric energy from a suitable source of supply such as a generator 151 (Fig. 2). These circuits are interconnected in such a manner that simultaneous energizing of the air valve solenoid 141, the handle holding magnets 135, and the motor 21 takes place. Such an arrangement permits the motor to get started before the clutch is thrown in.

The first of these electric circuits is a starting circuit indicated in the wiring diagram in Fig. 2 by the letter X. This circuit includes the generator 151, the air valve solenoid 141, a normally open button start switch 152, a normally closed stop switch 153, and a solenoid relay 154 which operates a normally open contact switch 155 and a normally open auxiliary switch 156. Referring now more in detail to this wiring diagram, when the button start switch 152 is closed to start the machine, electric energy from the generator 151 flows along a main lead wire 157, a connecting wire 158, air valve solenoid 141, a wire 159, the closed start switch 152, a wire 161, the closed stop switch 153, a wire 162, the solenoid relay 154, a wire 163, returning to the generator by way of a connecting main lead wire 164. Electric energy passing along this closed circuit energizes the air valve solenoid 141 and shifts the slide valve of the machine starting device 115 which raises the machine starting handle 35. Energizing the solenoid relay 154 at such time closes the contact switch 155 and the auxiliary switch 156.

Closing of the contact switch 155 establishes a magnet motor circuit Y which includes only the generator 151, the handle holding magnets 135, and the machine operating motor 21. When this circuit is closed energy from the generator 151 passing along the main lead wire 157 also passes through the closed switch 155, a wire 166, the magnets 135, a wire 167, the motor 21, a wire 168, the closed switch 155, returning to the generator along the main lead wire 164. Electric energy passing along this circuit energizes the magnets 135 and thereby holds the starting handle 35 in its raised machine starting position. The energy passing through the electric motor 21 sets it into operation.

Since the closing of the button start switch 152 is only temporary as the button will be immediately released and the switch opened, a holding circuit Z is provided for maintaining the solenoid relay 154 energized. Maintaining the solenoid relay energized, insures maintenance of the magnet motor circuit Y and thereby keeps the machine operating after it is once set in motion.

The holding circuit Z includes the generator 151, the contact switch 155, the auxiliary switch 156, the button stop switch 153, and the solenoid relay 154, and cuts out the button start switch 152, and the air valve solenoid 141. This holding circuit is established upon the closing of the contact switch 155 and the auxiliary switch 156. Energy from the generator 151 passing along the main lead wire 157 flows through the switch 155, a connecting wire 171, auxiliary switch 156, a wire 172, wire 161, stop switch 153, wire 162, solenoid relay 154, wires 163, 164 back to the generator. It is the energy passing along this circuit that keeps the solenoid relay 154 energized.

In cutting out the air valve solenoid 141 and the start switch 152 from the holding circuit Z,

the solenoid 141 immediately becomes de-energized whereupon its spring 143 pushes out the solenoid core and the slide valve 127. Slide valve 127 on return to atmosphere position, as hereinbefore explained, allows the piston 117 to return to its normal position while leaving the starting handle 35 in machine operating position.

To stop the machine it is merely necessary to break the holding circuit Z. This may be done by opening the stop switch 153. If desired such stopping of the machine may be effected by detector devices distributed throughout the machine at its various working stations and connected into the circuit. In such a case the circuit would be broken if any one of the detector devices were operated.

Breaking of the holding circuit Z de-energizes the solenoid relay 154 and this opens the contact switch 155 and the auxiliary switch 156. This breaks the magnet motor circuit Y. Hence the motor stops operating and the magnets 135 become de-energized. De-energizing of the magnets permits the starting handle 35 to fall of its own weight into the position shown in Fig. 8 and thus the clutch 22 is disengaged and the brake is applied as hereinbefore explained.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a die press, the combination of a press starting handle connected with movable parts of the machine adapting it for shifting into operating position by manual manipulation, electro-magnetically controlled valve actuated instrumentalities for independently moving said starting handle into machine starting position against resistance of said connected movable parts, a manually operable electrical circuit for actuating said instrumentalities when the circuit is closed and a flexible connection between said starting handle and said instrumentalities for permitting return of said instrumentalities to restarting condition when said electrical circuit is opened while leaving the handle in machine operating position.

2. In a die press, the combination of a press starting handle connected with movable parts of the machine and having operating and non-operating positions, a compressed air cylinder located adjacent said handle, a piston disposed within said cylinder, a slotted link flexibly connecting said starting handle with said piston, electro-magnetic means for admitting compressed air into said cylinder to operate said piston and thereby move said starting handle into machine starting position, said electro-magnetic means being further operative to open said cylinder to the outside atmosphere after movement of said starting handle to vent the air from the cylinder to permit said piston to return to restarting position within the cylinder.

3. In a die press, the combination of a press starting handle connected with movable parts of the machine and adapted to be shifted manually into operating and non-operating positions, a compressed air cylinder located adjacent said handle, a piston disposed within said cylinder, a

slotted link flexibly connecting said starting handle with said piston, a valve controlling the admission of compressed air into said cylinder to operate said piston and thereby move said starting handle into operating position, an electric circuit including an electric solenoid mechanically connected with said valve, and a starting switch for actuating said valve for the purpose described said solenoid and electric circuit being further automatically operative to open said cylinder to outside atmosphere after said operating movement of the starting handle, whereby to vent said cylinder and return said piston to re-starting position while maintaining said handle in press operating position.

4. In a die press, the combination of a power shaft, a brake mounted on said shaft for stopping its rotation, a friction clutch assembly including a clutch member keyed in fixed position on the shaft and a cooperating sliding clutch member also keyed on the shaft and slidably engageable with said first mentioned clutch member, an electric motor for rotating said clutch elements when the same are in engaged relation, a pivotally mounted machine starting handle having mechanical connection at one end thereof with said brake and also with said clutch member, said handle when moved in one direction releasing said brake and engaging said clutch members to drive said shaft, and when moved in the opposite direction releasing said clutch members from driving engagement and applying said brake to stop rotation of said shaft, electro-pneumatically controlled means connected with said starting handle for moving the same into motor starting position, and a manually controlled electrical circuit for actuating said electro-pneumatic means, whereby the closing of said circuit effects the release of said brake on the power shaft and the engagement of the clutch parts and the power shaft with the said electric motor to establish a driving connection with the die press.

5. In a die press, the combination of a press starting handle connected with movable parts of the machine and capable of being shifted into operating position by manual manipulation, means including an electro-magnetically controlled valve and a piston associated therewith connected to said starting handle for moving it into machine starting position against resistance of the connected machine parts, a manually operable electrical circuit for actuating said valve, a second normally open electrical circuit closed by the closing of said first mentioned circuit, magnetically controlled holding devices disposed in said second circuit and actuated by the closing thereof for retaining the shifted starting handle in machine starting position, and electrically controlled means for releasing said holding devices to permit said handle to return by gravity to inoperative position.

6. In a die press, the combination of a press starting handle capable of being shifted into operating position by manual manipulation, electro-pneumatic means including an electro-magnetically controlled compressed air valve and a piston associated therewith connected to said starting handle for moving it independently into machine starting position against resistance of connected parts, a manually controlled electrical circuit for actuating said valve, a second normally open electrical circuit closed by the closing of said first mentioned circuit, and electro-magnets disposed in said second circuit and actuated

by the closing thereof for retaining the shifted starting handle in machine starting position.

7. In a die press, the combination of a pivotally mounted press starting handle designed to be elevated into press starting position, means including an electro-mechanically controlled valve and a piston associated therewith connected to said starting handle for automatically elevating the same into machine operating position against gravital force and the resistance of the connecting machine parts, a manually closable electrical

circuit including an electro-magnet for actuating said valve to move the handle to press starting position when said circuit is closed, means actuated by the closing of said circuit for holding said handle in operative press starting position, and electrically controlled means for rendering said holding means no longer operative to hold said handle, to permit the same to return by gravity to inoperative position.

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