Aug. 14, 1951 L. G. HOLT 2,564,434

APPARATUS FOR SETTING FEEDING MECHANISMS FOR MATERIAL WORKING MACHINES

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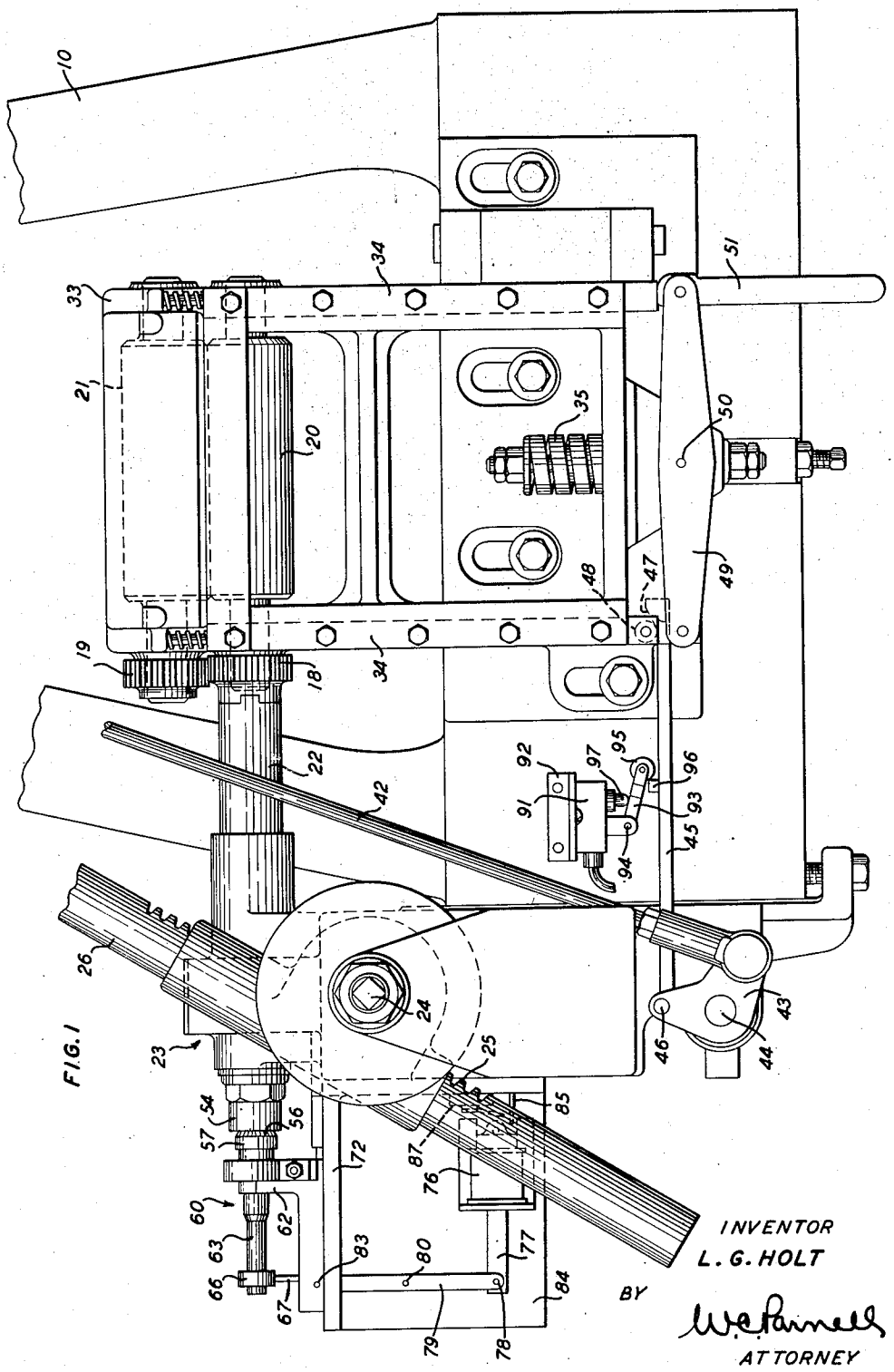


FIG. 1

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FIG. 2

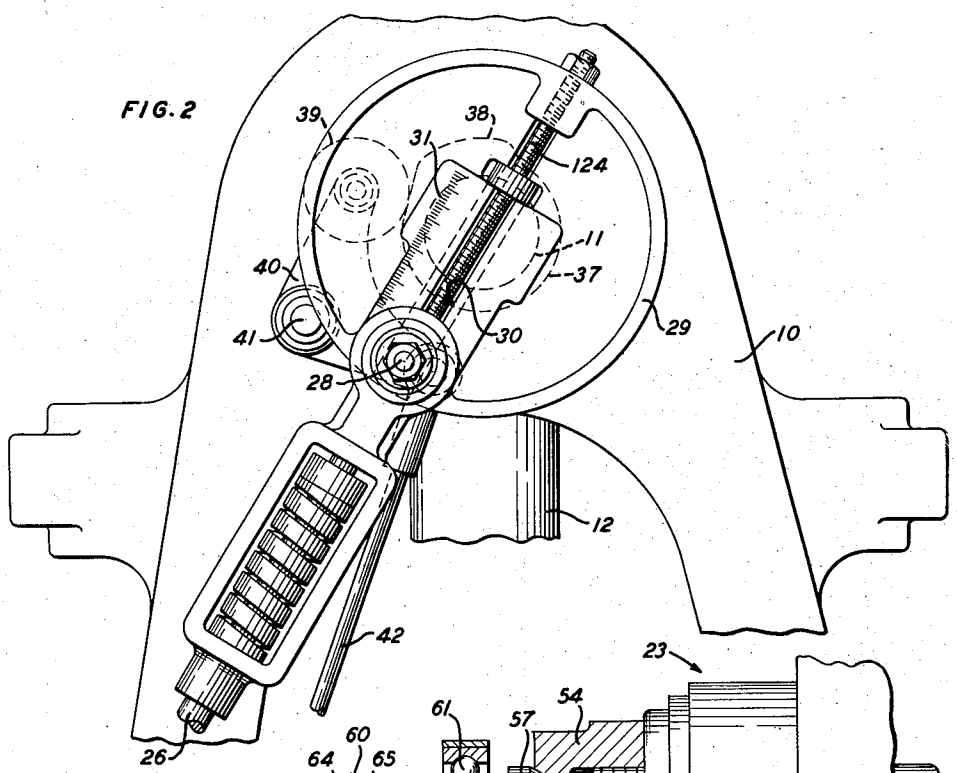


FIG. 3

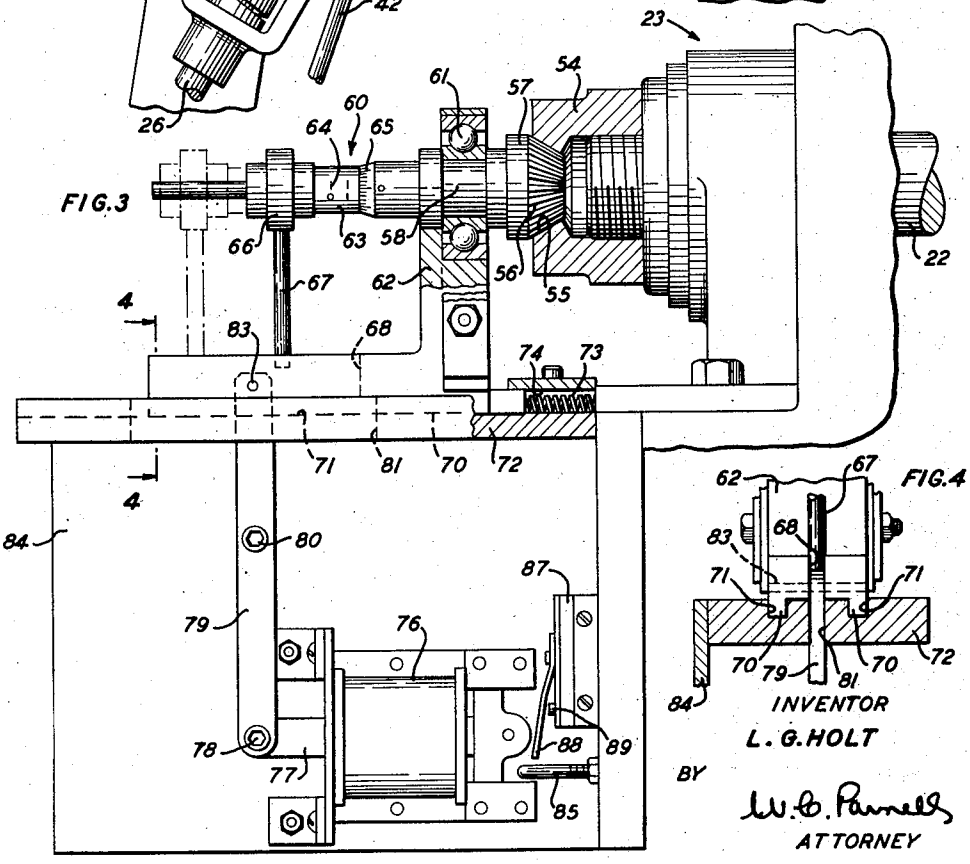


FIG. 4

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FIG. 7

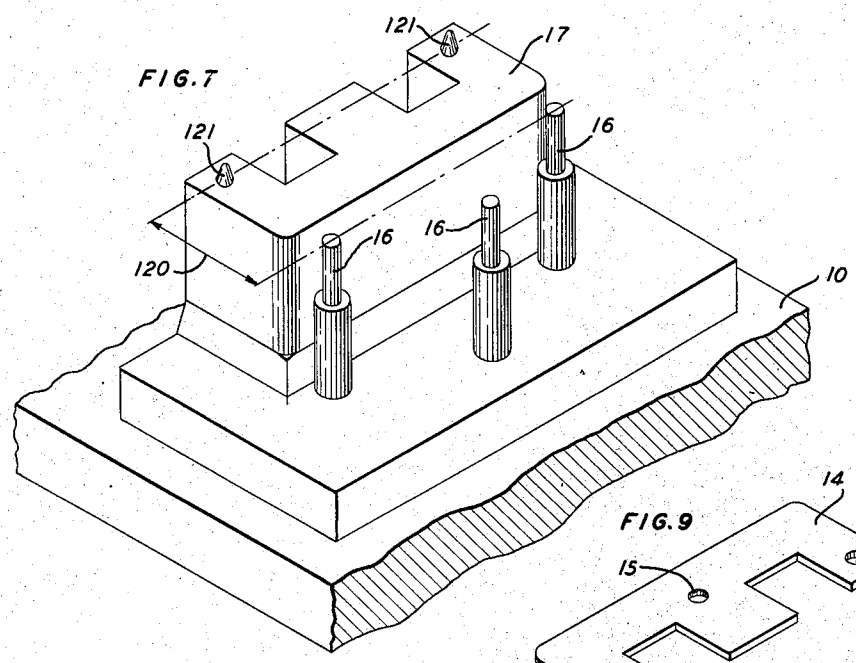


FIG. 9

FIG. 5

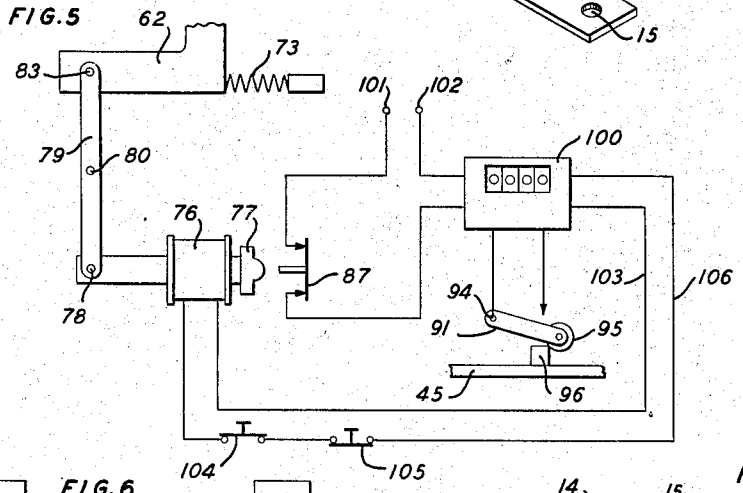


FIG. 6

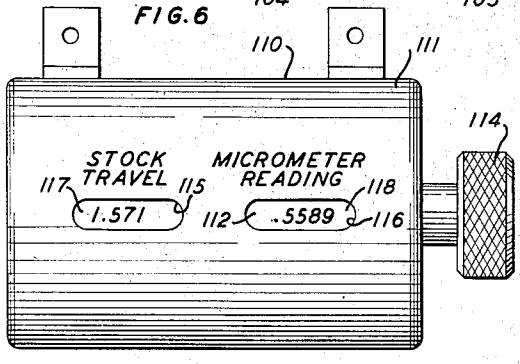
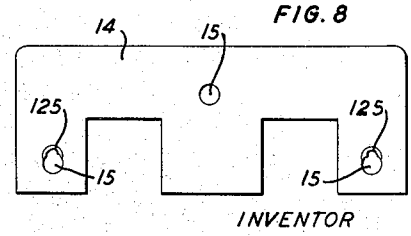


FIG. 8



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APPARATUS FOR SETTING FEEDING MECHANISMS FOR MATERIAL WORKING MACHINES

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Application December 11, 1947, Serial No. 790,948

5 Claims. (Cl. 164—22)

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This invention relates to an apparatus for setting feeding mechanisms for material working machines such as punch presses and has for its object an apparatus for varying the material feeding means for such machines without the use or loss of material required when using the conventional methods of setting feeding mechanisms of such machines.

The conventional automatic punch presses, for punching and blanking parts from large coils of strip stock, have feed rolls between which the stock is advanced longitudinally relative to the punches and blanking dies of the press. The distance the stock is fed during each operating cycle of the press must vary with variations in the size of parts to be blanked from the stock. Furthermore, in machines of this type which are operable at variable speeds depending upon the size of the part to be blanked and/or the thickness of the material from which it is to be blanked, there may exist an overrunning of the feed rolls or other conditions to cause an inaccurate advancement of the material for one or more blanking operations throughout the length of the stock.

In certain instances, where both punching and blanking operations are performed, to produce perforated parts blanked from the stock, although both perforating and blanking operations are performed simultaneously during an operating cycle of the press, they are in effect performed successively on each part produced from the stock. In other words, a portion of the stock, from which a part is to be produced, is punched during one operating cycle and then advanced to the blanking die for the next operating cycle when the part is blanked from the stock. In such instances, pilot pins are mounted on the blanking punch to enter the apertures in the stock formed during the previous punching or perforating operation to make a final adjustment in the stock, freed at that time from the feed rolls, to produce an accurate part. However, unless the stock is advanced the given distance required for that particular part, or within a minute variation therefrom, the pilot pins will fail to enter the apertures and will thus damage the part blanked from the stock.

Heretofore, the feeding mechanisms of such machines have been set by the cut and try method, the setup man initially guessing at the adjustment of the eccentric connection between the roller actuating mechanism and the crank shaft of the press and then operating the press while the feed rolls advance material to the dies. The operator then determines the conditions of the parts produced from the material, observing the

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positions of the apertures within the blanked parts to determine how far off, one way or the other, the initial setting of the feeding mechanism was made. The operator again adjusts the feeding mechanism, attempting to correct the initial error and again operates the machine feeding material thereto. This method of setting up the press requires considerable time and material. It is not possible during this method to determine whether or not the press is set accurately for the selected material and the desired speed of the press unless numerous parts have been blanked from the material.

In accordance with the aforementioned object, the invention comprises an appartus for setting the feeding mechanism of an automatic material working machine, such as the punch press, including feed rolls driven by an adjustable mechanism connected to the crank shaft of the machine, the apparatus including a measuring element movable relative to one of the feed rolls for operative connection therewith to measure the distance material is fed by the rolls relative to material working elements of the machine during each operating cycle of the machine.

More specifically, the measuring element is a micrometer arranged to accurately measure the length of material fed by the feed rolls during a given number of operating cycles. Electrically operable means, energized during operation of the press and under the control of a counter actuated by the press, holds the micrometer in engagement with the driven feed roll during a given number of operating cycles after which the electrically operable means is deenergized and the micrometer disengaged from the feed roll. A calculating unit indicates the distance the material travels during operating cycles of the machine as determined from the micrometer reading resulting from actuation of the feed roll.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a fragmentary side elevational view of an automatic machine or punch press embodying the invention;

Fig. 2 is a fragmentary side elevational view of the adjustable feature of the feed roll driving mechanism connected to the crank shaft of the machine;

Fig. 3 is an enlarged fragmentary side elevational view of the measuring element or micrometer unit and its actuating means;

Fig. 4 is a fragmentary sectional view taken along the line 4—4 of Fig. 3;

Fig. 5 is a wiring diagram including a schematic illustration of the counter and the micrometer unit actuating mechanism;

Fig. 6 is a front elevational view of the calculating unit;

Fig. 7 is an isometric view of the perforating punches and blanking punch employed in the machine;

Fig. 8 is a top plan view of a part produced by an inaccurate setting of the feeding mechanism of the machine; and

Fig. 9 is an isometric view of a part produced from an accurate setting of the feeding mechanism of the machine.

Referring now to the drawings, the automatic machine selected to illustrate the invention is a punch press of the commercially known type having a main frame 10 supporting stationary dies (not shown), the upper end of the frame shown in Fig. 2 supporting the conventional type of crank shaft 11. The crank shaft is rotated in the conventional manner to cause reciprocation of a ram 12 upon which the companion punches for the dies are mounted. In the present embodiment of the invention, E-shaped laminations 14 (Fig. 9) having perforations 15 are to be punched and then blanked from strip material fed intermittently to the dies. The perforations 15 are to be formed by punches 16 during one cycle of operation of the machine and the part or lamination 14 is to be blanked from the material by a blanking punch 17.

The conventional material feeding means of this machine includes a drive roll 20 and a driven roll 21 (Fig. 1) operatively connected to each other by gears 18 and 19. The drive roll 20 is connected through a spindle 22 to a driving unit indicated generally at 23. The drive unit 23 includes the standard roll friction clutch connecting the spindle 22 to a shaft 24. The shaft 24 is rotated or rocked intermittently by a gear (not shown) which is driven in opposite directions by a rack 25. The teeth for the rack 25 are formed in a rod 26, the upper end of which is adjustably secured at 28 to a wheel 29 mounted on the outer end of the crank shaft 11. The connection 28 is movable in a T-shaped slot 30 relative to graduations 31 toward or away from the axis of the crank shaft 11 to vary the stroke of the rod 26 and rack 25 to vary the action of the driving means 23 for the drive roller 20 and thus vary the feeding movement of the rolls 20 and 21 during each operating cycle of the machine.

The upper roll 21 is carried by a frame 33 movable vertically in guides 34 and normally urged downwardly by a spring 35 to apply a given force to the material whereby the rolls may pull the material from its supply and feed it to the punches and dies. The frame 33 is forced upwardly during each operating cycle of the machine to free the material during the punching and blanking portions. Upward movement of the frame 33 with the roll 21 is brought about by a cam 37 mounted on the crank shaft 11 and having a high portion 38 to engage a cam roller 39 and cause rocking movement of a bell crank lever 40, supporting the cam roller, about its pivot 41. A pull rod 42 carried by the bell crank lever 40 is pulled upwardly by a counterclockwise movement of the bell crank lever to rock a bell crank lever 43 (Fig. 1) in the same direction about its pivot 44 to move a cam rod 45 to the left. The cam rod 45 is connected to the bell crank lever 43 at 46 and has an enlarged

cam-like end 47 to move relative to a cam roller 48 at the lower end of the frame 33 to force the frame upwardly. A rocking lever 49 pivoted at 50 and engaging the other side of the frame 33 through an element 51 is also affected by the cam 47 to assist in raising the frame 33 to move the roll 21 away from the roll 20.

The apparatus for setting the feeding mechanism includes a clutch member 54 (Fig. 3) mounted on the outer end of the spindle 22 and having a conical aperture 55 in the outer end thereof, the surface of which is provided with teeth to be interengaged by the teeth 56 of a conical clutch member 57. The clutch member 57 is mounted upon and made a part of the outer shell or sleeve 58 of a micrometer unit indicated generally at 60 and is rotatably supported in a bearing 61 of a carriage 62. The companion portion 63 of the micrometer unit 60 is movable longitudinally in the conventional manner resulting from rotation of the sleeve 58 to cause the indications 64 thereon to move relative to the indications 65 of the sleeve. The portion 63 is held against rotation by a collar 66 mounted thereon and carrying a pin 67 which extends downwardly and rides in a longitudinal groove 68 of the carriage 62. The carriage 62 has integral leg portions 70 positioned to slide in grooves 71 of a table 72. A spring 73 mounted in a recess 74 in the table normally urges the carriage 62 outwardly away from the member 54 and functions to disengage the clutch members 54 and 57.

The carriage 62 with the micrometer unit 60 is moved into operative position shown in Fig. 3, with the clutch members 54 and 57 in closed positions, through the energization of a solenoid 76. The core 77 of the solenoid 76 is pivotally connected at 78 to the lower end of a lever 79, pivoted at 80 and having its upper end extending through an elongate slot 81 in the table 72 and into the slot 68 of the slide 62 where it is connected to the carriage by a pivot pin 83. The solenoid 76 is mounted on a bracket 84 which supports a stop 85 to limit movement of the core 77 to the right through the force of the spring 73. A switch 87 mounted on the bracket 84 has a resilient arm 88 positioned to be engaged by the core 77 when returned to its normal position against the stop 85 to actuate a plunger 89 to open the normally closed switch 87. Another switch 91 (Fig. 1), supported by a bracket 92 mounted on the main frame 10, carries a lever 93 pivotally supported at 94 and carrying a roller 95 at its outer end to be engaged by a cam or projection 96 on the cam arm 45. The switch 91 is normally open and during each actuation of the rod 45 with the cam 96, the lever 93 is actuated to actuate a plunger 97 to close the switch.

The switches 87 and 91 are shown schematically in the wiring diagram (Fig. 5) together with the slide 62 and its connection with the solenoid 76. An electric counter 100 is also included in the wiring diagram. The electric counter is of a commercially known type which operates by electrical impulses, one for each operating cycle of the machine until the completion of a predetermined number of cycles at which time the circuit to the solenoid 76 will be opened by the counter. The main supply lines of the circuit are indicated at 101 and 102. The normally closed switch 87 is in a circuit extending from line 101, through the switch 87, the counter 100, line 103, the winding of the solenoid 76, through

a start switch 104 when closed, a stop switch 105, line 106 and through the counter 100, to line 102. The wiring diagram illustrates the apparatus in operation with the start switch closed.

It would be understood that only a simple wiring diagram is illustrated and that conventional relays and locking circuits therefor may be employed to accomplish the desired result. The result desired is to cause energization of the solenoid 76 when the start switch 104 is closed, freeing the switch 87 which has been held open by the core 77 of the solenoid to close, to include the counter 100 in the main circuit. During each operating cycle of the machine, the cam rod 45 is reciprocated with its cam 96 causing the switch 91 to close and open intermittently to operate the counter one digit for each electrical impulse or closing of the circuit through the counter. This continues until a predetermined number of operations have been made at which time the counter 100, as the result of a predetermined setting thereof, will open a circuit including lines 103 and 106 to the solenoid 76, deenergizing the solenoid and allowing the spring 73 to disconnect the micrometer unit from the spindle 22 and drive roll 20 at the clutch members 54 and 57.

An indicating or calculating unit 110 mounted near the micrometer unit 60 includes a casing 111 cylindrical in cross-section and rotatably supporting therein a revolving cylinder 112, which may be rotated by the aid of a hand wheel 114. Windows 115 and 116 are provided at spaced positions in the casing 111 for the registration of figures 117 and 118 therewith. The figures 117 are disposed at spaced positions about the cylinder 112 and represent the stock travel for a given micrometer reading 118 which will register therewith at the window 116. The stock travel indications 117 extend from the minimum to the maximum distance the stock may be fed to the punches and dies, these indications being divided into thousandths of an inch. The corresponding micrometer reading for each indication 117 is positioned in general alignment therewith on the cylinder 112.

Consider now the apparatus to accurately set the material working machine or punch press without the need of material or even the presence of the punches and dies. The adjustable means shown in Fig. 2 is set by the operator as close as possible to the position required to cause the feed rolls to advance the stock the required distance. In the present embodiment of the invention the stock is to be advanced 1.571 inches per stroke of the machine. This is the distance indicated at 120 (Fig. 7) between the centerlines of the outer punches 16 and the centerlines of pilot pins 121 on the blanking punch 17 which are to enter the outermost perforations made in the stock by the outer punches 16. Owing to the fact that machines of this type must be run through approximately one hundred cycles to be assured of an accurate setting in the feeding means, the counter 100 is adjusted to operate through one hundred cycles of the machine and at the completion of the last cycle to deenergize the solenoid 76.

In the present machine, the diameter of the feed roll 20 is 2.834 inches, the circumference then being 2.834×3.1416 inches. The number of revolutions the feed roll makes in one hundred cycles of the machine is the total distance the stock travels divided by the circumference of the feed roll which is $157.1 \div (2.834 \times 3.1416) = 17.645$. The number of revolutions of the micrometer is the same as the number of revolutions of the feed roll 20. One revolution of the micrometer represents .025 inch on the micrometer scale. When the reading is taken, the micrometer is started from an open position (one inch) and since it advances .025 inch per revolution of the feed roll, the amount it would close, in this instance, would be 17.645 revolutions $\times$ .025 inch per revolution = .4411 inch. In order to make the micrometer direct reading the .4411 is subtracted from 1.000 inch which is .5589. The stock travel required being 1.571 inches is obtained by adjusting the feeding mechanism until the micrometer reads .5589.

If the micrometer reading should vary one way or the other, that is, above or below the reading .5589, the operator may determine the required additional adjustment necessary for the mechanism shown in Fig. 2. In order to simplify additional adjustment of the mechanism shown in Fig. 2, the adjusting screw 124, which has been substituted for the standard adjusting screw is so threaded, whereby one rotation of the screw 124 will change the micrometer reading approximately .025 inch per one hundred strokes of the machine which is one turn of the micrometer. By knowing the ratio between the adjusting screw 124 and the micrometer unit 60, the operator may come very close to the exact setting in the first adjustment requiring only one test run of the machine, a required second adjustment being readily determined from the micrometer reading and its difference from the indications 118 on the cylinder 112.

With this apparatus for setting the feeding mechanism of an automatic machine such as the punch press, there is considerable saving of time and material. The cut-and-try method has been eliminated and the machine may be set accurately without the aid of stock or the presence of the dies in the machine. Fig. 8 illustrates the result of an inaccurate setting of the feeding mechanism of the machine with the present perforating and blanking dies. The perforations 15 have been made by the punches 16 in the stock but due to the fact that stock was inaccurately advanced, the pilot pins 121 did not register with the outer apertures 15 sufficiently to correct the error and during the blanking operation, the pilot pins disrupted the material at 125 adjacent these apertures. This disturbing fact is eliminated by the use of the method and apparatus for setting the feeding mechanism for the machine.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An apparatus for setting the feeding mechanism of a material working machine having a main shaft to be driven through operating cycles to cause operation of tools on a material to be fed to the tools by feed rolls of the feeding mechanism driven intermittently variable rotary distances by an operating mechanism interposed between the feed rolls and the main shaft including an adjustable eccentric connection with the main shaft, the apparatus comprising a measuring unit to be driven by one of the feed rolls, and means to removably connect the unit to the feed roll to be driven thereby during a given number of operating cycles of the machine to cause the measuring

unit to measure the distance a material would travel between the feed rolls resulting from an initial setting of the adjustable eccentric connection, whereby a predetermined subsequent adjustment of the eccentric connection may be made to cause the feed rolls to advance a material a given distance during each operating cycle of the machine.

2. An apparatus for setting the feeding mechanism of a material working machine having a main shaft to be driven through operating cycles to cause operation of tools on a material to be fed to the tools by feed rolls of the feeding mechanism driven intermittently variable rotary distances by an operating mechanism interposed between the feed rolls and the main shaft including an adjustable eccentric connection with the main shaft, the apparatus comprising a measuring unit to be driven by one of the feed rolls, interengageable clutch members for the measuring unit and the feed roll to be connected thereto, means normally holding the clutch members disengaged, and means operable to connect the clutch members to form a driving connection between the said feed roll and the measuring unit during a given number of operating cycles of the machine to cause the unit to measure the distance a material would travel between the feed rolls resulting from an initial setting of the adjustable eccentric connection, whereby a predetermined subsequent adjustment of the eccentric connection may be made to cause the feed rolls to advance a material a given distance during each operating cycle of the machine.

3. An apparatus for setting the feeding mechanism of a material working machine having a main shaft to be driven through operating cycles to cause operation of tools on a material to be fed to the tools by feed rolls of the feeding mechanism driven intermittently variable rotary distances by an operating mechanism interposed between the feed rolls and the main shaft including an adjustable eccentric connection with the main shaft, the apparatus comprising a measuring unit to be driven by one of the feed rolls, a carriage to support the measuring unit for movement into and out of engagement with one of the feed rolls to be driven thereby, means normally holding the carriage in a position with the measuring unit out of engagement with the said feed roll, and electrically operable means to move the carriage to move the measuring unit into engagement with the said feed roll and hold the measuring unit engaged during a given number of operating cycles of the machine to cause the measuring unit to measure the distance a material would travel between the feed rolls resulting from an initial setting of the adjustable eccentric connection, whereby a predetermined subsequent adjustment of the eccentric connection may be made to cause the feed rolls to advance a material a given distance during each operating cycle of the machine.

4. An apparatus for setting the feeding mechanism of a material working machine having a main shaft to be driven through operating cycles to cause operation of tools on a material to be fed to the tools by feed rolls of the feeding mechanism driven intermittently variable rotary distances by an operating mechanism interposed between the feed rolls and the main shaft including an adjustable eccentric connection with the main shaft, the apparatus comprising a measuring unit to be driven by one of the feed rolls, a carriage to support the measuring unit for movement into and out of engagement with one of the feed rolls to be driven thereby, means normally holding the carriage in a position with the measuring unit out of engagement with the said feed roll, electrically operable means to move the carriage to move the measuring unit into engagement with the said feed roll and hold the measuring unit engaged during a given number of operating cycles of the machine, and a counter actuable during each operating cycle of the machine to deenergize the said electrically operable means at the completion of the given number of operating cycles of the machine to cause the measuring unit to measure the distance a material would travel between the feed rolls resulting from an initial setting of the adjustable eccentric connection, whereby a predetermined subsequent adjustment of the eccentric connection may be made to cause the feed rolls to advance a material a given distance during each operating cycle of the machine.

5. An apparatus for setting the feeding mechanism of a material working machine having a main shaft to be driven through operating cycles to cause operation of tools on a material to be fed to the tools by feed rolls of the feeding mechanism driven intermittently variable rotary distances by an operating mechanism interposed between the feed rolls and the main shaft including an adjustable eccentric connection with the main shaft, the adjustable eccentric connection having a standard adjusting screw, the apparatus comprising an adjusting screw, having a known thread pitch whereby one turn of the last mentioned adjusting screw will make a known variation in the operating mechanism for the feed rolls, substituted for the standard adjusting screw, a measuring unit to be driven by one of the feed rolls, and means to removably connect the unit to the feed roll to be driven thereby during a given number of operating cycles of the machine to cause the measuring unit to measure the distance a material would travel between the feed rolls resulting from an initial setting of the adjustable eccentric connection, whereby a predetermined subsequent adjustment of the eccentric connection may be made to cause the feed rolls to advance a material a given distance during each operating cycle of the machine.

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No references cited.