

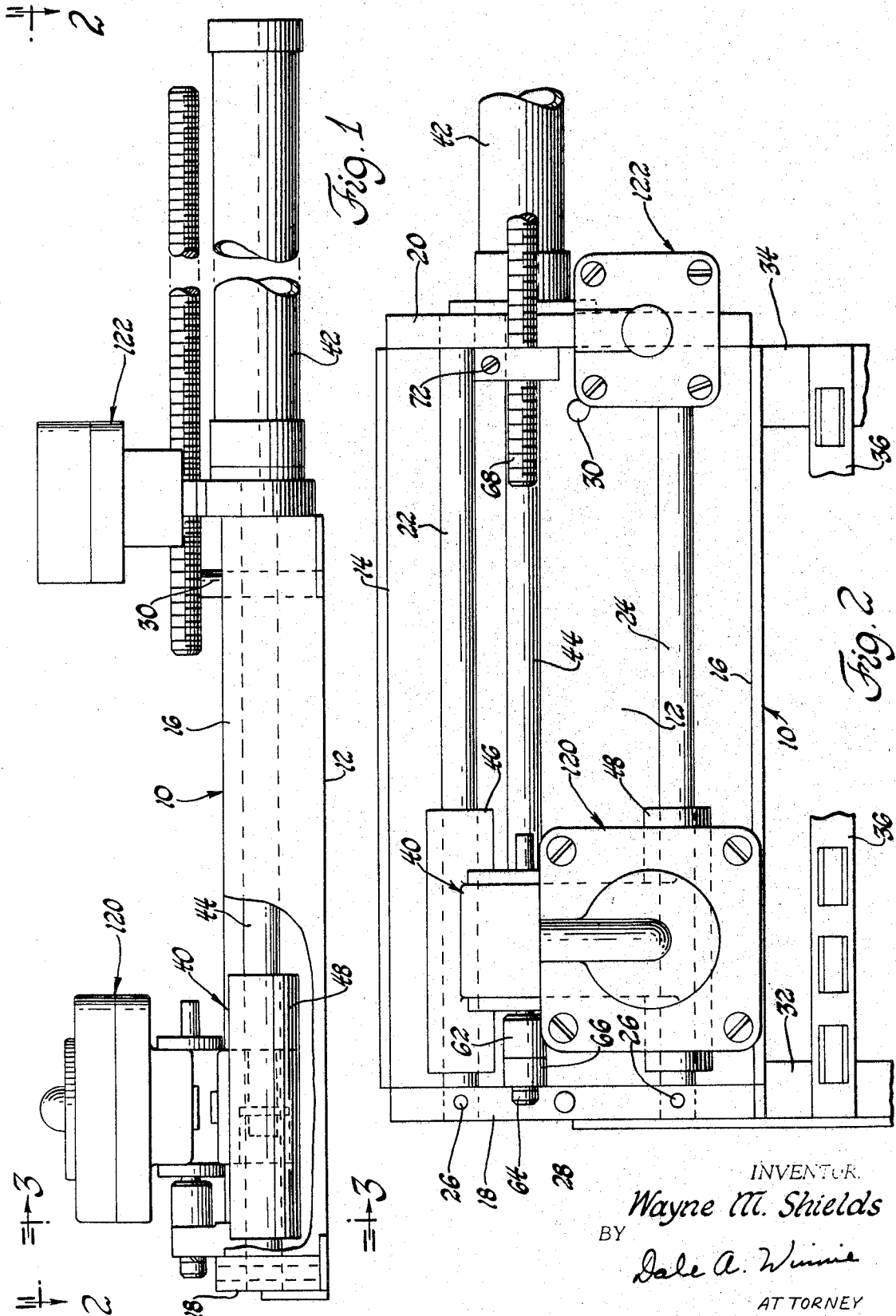
Aug. 11, 1970

W. M. SHIELDS
WORK FEED MECHANISM

3,523,632

Filed April 11, 1968

3 Sheets-Sheet 1



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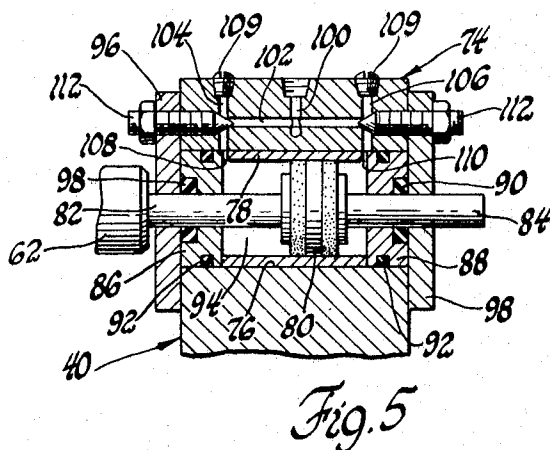
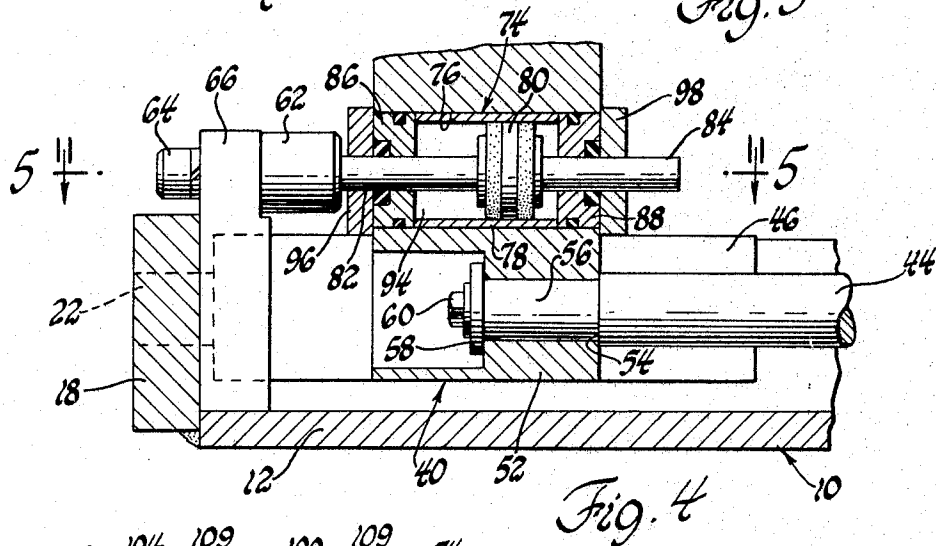
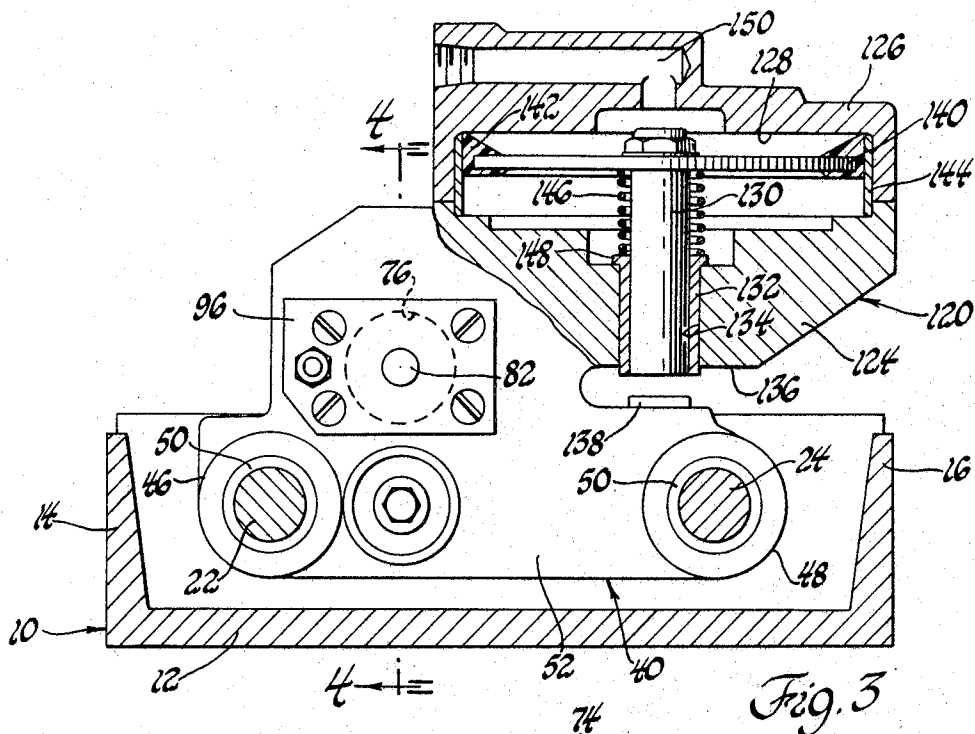
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3 Sheets-Sheet 3

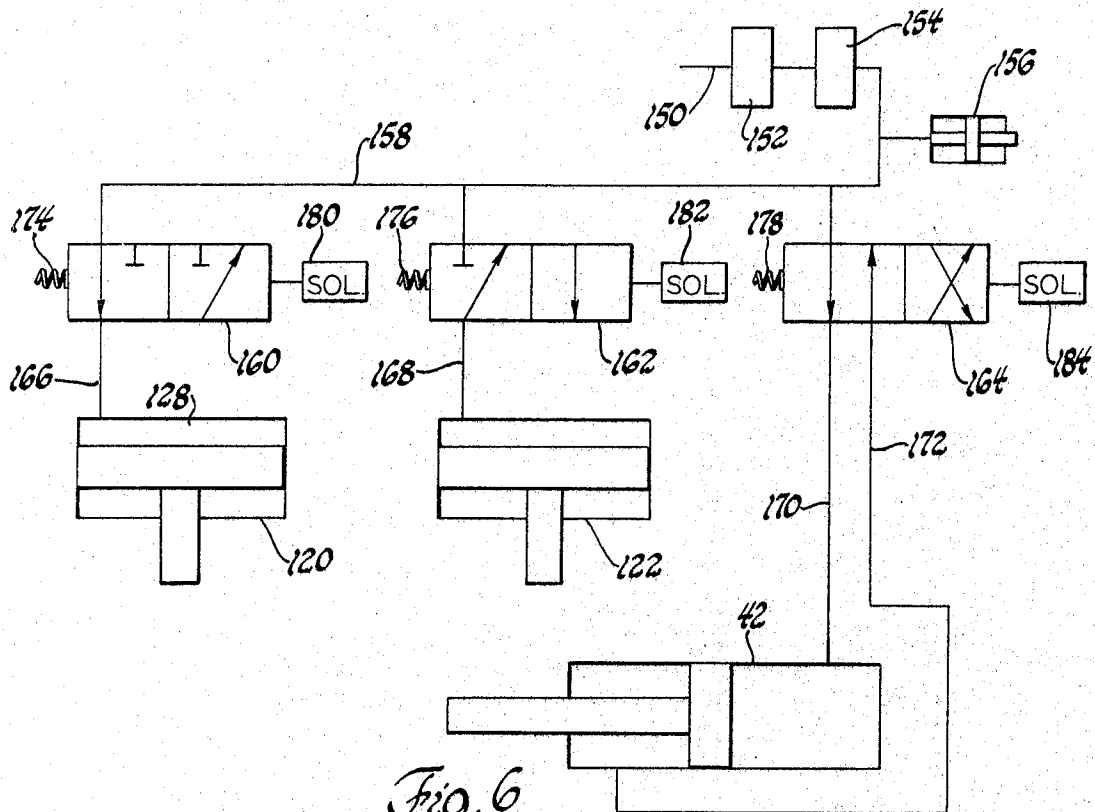


Fig. 6

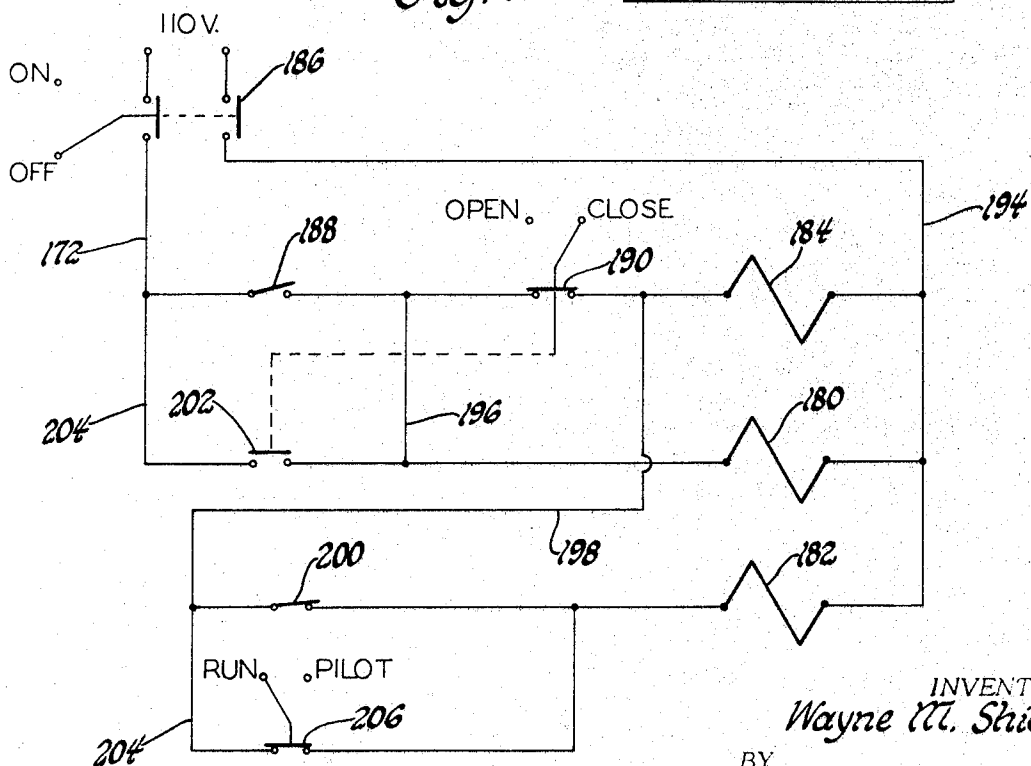


Fig. 7

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1

3,523,632

WORK FEED MECHANISM

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3 Claims

ABSTRACT OF THE DISCLOSURE

A device for intermittently feeding work stock material to a stamping or like machine and including a reciprocal carriage member having a gripper provided thereon, means for varying the feed stroke of the carriage and damping it, a gripper to hold the stock during retraction of the carriage member and an electro-pneumatic system for controlled operation thereof.

BACKGROUND OF THE INVENTION

Mechanical means are commonly known for feeding stock materials to punch presses, stamping machines and the like. They generally include a power operated device for gripping the stock, usually in strip form, and moving it into the press where it is held while the gripping device is retracted for another stroke.

Most such mechanical means are operated by fluid pressure controls and include a double acting fluid piston cylinder with means for varying the feed stroke as required by different jobs. They have a dashpot or other cushioning means to soften the feed stroke at the end of its travel and usually a self-actuating wedge-lock which serves with the cushioning means to prevent work slippage and rebound.

The principal problems encountered with this type of equipment are in providing a reasonably fast work feeding stroke, with just the right damping, a quick return, which should also be damped, and an effective interlock between the work feeding and holding grippers whereby they are mutually exclusive of each other to avoid interference therebetween. The equipment must be relatively simple in construction, to minimize the initial expense, relatively free of service and maintenance problems, and capable of efficient performance for all variable work strokes within the range of performance required.

SUMMARY OF THE INVENTION

The present invention is directed to mechanical work handling means and more particularly to equipment for feeding stock material into punch presses, stamping machines and the like. It is still more particularly directed to quick acting power operated work stock feeding devices having a variable stroke and adapted to service high production equipment with precision and accuracy.

In the present invention pneumatic means are used in place of a hydraulic fluid system to move the work carriage member, grip the work stock for feed, and to hold it during the return stroke of the carriage. The two grippers are made mutually exclusive of each other and an interlock control is provided to guard against retracting the carriage when the carriage gripper device is closed.

The pneumatic system includes solenoid operated control valves, acting against a return spring pressure, and adapted to provide alternate work feed and work holding return strokes in closely timed sequence, in accord with the demands of the production equipment.

Means are provided for varying the work feeding stroke of the carriage member and for damping or cushioning both the feed and return strokes of the carriage by sepa-

2

rate variable controls, in a simple arrangement, to assure maximum efficiency in service.

To facilitate the conversion from hydraulic to pneumatic controls and operating devices, significant innovations have been made in the diaphragm operated valve structures, for the gripping and holding mechanisms, in the damper, in the control system, as mentioned briefly, and elsewhere as will be more fully described in the detailed description provided hereinafter.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the stock feeding device of this invention with one side wall partially cut-away to better show the traveling member.

FIG. 2 is a top plan view of the stock feeding device with one side and an extended end cut away in part to better fit the drawing page.

FIG. 3 is an enlarged cross-sectional view through the stock feeding device as seen generally in the plane of line 3—3 of the first drawing figure.

FIG. 4 is a cross-sectional view taken in the plane of line 4—4 in FIG. 3, and showing the damper device for cushioning the stroke of the traveling gripper member.

FIG. 5 is a cross-sectional view through the damper valve housing, showing the means of individual adjustment for feed and return strokes, as seen in the plane of line 5—5 of FIG. 4.

FIG. 6 is a schematic illustration of the pneumatic control circuit.

FIG. 7 is a schematic illustration of the electrical control circuit.

DETAILED DESCRIPTION

The present equipment is for use with presses and stamping machines, or the like, which have a vertically reciprocal ram acting relative to a platen on which the work stock is received, while the ram is raised, and is adapted to feed the stock into the machine automatically and in timed sequence with the operation of the production machine. Accordingly, it is located near and is preferably attached to the production machine to support the work stock as it is fed across the platen a predetermined distance, in timed sequence with the raising of the ram, as required by the size of the work pieces being formed.

A base or frame member is provided of sufficient length to support and align the work stock being fed into the production machine and with suitable guides at opposite ends for a side edge of the strip or sheet material to keep it straight. A carriage member, on guide rails between the ends of the base frame, is moved back and forth by a double acting piston cylinder and is formed to receive and grip the stock material as it is moved forward, release it at the end of its forward stroke, and return for successive work feeding strokes.

The gripper provided on the carriage member is operated by a solenoid controlled air valve and a similar gripper with like controls is provided on the base frame to hold the work stock while the carriage member is returned for its next work feeding stroke.

Such work feeding and holding devices are made mutually exclusive of each other by interlocking controls so that they are never at cross purposes and, at the same time, one or the other thereof is in service at all times for faster feed rates and positive work stock location in the production machine.

An air operated buffer or damper is provided in the work carriage and is disposed for service at the ends of its forward and return strokes to enable fast operation without jarring effects causing work stock slippage in the grippers on the carriage and base frame. It includes a relatively simple double acting piston member with

separate air bleed controls by which the cushioning effect at different ends of the carriage travel can be adjusted as best suits needs and requirements.

Referring now to the drawings, the base frame 10 includes a casting or assembly of reasonable mass and weight to counter the inertial forces involved and comprises a bottom wall 12 extending the full length thereof, side walls 14 and 16 and end walls 18 and 20 standing slightly above the side walls to serve as guides for the work stock received and moved thereacross. A pair of guide rods or rails 22 and 24 extend in parallel spaced relation to each other between the end walls of the base frame and above the bottom wall 12. They are received within aligned bores in the end walls and are fixed by press fitted pins 26 against relative movement and thereby form an integral part of the base frame structure.

The side edge of strip stock or sheet material, supported on the end walls 18 and 20, is guided by a pin 28 on the end wall 18 and a post 30 aligned therewith and standing up from the bottom wall of the base frame. To accommodate sheet material and strip stock which overhangs the side wall of the base frame to any appreciable extent, outriggers 32 and 34 may be provided on the end walls with interconnecting roller tracks 36 or like means as best serves the need.

On the guide rods 22 and 24 is provided the carriage member 40 which is actuated between the end walls of the base frame by a double acting piston cylinder member 42 fastened to the end wall 20 and having its piston rod 44 extended therethrough and engaged to the carriage member.

The carriage member 40 is a casting which includes interconnected cylindrical portions 46 and 48 receiving the guide rods 22 and 24 therethrough and provided with bushings 50 for the free sliding movement of the carriage member back and forth on them under the control of the piston rod 44 engaged to the interconnecting web 52 therebetween. The piston rod is formed to include a shoulder 54 engaging the end wall of the carriage member, for pushing it in one direction, and has a slightly undersized close fitting extension 56 through the web wall 52, assuring alignment therewith, and a shoulder forming end cap 58 fixed thereto on its extended end, as by lock screw 60, for pulling the carriage back to its retracted position.

The stroke or travel of the carriage member 40, between the end walls of the base frame and relative thereto, is determined by a stop pin 62, fastened by a lock screw 64 on a block 66 on the inner face of end wall 18, and by an adjustable stop provided by the threaded screw member 68 extending through a fitting 70 fastened to the inside of the other end wall member 20. The fixed stop pin 62 will be noted as holding the ends of the carriage guides, provided by cylindrical portions 46 and 48, from engagement with the end wall 18 and it will be likewise appreciated that the adjustable stop precludes engagement of the carriage with the other end wall and any other structure provided thereon.

The adjustable stop extends through a threaded bore in the end wall fitting 70 that is slotted (not shown) so that it may be contracted, as by screw 72, to fix the adjusted location of the stop and safeguard it against damage from impact forces.

To further prevent impact loads in slamming the carriage against the adjustable stop and, to be more precise, to damp or cushion the inertial force of the carriage member at both ends of its feed and return strokes, so that it will not cause the work stock material to move relative to the feed and holding grippers, a damper or buffer arrangement 74 is provided within the carriage member 40, as is best shown by FIGS. 3-5 and will now be described.

A bore 76 is provided through the carriage member wall, from front to back, and is provided with a bearing sleeve 78 and a piston member 80 with rod extensions

82 and 84 on opposite sides thereof which extend through journal bearing supports 86 and 88 at the outer ends of the bore hole. Suitable seals 90 are provided in the journal bearing members, for the piston rods that extend therethrough, and about the bearings, as at 92, to provide an air tight chamber area 94 in which the piston member 80 is reciprocal. The assembled parts are retained by closure plates 96 and 98 with just the ends of the piston rods extending therethrough and disposed for engagement with the stop 62, at the forward end of the carriage travel, and the stop 68, when retracted.

The chamber area 94 in the bore hole passage 76 is charged with compressed air, and held under such pressure by a source connection to an inlet passage 100 which is in communication with a cross passage 102 and with passages 104 and 106 that are open into the ends of the chamber area, through openings 108 and 110 at the ends of the sleeve bearing, and which are aligned therewith. As shown by FIG. 5, the outer ends of the transverse passages 104 and 106 are closed by plugs 109 while cone-point adjustment screws 110 and 112 are received into the ends of the cross passage 102 at their junction with the cross passage for restricting air flow therepast in accord with their respectively adjusted positions.

In use, when one of the piston rods engages a stop it forces the piston member 80 towards the opposite end of the chamber area 94, further compressing the air charge therebehind and causing the bleed-off as permitted by the cone-point adjustment screw. The other adjustment screw will inhibit or allow further charging of the chamber area space on the other side of the piston member in accord with its adjusted position and thereby further serves to regulate the damping effect obtainable.

The power stroking piston cylinder 42 holds the carriage member against the stops at opposite ends of the base frame long enough for the bleed-down required to reset the piston member each time, for the next feed or return stroke, and so that the rod extensions thereof are extended for stop contact as required. During the carriage travel the balanced pressure on each side of the piston member causes it to hold its position near one or the other end of the chamber area.

The gripper devices for engaging the stock material and moving it forward with the carriage member 40 and the one for holding the stock material while the carriage is returned, are shown by FIGS. 1-3 and are identified 120 and 122, respectively.

The gripper arrangement 120, on the carriage member is shown most clearly by FIG. 3 to include a housing part 124 which extends towards one side and has a cover part 126 which forms a chamber area 128 therewith and in which is provided the operative mechanism for accomplishing the work stock engagement. This includes a vertically reciprocal plunger 130 extending through a bearing sleeve 132 in a bore 134, that intersects a side opening 136 in the lower housing part, of a size that will receive a side edge of the stock material, and aligned with an anvil seat or button 138 on the carriage frame. The plunger member 130 includes a disc 140 secured to its upper end and a sealing ring 142 about the disc and engaged with a sleeve liner 144 in the cover part 126 which forms the inner peripheral wall of the chamber area 128.

The plunger, or gripper as more appropriately designated, is biased in a retracted position by a spring 146 under the disc 140 and engaged with the bottom wall of the chamber area, or collar 148 of the bearing sleeve 132 as shown in the drawing. Passage means 150 through the cover part 126 and in open communication with the chamber area 128 over the plunger disc 140, are connected to a compressed air source, and when the chamber area is charged the disc 140 serves as a diaphragm or piston head forcing the plunger or gripper into holding engagement with the stock material when disposed thereunder.

It will be noted that the use of the liner 144, in the chamber area 128, and more particularly fitted in the cover part 126, avoids the machining otherwise necessary in cast parts and greatly reduces costs and service problems in maintaining a close fitting air pressure responsive assembly. Since the liner is fitted in the cover part, sealing between the housing and cover part is less critical than with conventionally known flexible diaphragm arrangements and the structure is greatly simplified in this respect also.

The other gripper device 122 is generally similar in construction to the one on the carriage member and so has not been shown and will not be described in detail. It is not mobile but is mounted on the end wall 20 of the base frame 10, in a fixed position, and is similarly aligned for work stock engagement as received through a side opening provided in the outer disposed side thereof.

Referring now to FIG. 6, the pneumatic circuit is shown as including an air line 150 from a source of compressed air, such as is commonly available in manufacturing plants and facilities. An air filter 152 and lubricator 154 are in the supply line and an air check valve 156 is provided, as is conventional, in supplying air to the manifold line 158. From here the air supply is to control valves 160, 162 and 164 for operating the carriage gripper 120, the holding gripper 122 and the carriage operating power cylinder 42, respectively, as shown by air lines 166, 168, 170 and 172 to the respective operating mechanisms.

The air supply valves 160, 162 and 164 are biased to hold a first position, or condition, as shown schematically by springs 174, 176 and 178 and in this respect it will be noted that the air supply valve 160 for the carriage gripper 120 is normally open to charge the chamber area 128. The valve is operated by solenoid 180 to vent the chamber area and effect release of the work stock gripper.

Solenoid 182 operates the holding gripper 122 from a normally vented condition to a charged condition, for gripping the work stock and holding it against relative movement, while solenoid 184 is operative of the control valve 164 for retracting the carriage member, which is otherwise held in its forwardly disposed position, by reversing the direction of air flow to opposite ends of the power cylinder.

In FIG. 7, the electrical circuit is shown to include a master on-off switch 186 to a 110 volt power source. The solenoid 184 for actuating the control valve 164 and retracting the carriage member is connected in series with a limit switch 188, and a manually operated switch 190, across the power supply and ground return lines 192 and 194. The solenoid 180 for inactivating the carriage gripper valve 160 is provided in a connection 196, across the control switch 190 and the solenoid 184, and the solenoid 182 for activating the holding gripper valve 162 is in a connection 198 in series with a limit switch 200 across the carriage retracting solenoid 184.

The manually operated control switch 190, between the limit switch 188 and solenoid 184, is an interlocking switch with circuit making means 202 in a connection 204 by-passing the limit switch 188, and operative of the carriage gripper solenoid 180. When the switch 190 is open the circuit making means 202 are closed and the solenoid 180 is energized to hold the carriage gripper open. Consequently, the carriage cannot be inadvertently retracted while the carriage gripper is closed.

A connection 204 is provided across the limit switch 200 and includes a manually operated control switch 206 for effecting single stroke operation, for pilot run purposes, or continuous automatic operation.

From the foregoing description it will be appreciated that the control valves in the pneumatic system are biased to provide air pressure to the power cylinder 42 to move and hold the carriage member in its forward stock feeding position, to charge the carriage gripper 120, and to vent and make inactive the stock holding gripper 122. The sole-

noid controls are to vary these conditions and only two limit switches are needed to accomplish the subsequent sequence of operations required.

Although not specifically shown in the drawings, it will be appreciated that the limit switch 188 is provided on the production machine and is adapted to be closed during the downward stroke of the ram; so that the solenoid 184 is energized and the control valve 164 is shifted to cause the carriage member 40 to be retracted. The limit switch 200 is also provided on the production machine and is normally closed, also, during the working stroke of the ram, so that the solenoid 182 is energized and the control valve 162 is shifted to charge the holding gripper 122 while the carriage member is being retracted. The solenoid 180 is energized with the carriage return solenoid 184, provided switch 190 is closed, and this causes the control valve 160 to be shifted to vent and accordingly release the carriage gripper 120 for the carriage return stroke.

When limit switch 188 is opened all of the solenoid controls are inactivated and the control valves shift to their biased positions releasing the holding gripper 122, setting the carriage gripper 120 and charging the feed cylinder to move the work carriage, with the work stock material, towards the production machine.

I claim:

1. In a device for intermittently advancing work stock material into a production machine and including a base frame having a carriage member slidably mounted thereon and a gripper on said carriage member for engaging and holding work stock material thereto, the improvement characterized by:

air pressure responsive means operatively connected to said carriage member and to said gripper and having a source of air under pressure connected thereto, passage means between said source and said responsive means biased to provide open communication therethrough for charging said gripper and for moving and holding said carriage member in a forwardly advanced position,

means for shifting said passage means in response to cyclic operation of a work stock using machine for discharging said gripper and releasing it and for retracting said carriage member via the responsive means operative thereof,

a second gripper provided on the base frame and including air pressure responsive means connected to said air pressure source and having passage means interposed therebetween and biased to preclude communication therethrough and said shifting means operatively connected thereto for charging said second gripper alternately with respect to said first mentioned gripper,

a source of electrical power and an electrical circuit wherein said shifting means includes solenoid operated means synchronously operative of said passage means and having a common limit switch control for activation thereof,

and interlocking switch mechanism in said electrical circuit for precluding activation of the solenoid operated means operative of the passage means effecting retraction of said carriage member and actuation of said second gripper and providing for activation of the solenoid operated means effecting the inactivation of said first gripper.

2. In a device for intermittently advancing work stock material into a production machine and including a base frame having a carriage member slidably mounted thereon and a gripper on said carriage member for engaging and holding work stock material thereto, the improvement characterized by:

air pressure responsive means operatively connected to said carriage member and to said gripper and having a source of air under pressure connected thereto,

7

passage means between said source and said responsive means biased to provide open communication therethrough for charging said gripper and for moving and holding said carriage member in a forwardly advanced position,

means for shifting said passage means in response to cyclic operation of a work stock using machine for discharging said gripper and releasing it and for retracting said carriage member via the responsive means operative thereof,

means for damping the travel of said carriage member at opposite ends of said base frame and including a chamber area provided within said carriage member and connected to said pressure source,

a piston member within said chamber area and having means operative thereof extended in air sealed relation through the end walls of said carriage member for arresting engagement with stop means provided on said base frame,

and passage means connected to opposite ends of said chamber area and with said air pressure source and having separate means for regulating the air flow thereto and from.

3. In a device for intermittently advancing work stock material into a production machine and including a base frame having a carriage member slidably mounted thereon and a gripper on said carriage member for engaging and holding work stock material thereto, the improvement characterized by:

air pressure responsive means operatively connected to said carriage member and to said gripper and having a source of air under pressure connected thereto,

passage means between said source and said responsive means biased to provide open communication therethrough for charging said gripper and for moving

8

and holding said carriage member in a forwardly advanced position,

means for shifting said passage means in response to cyclic operation of a work stock using machine for discharging said gripper and releasing it and for retracting said carriage member via the responsive means operative thereof,

means for damping the travel of said carriage member at opposite ends of said base frame and including a chamber area provided within said carriage member and connected to said air pressure source,

a piston member within said chamber area and having means operative thereof extended in air sealed relation through the end walls of said carriage member for arresting engagement with stop means provided on said base frame,

passage means connected to opposite ends of said chamber area and with said air pressure source and having separate means for regulating the air flow thereto and from,

and said passage means including a manifold passage connected to said air pressure source, disposed through the end walls of said carriage member, and having said regulating means engaged opposite ends thereof.

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ALLEN N. KNOWLES, Primary Examiner

U.S. Cl. X.R.

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