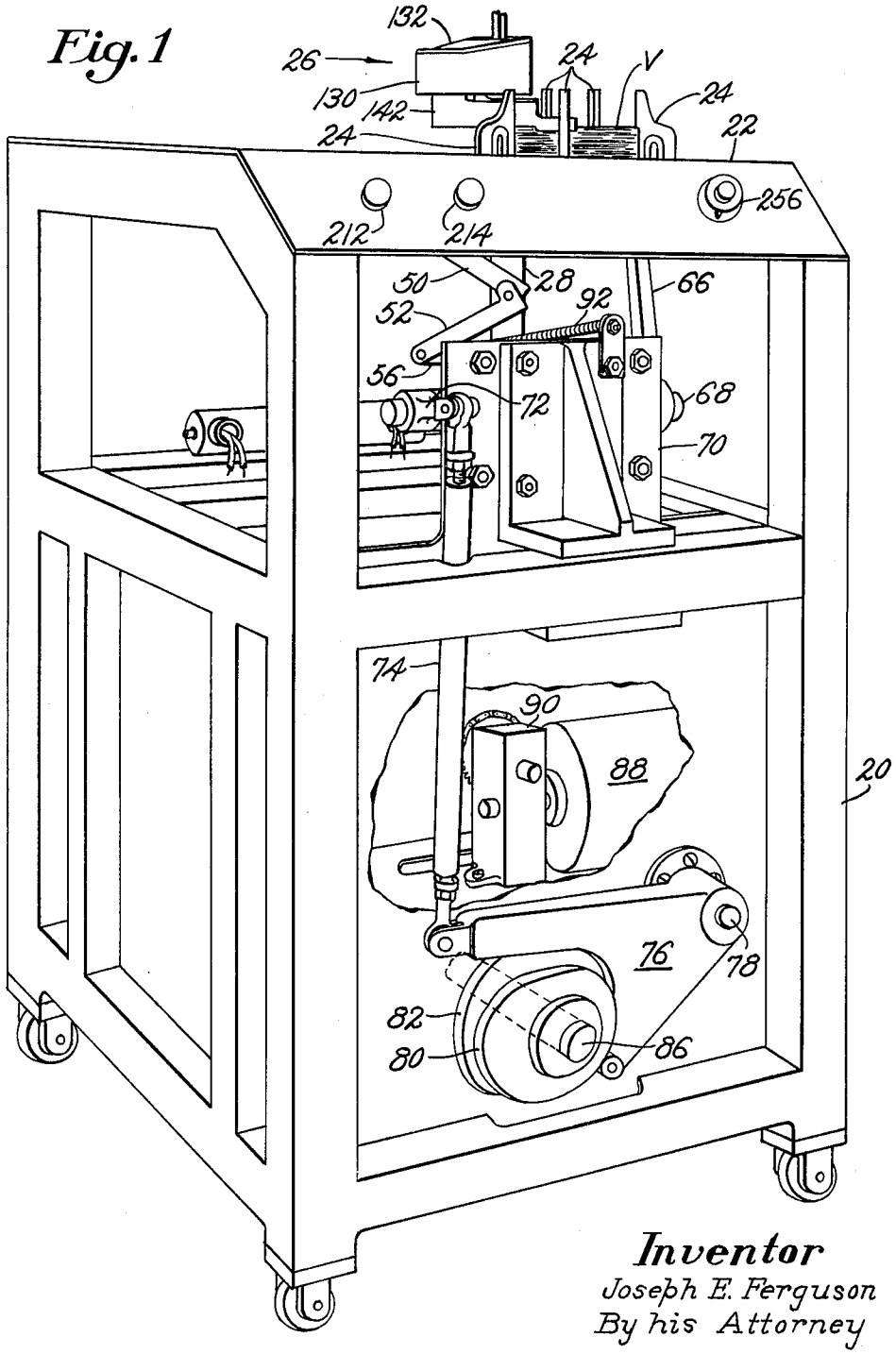
March 15, 1966 J. E. FERGUSON 3,240,358

WORK PIECE FEEDERS

Filed Sept. 23, 1963 9 Sheets-Sheet 1

Fig. 1



Inventor

Joseph E. Ferguson

By his Attorney

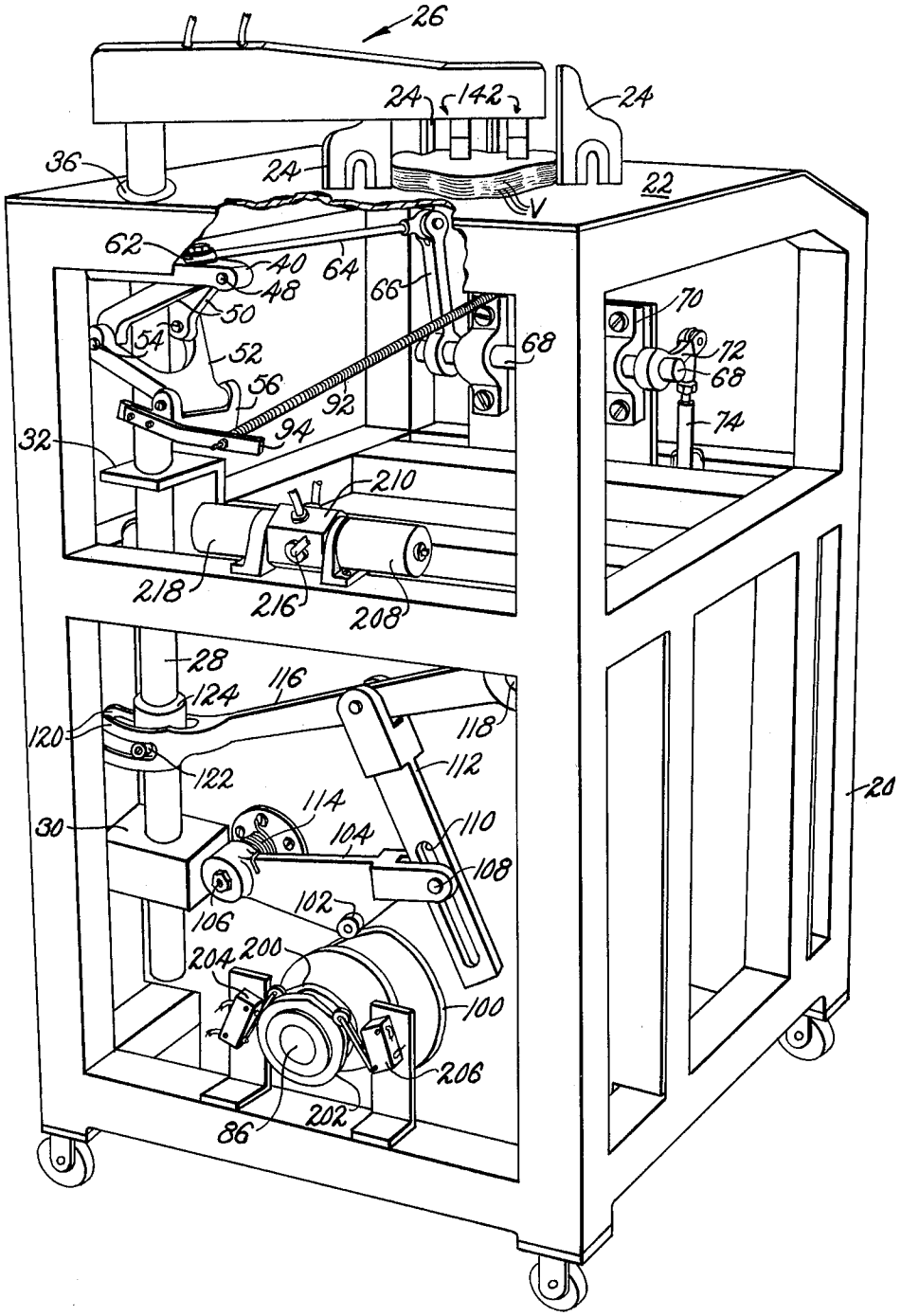
Carl E. Johnson.

March 15, 1966 J. E. FERGUSON 3,240,358

WORK PIECE FEEDERS

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Fig. 2

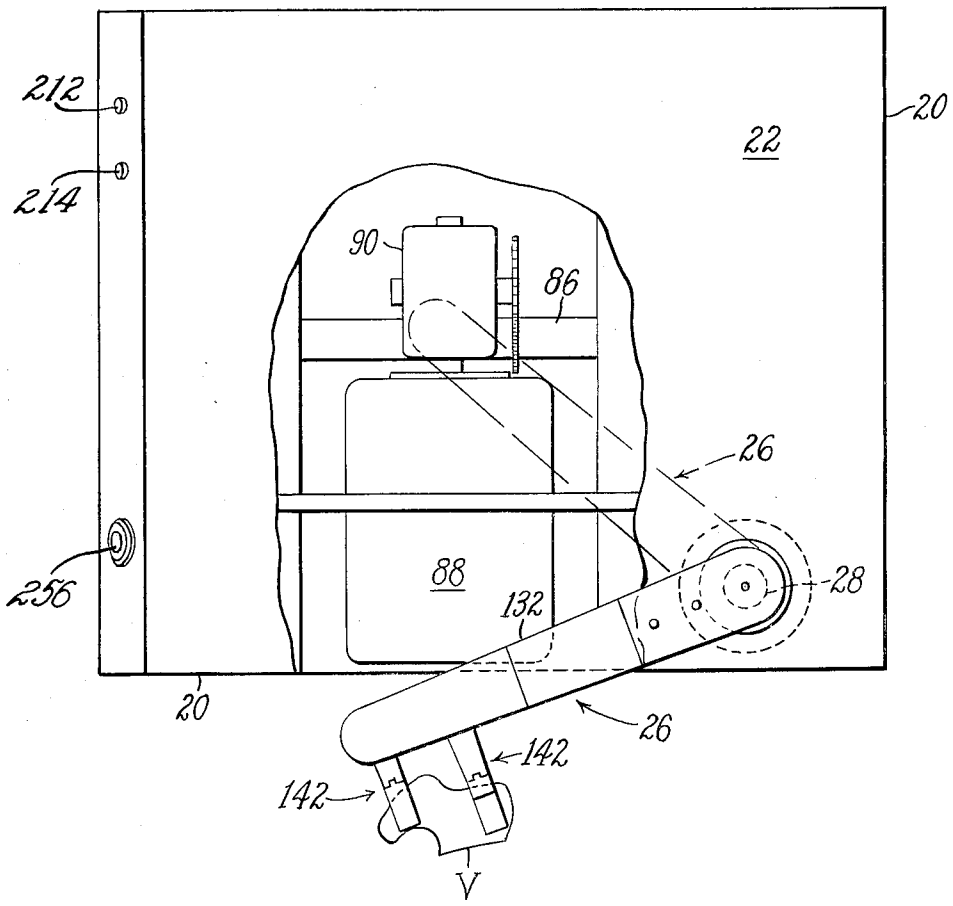


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WORK PIECE FEEDERS

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Fig. 3

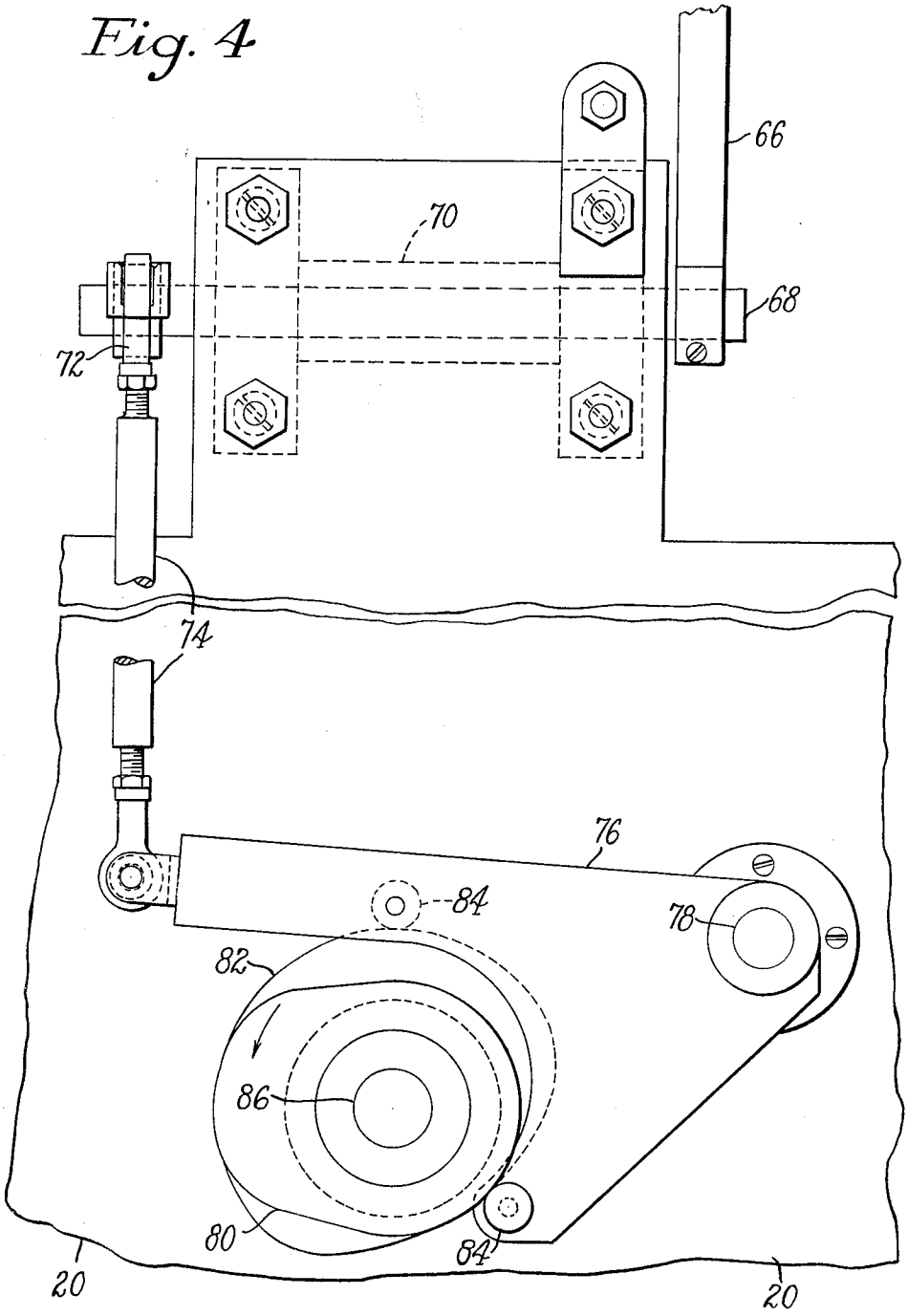


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WORK PIECE FEEDERS

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Fig. 4



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WORK PIECE FEEDERS

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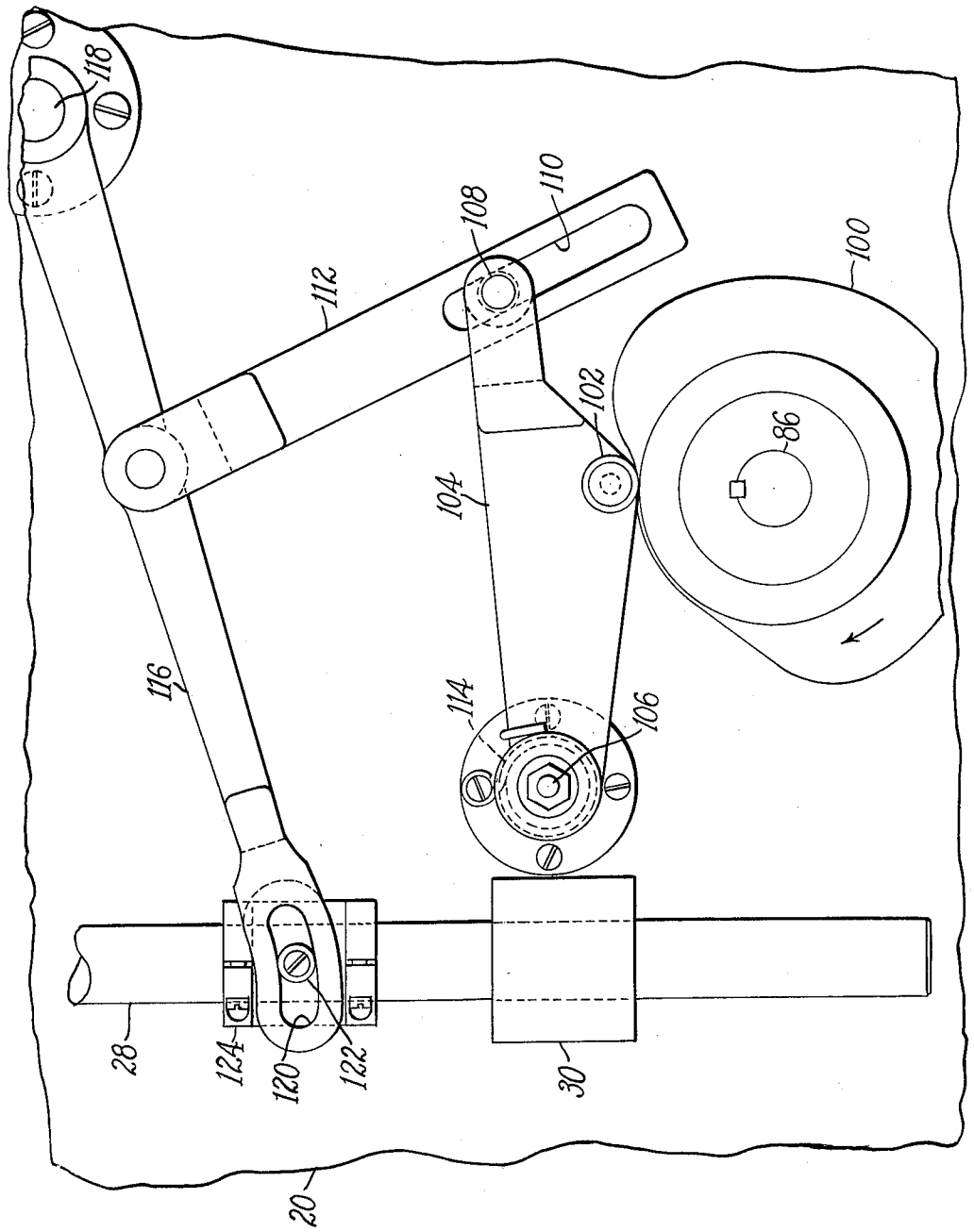
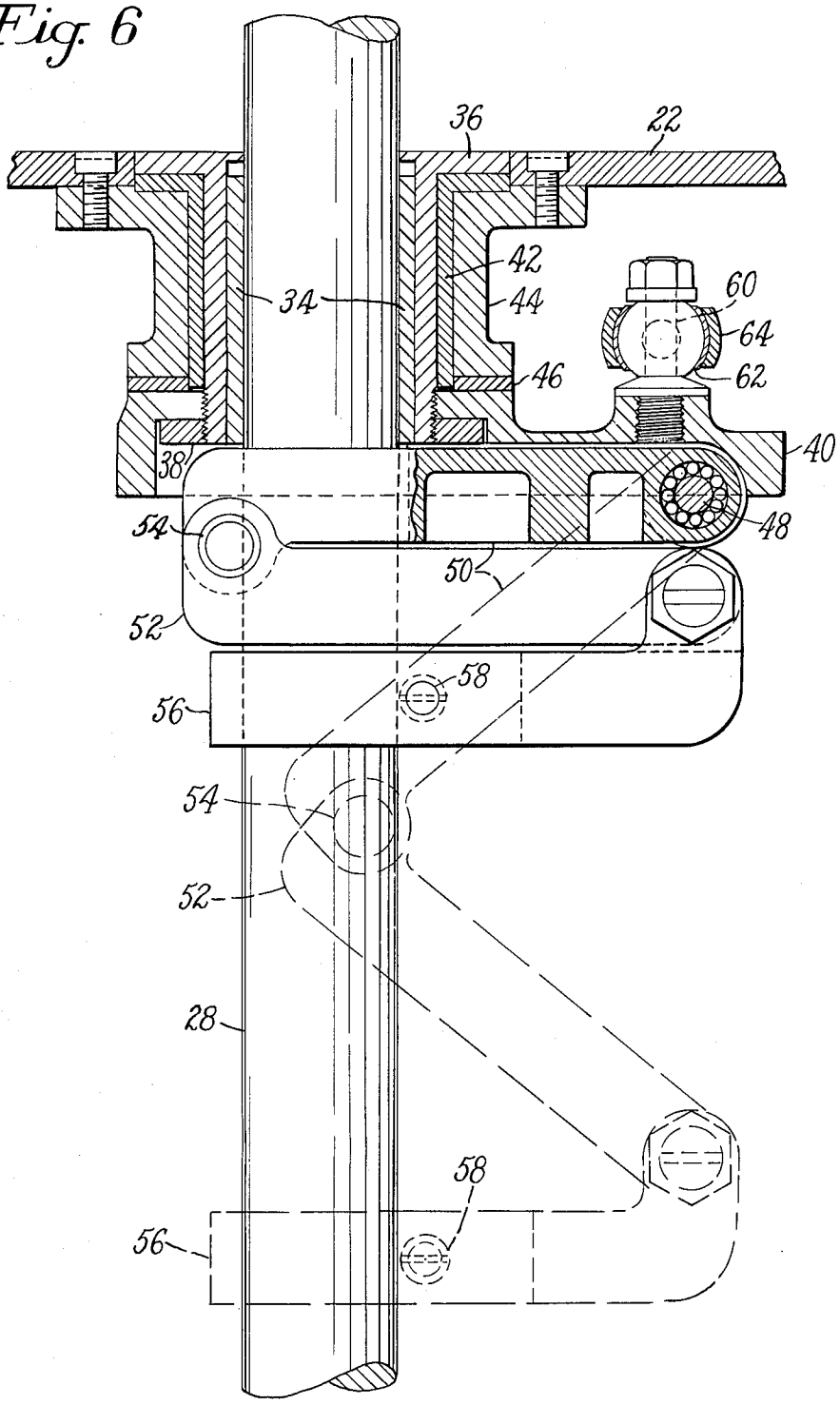


Fig. 5

Fig. 6



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WORK PIECE FEEDERS

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Fig. 7

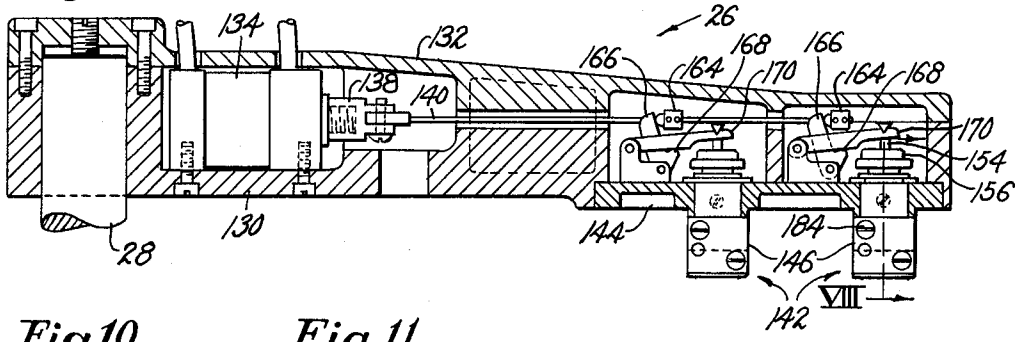


Fig. 10

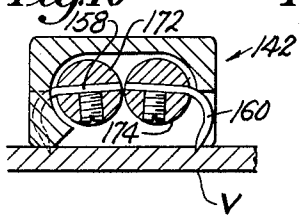


Fig. 11

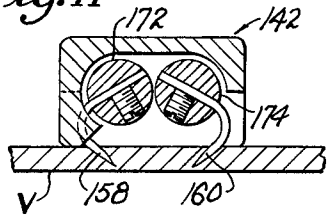


Fig. 8

Fig. 9

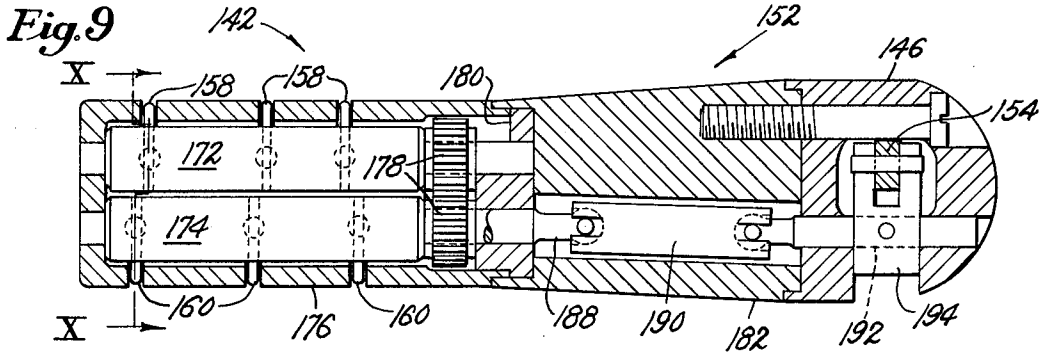


Fig. 12

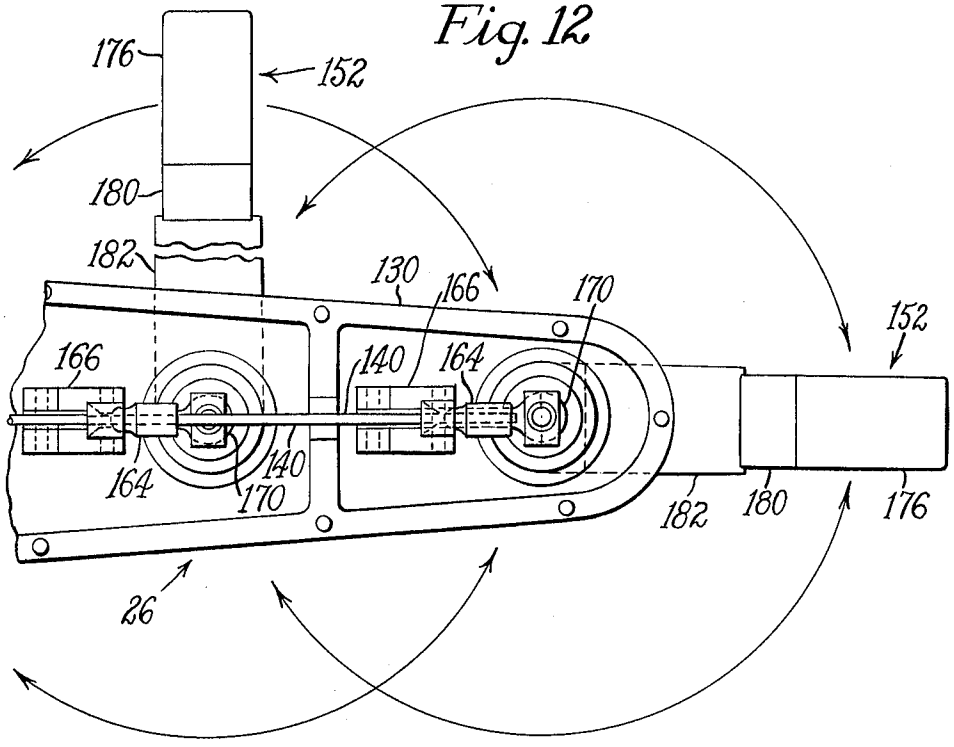
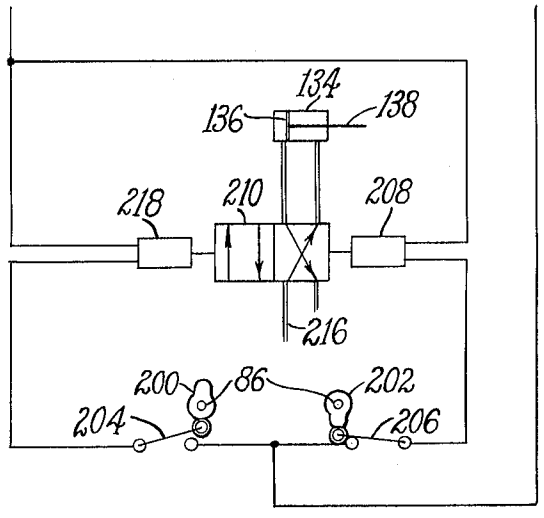

176
152
180
182
130
166
170
152
166
140
164
164
140
170
182
180
176
26

Fig. 13


134
136
138
218
210
208
216
200
86
202
204
206

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WORK PIECE FEEDERS

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Fig. 14

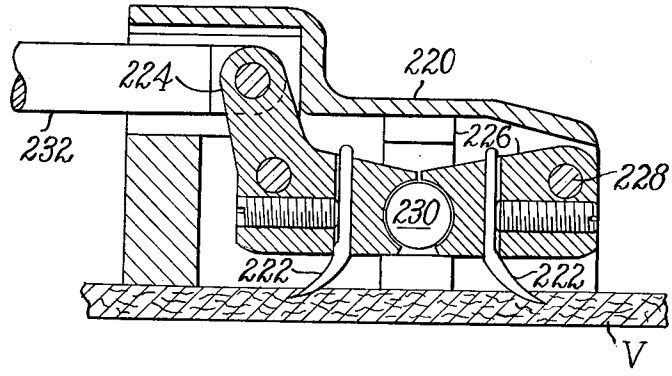


Fig. 15

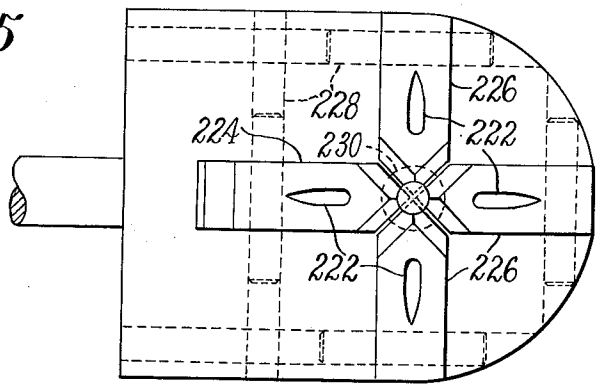


Fig. 16

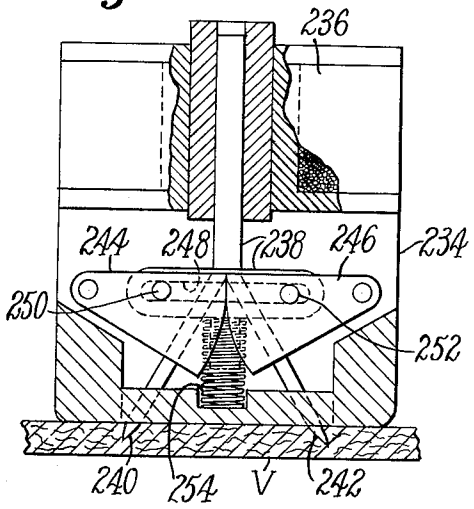
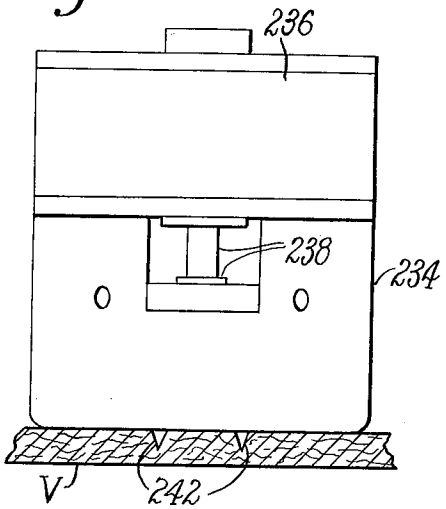


Fig. 17



United States Patent Office 3,240,358 Patented Mar. 15, 1966

3,240,358

WORK PIECE FEEDERS

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Filed Sept. 23, 1963, Ser. No. 310,837
2 Claims. (Cl. 214—1)

This invention relates to automatic work transfer mechanism. More particularly the invention pertains to the provision of improved means for successively moving topmost work pieces from a stack and positioning them in predetermined arrangement in the operating zone of an adjacent automatic machine whereby its operating instrumentalities can function continuously, or nearly so, without manual intervention on the pieces thus successively received. As herein illustrated, the invention is embodied in novel mechanism for transferring and positioning generally flat work pieces, especially of leather or the like, which are to be processed seriatim as occurs, for instance, in the upper fitting operations of a shoe factory. It will be appreciated that the invention is not thus limited in its application but is capable of broader industrial usage.

Many new machines are designed to complete automatically a process, treatment or progressive series of operations on a work piece once it has been properly presented thereto. In shoe machinery, for example, skiving, edge folding and stitching machines have been adapted by the addition of automatic work guidance mechanism (as disclosed, for instance, in United States Letters Patent No. 3,034,781—Touchman et al., No. 3,088,144—Weeks, and No. 3,080,836—Clemens et al., respectively) to operate satisfactorily and expeditiously on shoe parts without the aid of an operator when they have initially been positioned therein. Picking up, transferring and then putting down successive pieces of work, especially if they are of irregular shape, thin or flabby, can be a tedious and trying chore. It accordingly is an object of this invention to make more completely automatic the functioning of a cyclically operative machine by providing, as an adjunct, an automatic work piece feeder or presenting means adapted to unstack and then position successive pieces according to the cyclical needs of the machine.

In keeping with the object just stated, and as a feature of the invention, there is provided in combination with means for supporting a stack of work pieces, a movable transfer arm, work gripping means thereon, means for operating and controlling the gripping means, means for moving the arm laterally of the stack and heightwise thereof first to seize successive pieces from the top of the stack and then deposit them in an operating zone, and self-adjusting mechanism for automatically determining heightwise the successive work seizing positions of said gripping means in accordance with the variable upper level of the stack.

A further feature of the invention resides in the provision of novel power means for seizing and carrying flexible work pieces from a supply source to a presenting position, the means including at least one pair of cooperative impaling pins relatively movable toward and from one another.

The foregoing and other features of the invention, together with novel details and combinations of parts, will now be more particularly described in connection with an illustrative embodiment thereof and with reference to accompanying drawings, in which:

FIG. 1 is a front perspective view of a mobile flat-piece feeder as adapted for transferring leather vamps;

FIG. 2 is a rear perspective view of the machine shown in FIG. 1;

FIG. 3 is a plan view of the machine, a portion being broken away and indicating a transfer arm in two selective operating positions to which it may be swung;

FIG. 4 is a view in front elevation of mechanism shown in FIG. 1 for controlling swinging movement of the transfer arm about a vertical axis;

FIG. 5 is a view in rear elevation of mechanism shown in the lower portion of FIG. 2, but on a larger scale, permitting self-adjusting elevation of a control post carrying the transfer arm;

FIG. 6 is an enlarged view in rear elevation of mechanism shown in the upper portion of FIG. 2, indicating means for controlling the operating level of the transfer arm;

FIG. 7 is a longitudinal section of the transfer arm;

FIG. 8 is a section taken on the line of VIII—VIII of FIG. 7 and showing construction of one of two impaling heads;

FIG. 9 is a section taken on the line IX—IX of FIG. 8;

FIG. 10 is a section taken on the line X—X of FIG. 9 and showing mounting of a pair of impaling pins;

FIG. 11 is a view similar to FIG. 10 indicating operating positions of the pins during work transfer;

FIG. 12 is a plan view of a portion of the transfer arm shown in FIG. 7, with its cover removed, and showing diagrammatically the work piece area subject to being seized by the pair of impaling heads;

FIG. 13 is a schematic diagram of an electro-pneumatic system for controlling work pickup and release;

FIGS. 14 and 15 are sectional and bottom views, respectively, of an alternate form of impaling head useful on some forms of work; and

FIGS. 16 and 17 are, respectively, a side view partly in section and a view at right angles thereto of another impaling head construction.

The illustrative machine is desirably mounted in a mobile frame **20** providing a flat work supporting surface **22** (FIGS. 1 and 2). A stack of work pieces such as vamps V may accordingly be uniformly positioned on the surface **22**, for instance by a plurality of magnet type positioning blocks **24**, the machine wheeled to a selected location adjacent to apparatus (not shown) to be fed, such as an automatic skiver, edge folder or other device, a transfer mechanism hereinafter to be described placed in operation to move the successive work pieces from the top of the stack for presenting and prepositioning them with respect to the apparatus.

A work transfer arm generally designated **26** (FIGS. 1, 2, 3 and 7) is secured at one end to the top of a vertical control post **28** which is rotatably and slidably mounted in alined bearing brackets **30**, **32** (FIG. 2) and a sleeve **34** (FIG. 6) in a flanged bushing **36**. Means by which the post **28** is moved about its axis to carry the arm **26** laterally in a cycle of operations will next be described, followed by an explanation of the means provided for cyclically effecting heightwise movement of the arm.

Referring to FIG. **6**, the lower end of the bushing **36** has threaded thereon a nut **38** and a rotatable collar **40**. For supporting the bushing **36** a complementary bearing sleeve **42** is secured by a clamping ring **44** which is bolted to the underside of the surface **22**. A washer **46** takes frictional wear between the collar **40** and the lower end of the ring **44**. The lower portion of the collar **40** is recessed to support a pivot pin **48** for the upper end of a three-part, self-adjusting, forked linkage constituting a portion of both the lateral and vertical arm-moving means as will be explained. This linkage includes an upper link **50** (FIGS. 2 and 6) having at one end a ball bearing mounting on the pin **48**, an intermediate link **52** the forked upper end of which is pivotally connected to the forked end of the link **50** by pins **54**, and a lower link **56** piv-

otally connected at one end to the other end of the link **52**. The other end of the link **56** is formed as a split clamp and held secured to the post **28** by means of a bolt **58** (FIG. 6).

For turning the post **28** on its axis the collar **40** threadedly receives a stud **60** having a universal joint connection **62** with one end of a link **64**, the other end of which is connected to a crank arm **66** (FIGS. 1, 2 and 4). The latter is fast on one end of a rock shaft **68** journaled in a bearing bracket **70** secured to the frame **20**. The other end of the shaft **68** is connected by a crank **72** (FIGS. 1 and 4), and a vertical link **74**, to a cam lever **76** pivoted on a stub shaft **78** supported by the frame. Oscillation of the lever **76** is controlled by a dual cam **80**, **82** cooperative with a pair of follower rolls **84**, **84** carried by the lever.

For cyclical actuation of the transfer arm **26** a cam shaft **86** journaled in the frame **20**, and on which the dual cam **80**, **82** is secured, is driven from a variable speed motor **88** (FIGS. 1 and 3), a gear reducer **90** mounted on an internal portion of the frame and having conventional sprocket-and-chain operating connection. While the dual cam **80**, **82** is positive in its torque-exerting action on the control post **28**, a tension spring **92** (FIGS. 1 and 2) connecting the bracket **70** and an arm **94** affixed to the link **56** serves to bias the post **28** counterclockwise (as viewed from above in FIG. 2) and thus aids in overcoming inertia of the transfer arm **26** when loaded and ready to carry a work piece from its stack.

For effecting cyclical heightwise movement of the transfer arm **26** the shaft **86** carries a cam **100** (FIGS. 2 and 5) cooperatively related to a follower roll **102** supported by a lever **104**. The latter is pivoted at one end on a stub shaft **106** secured in the frame, and at its other end carries a roll **108** received in a lost motion slot **110** formed longitudinally in a link **112**. A torsion spring **114** on the stub shaft **106** maintains the roll **102** in engagement with the cam **100**. As indicated in FIG. 2, when the transfer arm **26** is in its initial work piece-seizing position, the roll **108** may be spaced from the upper end of the slot **110** by an amount (not exceeding the throw of the cam **100**) which increases as the upper level of the stack of work pieces diminishes during the feeding operations. The upper end of the link **112** is pivoted to a lifting lever **116** (FIGS. 2 and 5). This lever has one end fulcrumed on a bearing pin **118** projected from the frame and its other, or forked, lifting end formed with arcuate slots **120**, **120** for respectively receiving rolls **122** (one shown) carried by a collar **124** clamped on the post **28**. Accordingly, as the roll **102** rises on the high portion of the cam **100**, the roll **108** will engage the uper end of the slot **110** and cause the lever **116** to elevate the rolls **122** and hence the arm **26**.

The arm **26** may be modified a number of ways to adapt it for the handling of particular types of work pieces. FIGS. 7–11 illustrate a pneumatic construction now to be described which has been found especially useful in seizing and feeding flexible leather, plastic, fabric and the like, where an important consideration is that a finished surface thereof must not be marred and little, if any, defect incurred in the surface actually seized. The arm includes a hollow base **130** and a cover **132** secured thereon. Affixed in the base **130** adjacent to the post **28** is an air motor **134** (FIGS. 7 and 13) including a reciprocable piston **136** (FIG. 13) having its piston rod **138** secured to a cable **140** for operating a pair of rotatably adjustable impaling heads generally designated **142**, **142** (FIGS. 2, 3, 7, and 12). It will be apparent that for smaller and stiffer work pieces only one so-called pickup head **142**, or its equivalent, may suffice and that for larger and more flabby work pieces two or more heads may be required. Since construction and operation of each of the heads **142** is generally similar, it will now suffice to describe but one of them in detail.

Referring mainly to FIGS. 7–11, a plate **144** secured to the base **130** is bored to receive cylindrical bearing portions of a pair of depending, axially slotted members **146**. Each of these members is rotatably supported on the plate **144** by means of a retaining ring **148** (FIG. 8), a set screw **150** in the plate abutting the member endwise to hold it and a composite picker arm **152** secured thereto in selected position as desired within the angular range indicated by arrows in FIG. 12. A depending plunger **154** extending into the member **146** and through a cap **156** adjustably screwed thereon is actuated by the cable **140**, as will be described, simultaneously to control work seizure and release by spaced pairs of cooperative impaling pins **158**, **160** in each of the heads **142**. The arrangement is such that each of several (in this case 3) pairs of the pins **158**, **160** is normally held ineffective and retracted within the picker arm **152** by means of a compression spring **162** (FIG. 8) which has an upper end abutting an internal shoulder of the member **146** and a lower end engaging a collar of the plunger **154** to urge it downward. Upon retraction of the cable **140** (to the left, as seen in FIG. 7) upon operation of controls later explained, an adjustable block **164** on the cable swings counterclockwise (as seen in FIG. 7) a lever **166** pivoted to the base. Consequently a portion **168** of the lever **166** is caused to swing counterclockwise a lever **170** pivoted to the base and thereby moves the plunger **154** upwardly endwise against resistance of the spring **162** to effect impaling movement of the pins **158**, **160** by means next to be described.

The function of the cap **156** is to limit the return or clockwise movement of the lever **170** and hence determine the fully retractive positions of the pins **158–160**.

As illustrated in FIGS. 10 and 11, the pins **158**, **160** are preferably moved toward one another angularly to impale the work piece from one side thereof. For this purpose the pins are detachedly mounted in oppositely rotatable cylindrical holders **172**, **174** (FIGS. 9–11) having operative connection with the lower end of the plunger **154**. Thus the holders **172**, **174** have their outer ends journaled in an outer portion **176** of the picker arm **152** and their inner ends, which are integrally formed with meshing pinions **178**, **178** have bearings in an insert portion **180** (FIGS. 8 and 9) of the arm **152**. The outer portion **176**, the insert portion **180** and a hollow inner portion **182** of the composite arm **152** are threadedly secured in assembled relation by a screw **184** (FIGS. 7 and 8). For oscillating the holders **172**, **174**, one of their pinions **178** is enmeshed with a drive gear **186** (FIG. 8) on a ball-ended shaft **188** journaled in the portions **176**, **180**. The shaft **188** has swivel connection by means of a link **190** to a ball-ended shaft **192** journaled in the member **146**. Completing this pin-operating linkage is a crank arm **194** which has one end pinned to the shaft **192** and its other end pinned to the lower end of the plunger **154**.

Referring mainly to FIGS. 2 and 13, means for electropneumatically controlling seizure by the pins **158**, **160** of each uppermost vamp V, and their subsequent release of it at the instant in transfer when it has been properly positioned and presented, for instance, with respect to operating tools about to operate thereon, will now be described. Secured on the cam shaft **86** is a pair of cams **200**, **202** the high points of which are 180° out-of-phase. Each of these is arranged to cooperate with a microswitch **204**, **206** respectively, one of which is thus held closed while the other is thus allowed to open. The switch **206** when closed as shown in FIG. 13 energizes a solenoid **208** effective to shift a four-way valve **210** thereby admitting air under pressure to the right side (as seen in FIG. 13) of the piston **136**. This assumes that a master electrical switch **212** (FIG. 1) and a master air switch **214** (FIG. 1) admitting air to inlet **216** (FIGS. 2 and 13) have been first turned to their "on" positions. As a result the cable **140** is retracted to

project the pins **158, 160** downwardly and convergingly from the picker arm **152** and into the topmost stacked work piece. These pin projections are sufficient to enter and effect seizure of the piece so that it may thereafter be carried reliably despite abrupt motions in any direction, without detrimental marring or piercing of the opposite or finished undersurface of the piece, which may be the grain side of leather, for example, is avoided.

When, near the end of the first half of the cycle, by reason of operation of the above described transfer mechanism, the arm **26** has delivered the work piece V to an operating zone, the cam **202** allows the switch **206** to open, deenergizing the solenoid **208**, and the cam **200** closes the switch **204**. Consequently a solenoid **218** is energized to return the valve **210** and hence admit air under pressure to the left side (as seen in FIG. 13) of the piston **136** thereby permitting the springs **162** to withdraw the pins **158, 160** simultaneously from the work so that it may be deposited in predetermined position.

The convergent-pin type of pick-up head **142** is useful in handling many materials provided they are not too flimsy. In FIGS. 14 and 15 is shown a divergent, multi-pin type of pick-up head **220** wherein its 4-pins **222** are respectively carried in an actuator lever **224** and 3 links mutually disposed at right angles. The lever **224** and the links **226** are respectively carried on pivot pins **228** in the head **220** and each has a narrower, semi-spherically recessed inner end for mating with a bearing ball **230**. The other end of the actuator lever is pivoted to a rod **232**. It will be apparent that movement to the right in FIG. 14 of the rod **232** is effective to project the pins **222** thus causing the work V to be seized; movement of the rod **232** to the left effects work release.

In FIGS. 16 and 17 an alternate form of impaling head **234** includes a solenoid **236** and its plunger **238** for actuating two pairs of straight or curved, parallel impaling pins **240, 242**, one pair diverging from the other. Two pairs of parallel links **244, 246** (only one link of each pair is shown) are pivoted at their outer ends to the head **234**. The lower end of the plunger **238** is formed with a horizontal slot **248** for receiving pins **250, 252** respectively bridging the links **242, 244**. Accordingly energization of the solenoid **236** (which may, for instance, be effected by a circuit controlled by the switches **204, 206**) depresses the plunger **238** against resistance of a return spring **254** centrally inserted in the head, thereby causing the impaling pins to be thrust into the work piece, two in one direction and two in a divergent direction thus tending to spread it. Such work spreading impalements, also effected with the arrangement of FIGS. 14 and 15, are sometimes advantageous where the material to be transferred is of stretchable character or particularly thin and its quality does not impede release at the point of delivery.

Reviewing briefly a cycle of operation of the machine, the work to be fed is first uniformly stacked on the surface **22** and held in selected orientation with the aid of the gage blocks **24**. The latter may have straight edges abutting the sides of the stack in spaced localities selected to avoid interference of the transfer arm **26**, the stack itself being initially spotted to come within the range of the adjustably rotatable heads **142**. At the end of each cycle these heads will normally come to rest on the uppermost work piece as shown in FIG. 2, the pins **158, 160** then being retracted. They are projected early in a cycle by operation of the electropneumatic control means above described, for instance, to impale the top piece V from the flesh side of a leather vamp. Then the cam **100** is effective through the lever **104**, the link **112**, the lever **116**, and the control post **28** to determine upward separation of the arm **26** and the impaled piece V from the stack, followed by further suitable heightwise movements of the arm to transfer the piece V to its release point, and then to return the heads **142** to their pick-up position on the stack. Simultaneously in the cycle the dual cam **80, 82** transmits torque to the post **48** via the lever **76**, the link **74**, the cranks **72** and **66**, the link **64**, and the collar **44**. The post accordingly shifts the transfer arm **26** first to swing it with a work piece from the dash position shown in FIG. 3 to the full-line position indicated. It will be apparent that other cams of selected shape may be substituted as appropriate for different heightwise and/or lateral feeding movements which may be required. A knob **256** (FIG. 1) is rotatable to control the speed of the motor **88** and hence the rate of work transfer, the delivery of each piece preferably being timed to correspond with the production rate of the machine to be fed.

It is especially to be noted that, as the work stack diminishes, the described self-adjusting mechanism for controlling the heads **142** heightwise automatically adjusts to the changing height of the stack, the slot **110** allowing the link **112**, the lever **116** and the control post **28** to descend in steps (equal to work piece thickness) under the influence of gravity and to the extent required without disruption of the operative connection between the torque applying link **64** and the 3-part linkage **50, 52, 56** which is correspondingly collapsible heightwise as shown in FIG. 6. This is to say that the link **56**, in any heightwise position imposed by the cam **100** and/or the work stack, remains operative to impart torque or lateral positioning to the arm **26** as dictated by the cam **80, 82**.

A reason for employing impaling pin heads rather than, for instance, a suction type pickup means is that the latter is commonly incapable of lifting from a stack only one work piece but will, depending on its foraminous nature, tend to separate more than one at a time. Also, precise control of the release of the work subjected to suction is at times difficult. Usage of pin type transfer heads of the sort herein illustrated normally requires a less expensive machine, and the pins normally only partly penetrate each work piece thus leaving fabric, plastic, and the grain side of leather unmarred.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a work transfer apparatus having a frame, and a transfer arm which has work gripping means for seizing an article and which swings horizontally and moves vertically to transfer the article from a stack, automatic means for permitting the work gripping means to assume in each seizing operation a new heightwise work seizing level corresponding to the current level of the stack from which the work is to be transferred, said automatic means comprising a post for supporting said arm, a lever connected to said post, a link connected to said lever, said link having a slot, a second lever attached at one end to said frame, a slide member attached to the other end of said second lever and being disposed in said slot, a cam follower attached to said second lever, and a rotatable cam engageable with said cam follower.

2. In a work transfer apparatus having a frame, and a transfer arm which has work gripping means for seizing an article and which swings horizontally and moves vertically to transfer the article from a stack, automatic means for permitting the work gripping means to assume in each seizing operation a new heightwise work seizing level corresponding to the current level of the stack from which the work is to be transferred comprising a control post for mounting said arm, a lifting lever connected to said control post, a link pivotally connected to said lifting lever and having a lost motion slot, a second lever pivotally attached at one end to said frame, a slide member attached to the other end of said second lever, said slide member being slidably retained in said lost motion slot, a cam follower attached to said second lever, a rotatable cam engageable with said cam follower, and power means for rotating said cam.

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2,253,283	8/1941	Minaker.	
2,610,746	9/1952	Steck.	
2,625,120	1/1953	Eddy	198—178 X
2,683,538	7/1954	Kinkston.	
2,716,765	9/1955	Quinn.	
2,956,696	10/1960	Drakengren.	
2,974,811	3/1961	Dammert.	
3,031,906	5/1962	Holman.	

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