US00RE34581E

United States Patent [19]

Sofy et al.

[11] E **Patent Number: Re. 34,581**

[45] **Reissued Date of Patent: Apr. 12, 1994**

[54] PUNCH PRESS TRANSFER MECHANISM

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[21] Appl. No.: **879,023**

[22] Filed: **May 6, 1992**

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Reissue of:

[64] Patent No.: **4,833,908**
Issued: **May 30, 1989**
Appl. No.: **140,479**
Filed: **Jan. 4, 1988**

[51] **Int. Cl.**[5] **B21J 13/08**
[52] **U.S. Cl.** **72/405**; 198/621
[58] **Field of Search** 72/405, 421; 198/621, 198/774

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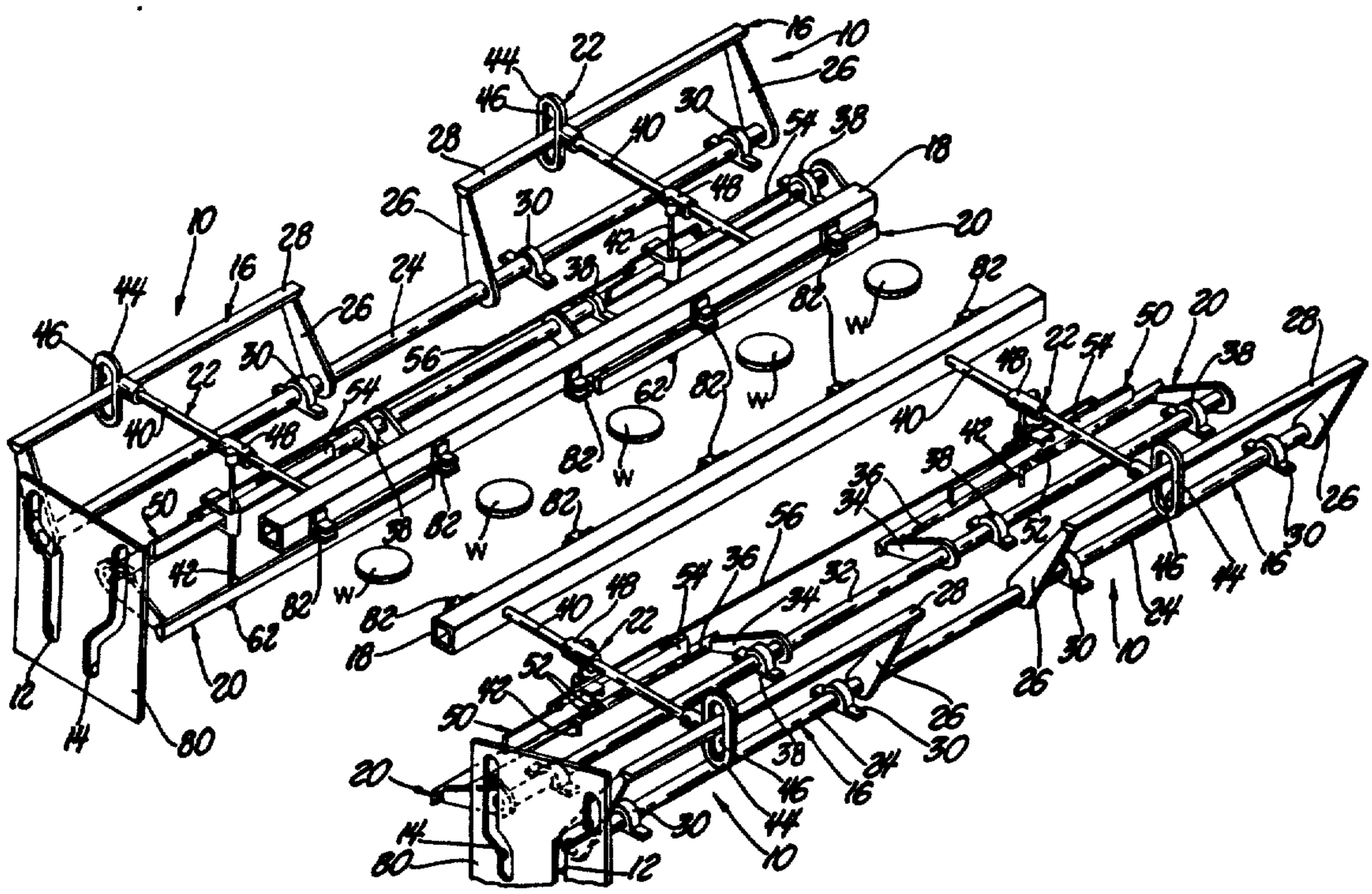
[57] **ABSTRACT**

A workpiece (W) transfer assembly (**10**) is provided for a progressive die type punch press. The assembly (**10**) includes a first crank bar (**28**) driven to oscillate about a first rock shaft (**24**) by the press ram, and a second crank bar (**36**) driven to oscillate about a second rock shaft (**32**) by the press ram. A horizontal linkage (**40**) extends between the first crank bar (**28**) and a workpiece engaging jaw (**18**). A vertical linkage (**42**) extends between the second crank bar (**36**) and the horizontal linkage (**40**). A linear bearing (**48**) interconnects the vertical linkage (**42**) and the horizontal linkage (**40**). A plate (**44**) having a vertically elongated slot (**46**) disposed therein is attached to the horizontal linkage (**40**). The first crank bar (**28**) extends through the slot **[(48)]** (*46*) and thereby imparts motion to the jaw (**18**). The combination of elements allow horizontal jaw (**18**) movement into and out of engagement with the workpieces (W), and lost motion transmission in the vertical direction for raising and lowering the jaw (**18**) relative to the stations.

25 Claims, 3 Drawing Sheets



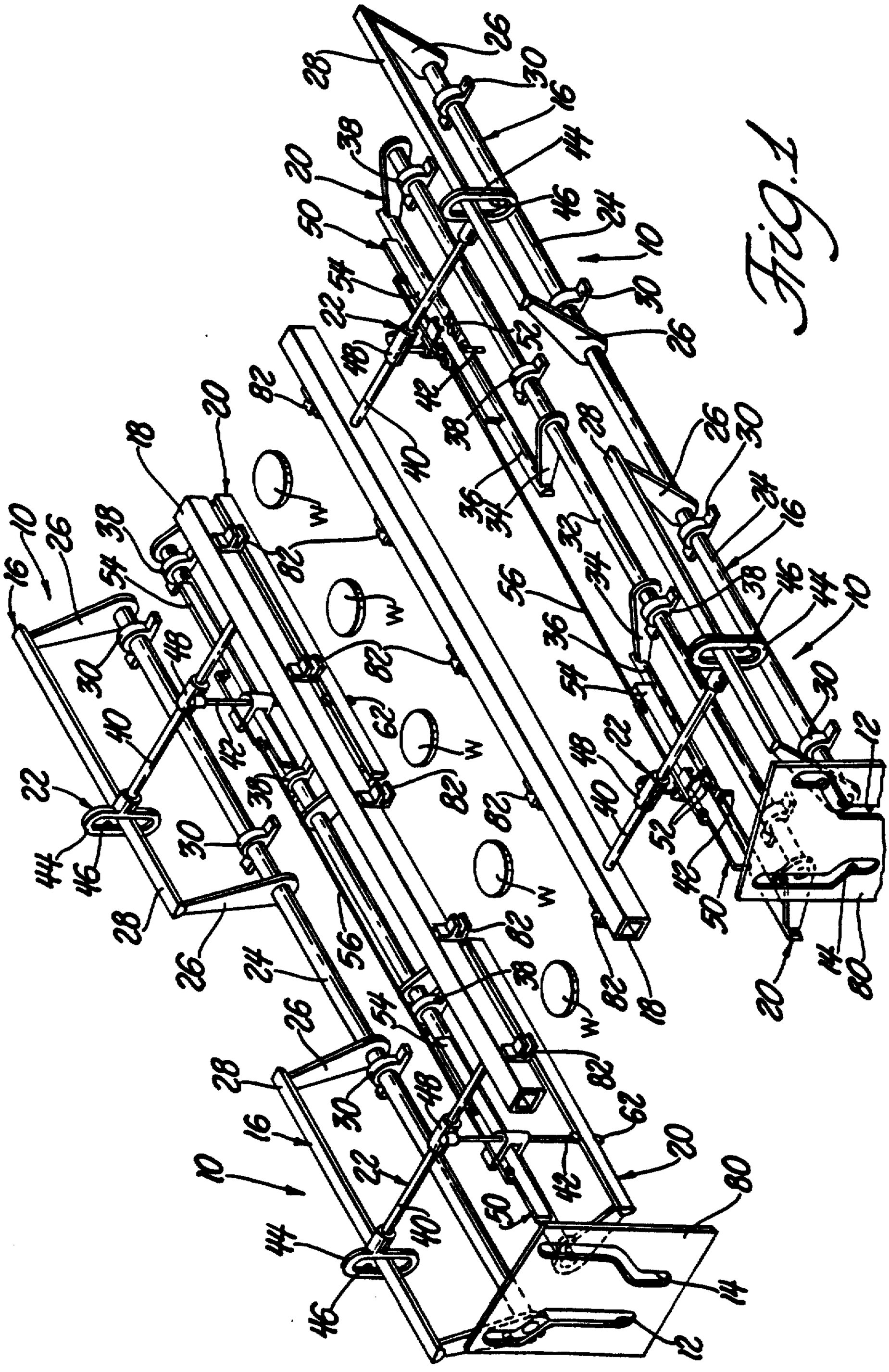


Fig. 1

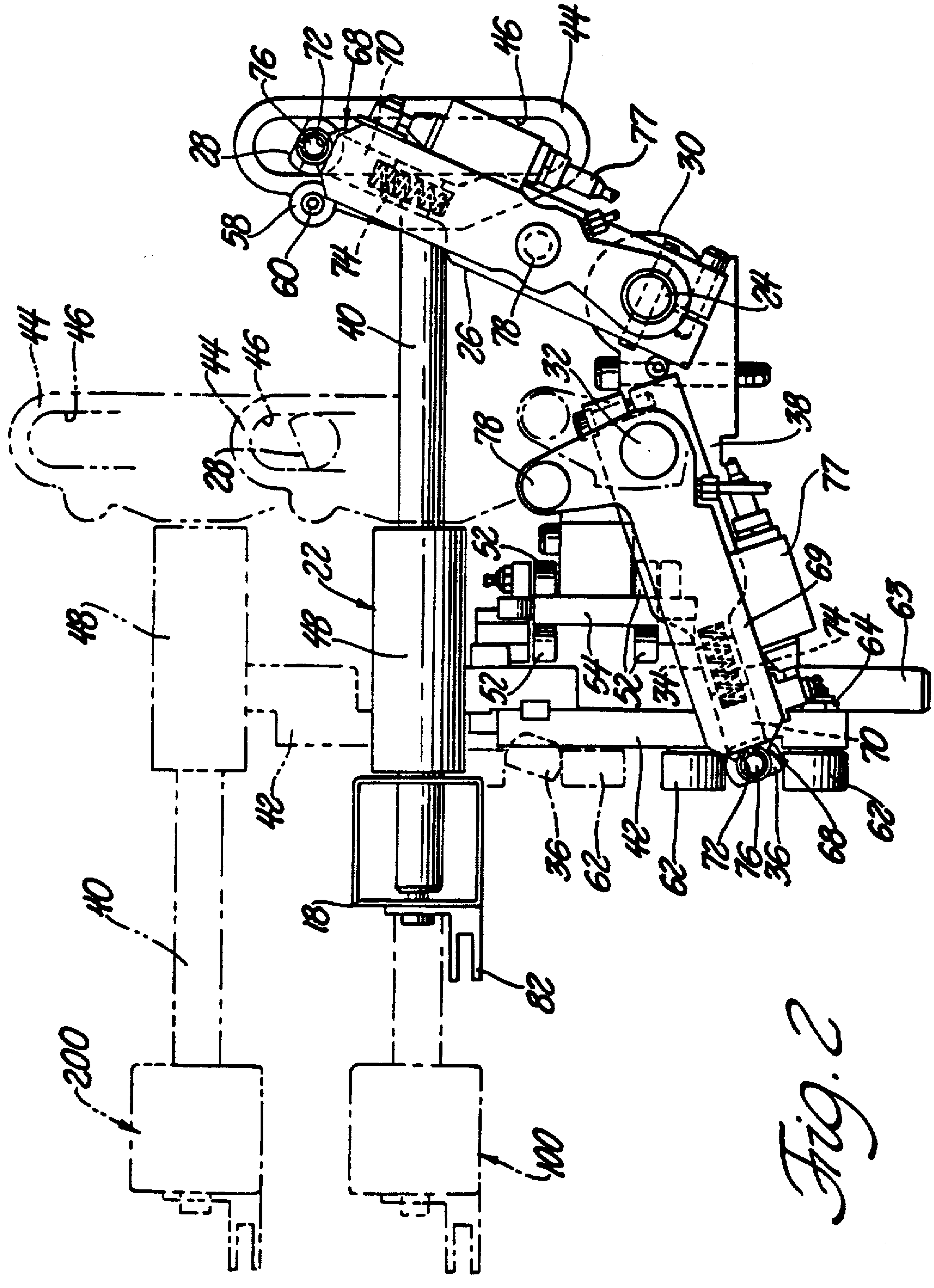


Fig. 2

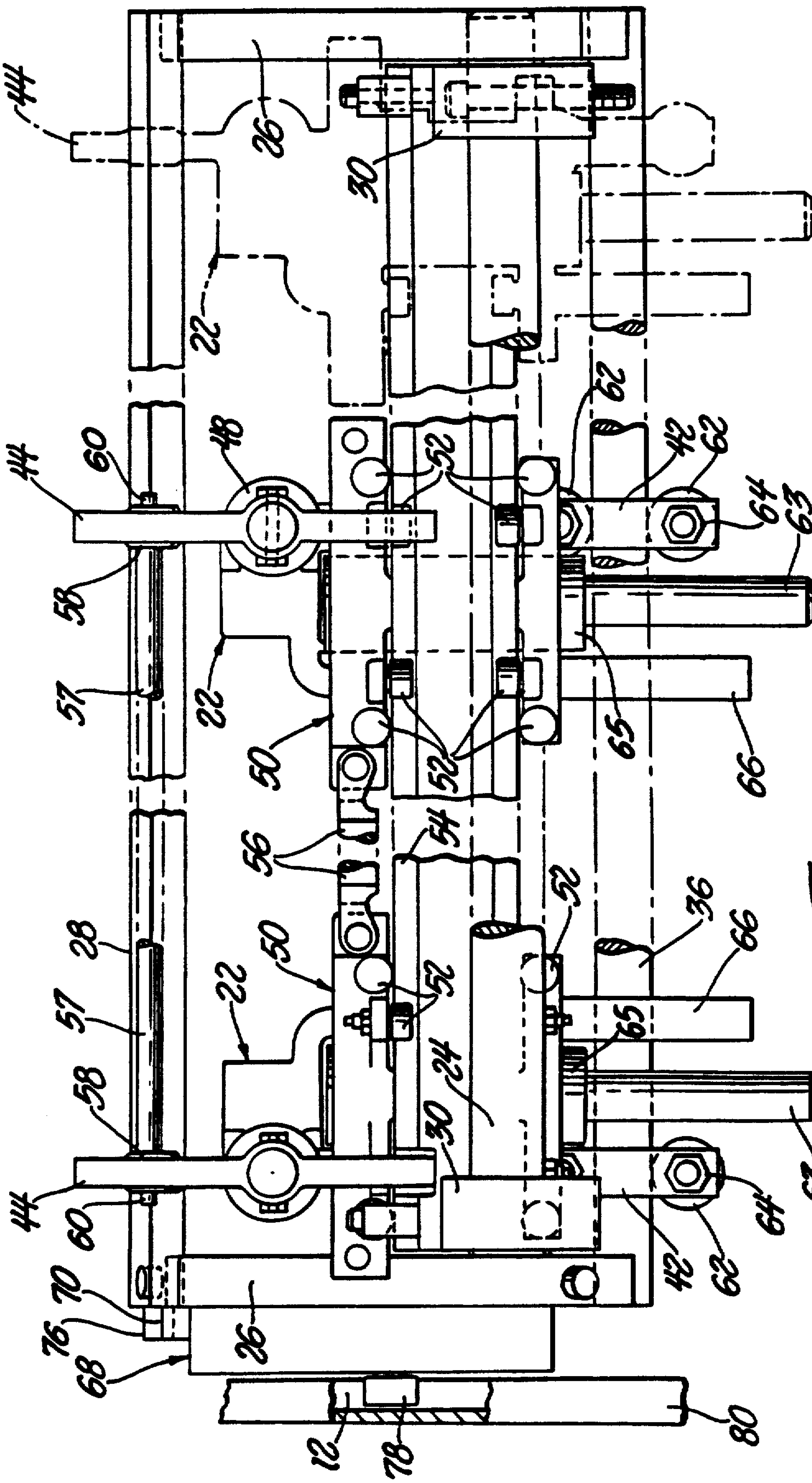

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Fig. 3

PUNCH PRESS TRANSFER MECHANISM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

TECHNICAL FIELD

This invention relates generally to assemblies used to transfer workpieces through a machine having a reciprocating member. More particularly, the invention relates to an assembly which is driven by the ram of a punch press for engaging the workpieces to move them progressively from one die station to another so that a plurality of sequential operations may be performed on them.

BACKGROUND ART

Workpiece transfer assemblies for use in progressive die type punch presses are well known in the art. Examples of these are shown in U.S. Pat. Nos. 3,138,128 granted June 23, 1964, 3,421,637 granted Jan. 14, 1969, 4,198,845 granted Apr. 22, 1980, and 4,513,602 granted Apr. 30, 1985, all in the name of the inventor of the subject invention.

A common problem not effectively eliminated by the prior art technology rises when the workpieces are lifted above the surface of the die before they are moved to the next station, either because of workpiece shape on the nature of the forming operation. In the past, this lift and carry operation was preformed by complex rack and pinion assemblies, as shown in the U.S. Pat. No. 4,436,199 to Baba et al granted Mar. 13, 1984, or by devices that were bolted onto the workpiece engaging jaws, as shown in my U.S. Pat. No. 4,198,845. These prior art lifting devices were clumsy, difficult to maintain, and comparatively expensive to produce.

SUMMARY OF THE INVENTION AND ADVANTAGES

The subject invention provides a workpiece transfer assembly for a press of the type including a reciprocating member and a series of in-line stations wherein each station is a further progression of the workpiece forming process. The transfer assembly comprises a first cam and a second cam for actuation by a reciprocating member, a first cam follower actuated by the first cam for driving a workpiece engaging jaw in a horizontal direction into and out of a workpiece engagement position, and a second cam follower means actuated by the second cam for raising and lowering the jaw in a vertical direction relative to the stations. The transfer assembly is characterized by including a motion transmitting means disposed between the jaw and the first and second cam follower means which provides positive motion transmission to the jaw for horizontal movement into and out of engagement with the workpieces, and provides lost motion transmission in the vertical direction to allow the jaw to be raised and lowered relative to the stations while the first cam follower means remains in the workpiece engagement position.

The subject invention provides a sturdy operating design which is inexpensive to manufacture, readily adaptable to die changes in the press, and easily serviced.

FIGURES IN THE DRAWINGS

Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. **1** is a perspective view of the preferred embodiment of the subject invention;

FIG. **2** is an end view of the subject invention shown with cams removed; and

FIG. **3** is a rear view of the subject invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the figures, wherein like numerals indicate like or corresponding parts throughout the several views, a workpiece transfer assembly is generally shown at **10**. The transfer assembly **10** is specifically adapted for operation with a press of the type including a reciprocating member, i.e., ram, and a series of in-line die stations wherein each station is a further progression of the workpiece forming process. For convenience, a plurality of workpieces W are shown in FIG. **1**.

The assembly **10** comprises a first cam **12** and a second cam **14** for actuation by the reciprocating member. A first cam follower means, generally indicated at **16**, is actuated by the first cam **12** for driving a workpiece engaging jaw **18** in a horizontal direction into and out of a workpiece engagement position (shown in phantom at **100** in FIG. **2**). The second cam follower means, generally indicated at **20**, is actuated by the second cam **14** for raising and lowering the jaw **18** in a vertical direction relative to the stations.

The transfer assembly **10** is characterized by including motion transmitting means, generally indicated at **22**, disposed between the jaw **18** and the first **16** and second **20** cam follower means for providing positive motion transmission to the jaw **18** for horizontal movement into and out of engagement with the workpieces W and for providing lost motion transmission in the vertical direction to allow the jar **18** to be raised and lowered relative to the stations while the first cam follower means **16** remains in the workpiece engagement position.

The first cam follower means **16** comprises a first rock shaft **24**, at least one, and preferably two, rocker arms **26** oscilatory about the first rock shaft **24**, and a first crank bar **28** disposed on the distil end of the rocker arms **26**. The first rock shaft **24** rotates axially in a plurality of fixed bearings **30**. Therefore, as the first cam **12** reciprocates with the ram, the first rock shaft **24** is axially rotated within the bearings **30**, and the first crank bar **28** oscillates in an arcuate path therewith. The first crank bar **28** engages the motion transmitting means **22**, such that oscillation of the first crank bar **28** ultimately moves the jaw **18** horizontally into and out of engagement with the workpieces W, as will be described subsequently.

The second cam follower means **20** comprises a second rock shaft **32**, at least one, and preferably two, rocker arms **34** oscillatory about the second rock shaft **32**, and a second crank bar **36** disposed on the distil end of the rocker arms **34**. The second rock shaft **32** is held [axial] *axially* rotatable within a plurality of strategically placed bearings **38**. As the second cam **14** reciprocates with the ram, the second cam follower means **20** is driven to oscillate about the second rock shaft **32**, so

that the second crank bar **36** also scribes an arcuate path. The second crank bar **36** engages the motion transmitting means **22** such that during the arcuate oscillation of the second crank bar **36**, the jaw **18** is raised and lowered relative to the stations.

The motion transmitting means **22** includes a horizontal linkage **40** extending between the jaw **18** and the first crank bar **28** for transferring horizontal motion to the jaw **18** from the first cam follower means **16**. The horizontal linkage **40** preferrably comprises an elongated tubular member having a constant circular cross section therealong.

The motion transmitting means **22** also includes a vertical linkage **42** which extends between the second crank bar **36** and the horizontal linkage **40**. The vertical linkage **42** transfers vertical motion to the jaw **18** from the second cam follower means **20**. That is to say, as the second crank bar **36** is driven to oscillate, it moves the vertical linkage **42** between raised and lowered positions, which in turn moves the horizontal linkage **40** and ultimately the jaw **18**. Preferably, the vertical linkage **42** comprises an elongated tubular member having a constant circular cross section therealong.

The motion transmitting means **22** includes a plate **44** having a vertically elongated slot **46** disposed therein for transmitting positive horizontal motion in response to force applied horizontally to the slot **46** from the first cam follower means **16**, and for providing lost vertical motion within the slot **46** to the first cam follower means **16** in response to force applied vertically from the second cam follower means **20**. As shown in FIGS. **1** and **2**, the plate **44** is disposed on the outermost end of the horizontal linkage **40**. The first crank bar **28** extends through the slot **46** so that the during oscillation, the first crank bar **28** moves the horizontal linkage **40** in response to force applied on the inside surfaces of the slot **46**, thereby providing positive motion transmission.

In the preferred embodiment, the first rock shaft **24** and the second rock shaft **32** extend in a parallel longitudinal direction relative to the stations. Preferably, the first **24** and second **32** rock shafts are orientated in close proximity to each other, for reasons which will become obvious during later discussion of the first and second cam **12**, **14** embodiments.

The motion transmitting means **22** also includes a bearing means **48** interconnecting the horizontal linkage **40** and vertical linkage **42** for allowing the horizontal linkage **40** to be moved relative to the vertical linkage **42**. More specifically, the bearing means **48** comprises a linear type bearing **48** fixedly disposed on the vertical linkage **42**. The horizontal linkage **40** extends through the bearing **48** for providing guided horizontal motion to the horizontal linkage **40**. As shown in the figures, the bearing means **48** is rigidly positioned on the uppermost end of the vertical linkage **42**, and the tubular horizontal linkage **40** extends through the bearing means **48** for allowing the horizontal linkage **40** to move into and out of the workpiece engagement position relative to the vertical linkage **42**.

A trolley support means, generally indicated at **50**, is included for supporting the motion transmitting means **22** and providing guided linear movement to the motion transmitting means **22** in the longitudinal direction. More specifically, the trolley support means **50** comprises a plurality of roller elements **52** disposed about a fixed guide member **54**. The guide member **54** preferably comprises an elongated rail **54** having a constant rectangular cross section. As perhaps best shown in

FIGS. **2** and **3**, the trolley support means **50** comprises at least four roller elements **52** disposed against each of the wide faces of the rectangular guide member **54**, and at least two roller elements **52** disposed against each of the narrow faces of the rectangular guide member **54**. The roller elements are attached to the trolley support means **50** by threaded fasteners having grease fitting receiving ends for conveniently lubricating the roller elements **52**. In other words, the roller elements **52** are disposed about the guide member **54** in tight abutting engagement, such that, as viewed from FIG. **2**, four roller elements **52** are disposed on each of the wide vertical faces of the guide member **54**, and two roller elements **52** are disposed against each of the narrow horizontal faces of the guide member **54**.

In operation, the trolley support means **50** allow the motion transmitting means **22** and the attached jaw **18** to move longitudinally relative to the stations for indexing the workpieces W to their respective next die stations. Indexing means, not shown, drive the motion transmitting means **22** and attached jaw **18** longitudinally along the trolley support means **50**. The indexing means may comprise any suitable apparatus, such as mechanical, electric servo, pneumatic, or hydraulic indexing mechanisms.

As shown in FIGS. **1** and **3**, it is frequently desirable to interconnect two motion transmitting means **22** on each flank of the press for use in tandem during the workpiece W transfer operation. Therefore, in the preferred embodiment, the transfer assembly **10** includes a coupling means **56** for connecting one of the motion transmitting means **22** to another like motion transmitting means **22**, and for allowing the two to operate in tandem during the workpiece W transferring operation. As perhaps best shown in FIG. **3**, the coupling means **56** attached between the trolley support means **50** of the tandemly operating motion transmitting means **22**. The length of the coupling means **56** is determined by the physical characteristics of the particular punch press machine employed. As will be appreciated, the jaw **18** also serves to interconnect two tandemly operating motion transmitting means **22**. In addition, a bar, or rod-like member **57**, may extend between two tandemly operating motion transmitting means **22**, as shown in FIG. **3**. The rod **57** is fixed to the plates **44**, thus increasing the coupled stability. Mounting surfaces **58** are provided on each of the plates **44** for mounting the connecting rod **57** as previously described. Bolts **60** may be extended through apertures in the mounting surfaces **58** for threading into the ends of the rod **57** and securely holding them in place, as shown in FIG. **2**.

As best shown in FIGS. **2** and **3**, the vertical linkage **42** includes a second crank bar retaining means **62** for transferring vertical movement from the second crank bar **36** to the vertical linkage **42**. More specifically, the second crank bar retaining means **62** comprises at least one roller element **62** disposed on each side of the second crank bar **36** for allowing unrestricted longitudinal movement of the vertical linkage **42** along the second crank bar **36**. Said another way, the roller elements **62** are positioned in tight abutting engagement against opposing surfaces of the second crank bar **36**. The rollers **62** are orientated to roll along the crank bar **36**, however, will transmit movement positively to the vertical linkage **42** in response from oscillation of the second crank bar **36**. The roller elements **62** of the second crank bar retaining means **62** are attached to the lowermost end of the vertical linkage **42** by bolts **64**

extending through the vertical linkage **42**, as shown in FIG. **3**. The bolts **64** include grease fitting receiving ends for allowing convenient lubrication of the rollers **62**. In this manner, the rollers **62** can also be easily removed for service.

In the preferred embodiment, best illustrated in FIG. **3**, the vertical linkage **42** includes a tubular vertical guide shaft **63** attached adjacent thereto and moveable therewith. The vertical guide shaft **63** extends through a vertically oriented linear guide bearing **65**. The guide bearing **65** is affixed to the trolley support means **50**, and provides guided vertical motion to the motion transmitting means **22** via the vertical guide shaft **63**.

As perhaps best shown in FIG. **2**, the first **28** and second **36** crank bars are arcuate in cross section over at least the portions thereof contacting the motion transmitting means **22**. That is to say, the first crank bar **36** has a constant cross section along the length thereof, with at least a portion of that cross section being circular. Therefore, as the first crank bar **28** forces the slot **46** into and out of the workpiece engagement position, the arcuate surface of the first crank bar **28** rolls, or slides, against the inner surface of the slot **46**. Thus, the first crank bar **28** smoothly moves the horizontal linkage **40** back and forth. Likewise, the second crank bar **36** has a constant cross section along the length thereof, with at least a portion of that cross section being circular. The rollers **62** of the second crank bar retaining means **62** engage the second crank bar **36** at the arcuate cross sectional portions. Accordingly, as the second crank bar **36** is oscillated by the press ram, the second crank bar retaining means rollers **62** smoothly slide across the arcuate surfaces or the second crank bar **36**. As will be appreciated, the first **28** and second **36** crank bars may have fully circular cross sections along the lengths thereof, and the partial circular cross sections serve only to reduce material costs and weight.

The transfer assembly **10** includes assist means **66** for providing pressurized air to aid in overcoming a portion of the force required to move the motion transmitting means **22** vertically. More specifically, the assist means **66** comprises a vertically orientated pneumatic piston acting against the weight of the motion transmitting means **22**, for overcoming, or counter balancing, a significant portion of the force required by the ram when driving the second cam follower means **20** to raise the motion transmitting means **22**. In FIG. **3**, the pneumatic assist means **66** are shown adjacent the vertical guide shafts **63**, extending parallel thereof, for acting upwardly against the motion transmitting means **22**. Pneumatic assist means **66** are well known to those skilled in the art, therefore a complete description of such will not be presently addressed.

The first **16** and second **20** cam follower means include safety clutch means, generally indicated at **68**, for disengaging the motion transmitting means **22** from actuation in response to a predetermined level of resistance encountered by the jaw **18**. The safety clutch means **68** are disposed adjacent at least one rocker arm **26, 34** of each the first **16** and second **20** cam follower means. The safety clutch means **68** include a driving arm **69** coextending adjacent the respective rocker arms **26, 34**. A slide member **70** is slideably disposed in each driving arm **69**. The slide member **70** has an arcuate seat portion **72** spring biased into engagement with the rocker arms **26, 34**. More specifically, a spring **74** disposed in the driving arm **69** urges each slide member **70** against a pin **76** extending outwardly from each of the rocker arms **26, 34**.

If a workpiece W jam or obstruction is encountered during the transfer cycle, the jaw **18** will be prohibited from following through its predetermined motion. When this occurs, the safety clutch means **68** will disengage the first **12** and second **14** cams from the first **16** and second **20** cam follower means. More specifically, the driving arms **69** are driven to oscillate about the first **24** and second **32** rock shafts, which in turn drive the first **26** and second **34** rocker arms via the connection between the arcuate seat portion **72** of the slide member **70** and the pin **76** of the rocker arms **26, 34**. When an obstruction is encountered, the pins **76** extending from the rocker arms **26, 34** with roll out of the arcuate seat portions **72**. At this, the driving arms **69** continue to oscillate as they are driven by the cams **12, 14**, however, the first **16** and/or second **20** cam follower means remain stationary. For a more complete description of the specific elements and operation of the safety clutch means **68**, reference may be made to prior art U.S. Pat. Nos. 4,198,845 and 4,513,602.

As shown in FIG. **2**, a limit switch **77** is attached to each safety clutch means **68** adjacent the slide member **70** for signaling when a pin **76** extending from a rocker arm **26, 34** has rolled out of the arcuate seat portion **72** of a slide member **70**, i.e., during workpiece jam or obstruction conditions.

The driving arms **69** adjacent the first **26** and second **34** rocker arms each include a cam engaging element **78** disposed thereon for tracing the predetermined motion imparted by the first **12** and second **14** cams. The cam engaging elements **78** preferably embody a pin, roller. In this manner, the cams **12, 14** drive each of the safety clutch means **68**, which in turn drive each of their respective first **16** and second **20** cam following means.

The first **12** and second **14** cams are of the linear plate type, having a curvilinear slot disposed in each, for reciprocation in a planar path. Therefore, the cam engaging elements **78** are disposed in the curvilinear slots of the first **12** and second **14** cams so that during reciprocation by the press ram, the cam engaging elements **78** are displaced within the curvilinear slots thereby ultimately driving the first **16** and second **20** cam follower means in an oscillatory motion about their respective rock shafts **24, 32**. In the preferred embodiment, both of the curvilinear slots of the first **12** and second **14** cams are disposed within an integral carrier plate **80**. The carrier plate **80** is attached adjacent the press reciprocating member, or ram. As described previously, the close proximity of the parallel extending rock shafts **24, 32** facilitate the use of an integral carrier plate **80** housing both the first **12** and second **14** cams, thus allowing the cams **12, 14** to comprise a compact configuration. In FIG. **1**, the curvilinear slots of the first **12** and second **14** cams are shown extending completely through the carrier plate **80** merely for convenience. In practice, however, it is found safest to only partially extend the curvilinear slots **12, 14** into the carrier plate **80**, as shown in partial cross section in FIG. **3**.

OPERATION OF THE PREFERRED EMBODIMENT

In practice, it is found most desirable to provide the transfer assemblies **10** on each flank of the press, so that the workpieces W are engaged from both sides. As shown in FIG. **1**, opposing sets of transfer assemblies **10** flank each side of the workpieces W. To those skilled in

the art, it will be appreciated that the opposing sets of transfer assemblies **10** are generally **[**minor**]** *mirror* images of each other.

Turning now to FIG. **2**, when the press ram is in the fully closed position, i.e., engaging the workpieces W in the die stations, the transfer assembly **10** is in the position shown in solid lines. As the ram begins its ascent, away from the workpieces W, the curvilinear slot in the first cam **12** urges the cam engaging elements **78** on the first cam follower means **16** to rotate about the first rock shaft **24**, thus moving the horizontal linkage **40** with the attached jaw **18** into, or toward, the workpieces W. The jaw **18** moves toward a workpiece engagement position, shown in phantom at **100**. A plurality of fingers **82**, each corresponding to a workpiece in a die station, are mounted on the jaw **18** and engage the workpieces W when in the workpiece engagement position **100**.

Before the press ram reaches the top of its ascent, and after the first cam follower means **16** has moved the jaw **18** into the workpiece engagement position **100**, the curvilinear slot in the second cam **14** urges the second cam follower means **20** to rotate about the second rock shaft **32**, thus driving the motion transmitting means **22** and the attached jaw **18** above the surface of the dies, as shown in phantom at **200**. It will be appreciated that during the workpiece W lifting operation, the lost motion provided in the slot **46** is imparted to the first cam follower means **16** while it means in the workpiece engagement position. At the workpiece lifted position **200**, the indexing means moves the motion transmitting means **22** along with the jaw **18** and the workpieces W, longitudinally along the dies a predetermined distance. The predetermined distance, of course, being equal to the distance between die stations.

During the indexing operation, the press ram has reached its maximum height, and has just begun its descent. As the ram descends, the cam engaging element **78** of the second cam follower means **20** begins to retrace the curvilinear slot in the second cam **14**, thereby urging the motion transmitting means **22** to lower the workpieces W into their new die stations. At this, the transfer assembly **10** returns to the workpiece engagement position **100**, and places the workpieces W into their new die stations. The first cam **12** then urges the jaw **18** to retract from the workpiece engagement position **100**, thus returning the transfer assembly **10** to the solid line position shown in FIG. **2**. At this, the press ram has almost closed down upon the workpieces W in their new die stations. The indexing means next retract the motion transmitting means **22** back to the starting position so that the fingers **82** on the jaw **18** will be in the corresponding position of their original die stations. Thus, one complete cycle of the transfer assembly **10** has been described. It will be understood, that each complete transfer cycle is performed with every full cycle of the press ram.

The invention has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, wherein reference numerals are merely for convenience and are not to be in any way limiting, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A workpiece transfer assembly **(10)** for a press of the type including a reciprocating member and a series of *longitudinally spaced* in-line stations wherein each station is a further progression of the workpiece (W) forming process, said assembly **(10)** comprising: a first cam **(12)** and a second cam **(14)** for actuation by the reciprocating member; a first cam follower means **(16)** actuated by said first cam **(12)** for driving a workpiece engaging jaw **(18)** in a horizontal direction laterally of the stations into and out of a workpiece engagement position; a second cam follower means **(20)** actuated by said second cam **(14)** for raising and lowering said jaw **(18)** in a vertical direction relative to the stations; **[**said assembly **(10)** characterized by including**]** *said first cam follower means (16) including a first rock shaft (24), a pair of first rocker arms (26) longitudinally spaced from each other and each oscillatory about said first rock shaft (24), and a first crank bar (28) extending longitudinally parallel to said first rock shaft (24) and carried by said pair of first rocker arms (26); said second cam follower means (20) including a second rock shaft (32), a pair of second rocker arms (34) longitudinally spaced from each other and each oscillatory about said second rock shaft (32), and a second crank bar (36) extending longitudinally and parallel to said second rock shaft (32) and carried by said pair of second rocker arms (34); and* motion transmitting means **(22)** disposed between said jaw **(18)** and said first **(16)** and second **(20)** cam follower means *and operatively interconnecting said first and second crank bars (28, 36)* for providing positive motion transmission to said jaw **(18)** for horizontal movement into and out of engagement with the workpieces (W) and for providing lost motion transmission in the vertical direction to allow said jaw **(18)** to be raised and lowered relative to the stations while said first cam follower means **(16)** remains in the workpiece engagement position.

2. An assembly **(10)** as set forth in claim **1** characterized by said motion transmitting means **(22)** including a plate **(44)** having a vertically elongated slot **(46)** disposed therein for transmitting positive horizontal motion in response to force applied horizontally to said slot **(46)** from said first cam **(12)** follower means **(16)** and providing lost vertical motion within said slot **(46)** to said first cam follower means **(16)** in response to force applied vertically from said second cam follower means **(20)**.

[3. An assembly **(10)** as set forth in claim **2** further characterized by said first cam follower means **(16)** comprising: a first rock shaft **(24)**, at least one rocker arm **(26)** oscillatory about said first rock shaft **(24)**, and a first crank bar **(28)** disposed on the distil end of said rocker arm **(26)** in engagement with said motion transmitting means **(22)**.**]**

[4. An assembly **(10)** as set forth in claim **3** further characterized by said second cam follower means **(20)** comprising: a second rock shaft **(32)**, at least one rocker arm **(34)** oscillatory about said second rock shaft **(32)**, and a second crank bar **(36)** disposed on the distil end of said rocker arm **(34)** for engaging said motion transmitting means **(22)**.**]**

5. An assembly **(10)** as set forth in claim **[4]** *2* further characterized by said first rock shaft **(24)** and said second rock shaft **(32)** extending in a parallel longitudinal direction relative to the stations.

6. An assembly **(10)** as set forth in claim **5** further characterized by said motion transmitting means **(22)** including a horizontal linkage **(40)** extending between said jaw **(18)** and said first crank bar **(28)** for transferring

horizontal motion to said jaw (18) from said first cam follower means (16).

7. An assembly (10) as set forth in claim 6 further characterized by said motion transmitting means (22) including a vertical linkage (42) extending between said second crank bar (36) and said horizontal linkage (40) for transferring vertical motion to said jaw (18) from said second cam follower means (20).

8. An assembly (10) as set forth in claim 7 further characterized by said motion transmitting means (22) including a bearing means (48) interconnecting said horizontal linkage (40) and said vertical linkage (42) for allowing said horizontal linkage (40) to be moved relative to said vertical linkage (42).

9. An assembly (10) as set forth in claim 8 further characterized by said bearing means (48) comprising a linear type bearing (48) fixedly disposed on said vertical linkage (42) with said horizontal linkage (40) extending therethrough for providing unrestricted horizontal motion to said horizontal linkage (40).

10. An assembly (10) as set forth in claim 8 further characterized by including trolley support means (50) for supporting said motion transmitting means (22) and allowing unrestricted linear movement of said motion transmitting means (22) in the longitudinal direction.

11. An assembly (10) as set forth in claim 10 further characterized by said trolley support means (50) comprising a plurality of roller elements (52) disposed about a fixed guide member (54).

12. An assembly (10) as set forth in claim 11 further characterized by said guide member (54) comprising an elongated rail (54) having a constant rectangular cross section.

13. An assembly (10) as set forth in claim 12 further characterized by said trolley support means roller elements (52) comprising at least four of said roller elements (52) disposed against each of the wide faces of said rectangular guide member (54) and at least two of said roller elements (52) disposed against each of the narrow faces of said rectangular guide member (54).

14. An assembly (10) as set forth in claim 10 further characterized by including coupling means (56) for connecting one of said motion transmitting means (22) to another like motion transmitting means (22) and for allowing the two to operate in tandem during the workpiece (W) transferring operation.

15. An assembly (10) as set forth in claim 12 further characterized by said vertical linkage (42) including a second crank bar retaining means (62) for transferring vertical movement from said second crank bar (36) to said vertical linkage (42).

16. An assembly (10) as set forth in claim 15 further characterized by said second crank bar retaining means (62) comprising at least one roller element (62) disposed on each side of said second crank bar (36) for allowing unrestricted longitudinal movement of said vertical linkage (42) along said second crank bar (36).

17. An assembly (10) as set forth in claim 16 further characterized by said first (28) and second (36) crank bars being arcuate in cross-section over at least the portions thereof contacting said motion transmitting means (22).

18. An assembly (10) as set forth in claim 17 further characterized by said assembly (10) including assist means (66) for providing pressurized air to aid in overcoming a portion of the force required to move said motion transmitting means (22) vertically.

19. An assembly (10) as set forth in claim 15 further characterized by said first (16) and said second (20) cam follower means including safety clutch means (68) for disengaging said motion transmitting means (22) from actuation in response to a predetermined level of resistance encountered by said jaw (18).

20. An assembly (10) as set forth in claim 19 further characterized by said safety clutch means (68) comprising a driving arm (69) coextending adjacent each of said rocker arms (26, 34) including a slide member (70) having a seat portion (72) spring biased into engagement with said rocker arms (26, 34) disposed in said driving arms (69).

21. An assembly (10) as set forth in claim 20 further characterized by said driving arms (69) adjacent said first (26) and second (34) rocker arms each including a cam engaging element (78) disposed thereon for tracing the predetermined motion impaired by said first (12) and second (14) cams.

22. An assembly (10) as set forth in claim 21 further characterized by said first (12) and second (14) cams being of the linear plate type having a curvilinear slot (12, 14) disposed in each for reciprocation in a planar path.

23. An assembly (10) as set forth in claim 22 further characterized by both of said curvilinear slots (12, 14) of said first (12) and second (14) cams being disposed within an integral carrier plate (80).

24. An assembly (10) as set forth in claim 23 further characterized by said carrier plate (80) being attached adjacent the press reciprocating member.

25. A workpiece transfer assembly (10) for a press of the type including a reciprocating member and a series of in-line stations wherein each station is a further progression of the workpiece (W) forming process, said assembly (10) comprising: a first cam (12) of the linear plate type and a second cam (14) of the linear plate type for actuation by the reciprocating member; a first crank bar (28) driven to oscillate about a first rock shaft (24) by said first cam (12) for driving a workpiece engaging jaw (18) in a horizontal direction into and out of a workpiece (W) engagement position; a second crank bar (36) driven to oscillate about a second rock shaft (32) by said second cam (14) for raising and lowering said jaw (18) in a vertical direction relative to the stations, said first (24) and second (32) rock shafts extending in a parallel longitudinal direction relative to the stations; a horizontal linkage (40) extending between said first crank bar (28) and said jaw (18); a vertical linkage (42) extending between said second crank bar (36) and said horizontal linkage (40) including a linear bearing (48) interconnecting said vertical linkage (42) and said horizontal linkage (40); said assembly (10) characterized by said horizontal linkage (40) including a plate (44) disposed thereon having a vertically elongated slot (46) disposed therein through which said first crank bar (28) extends.

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