

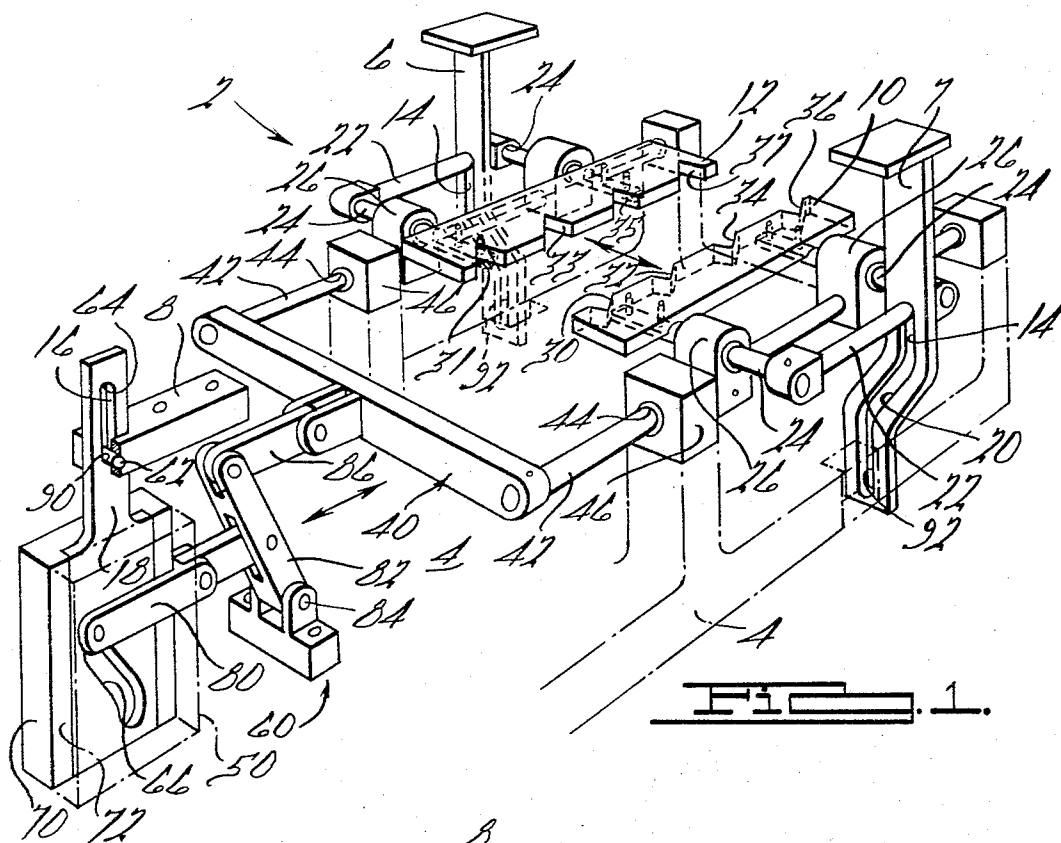
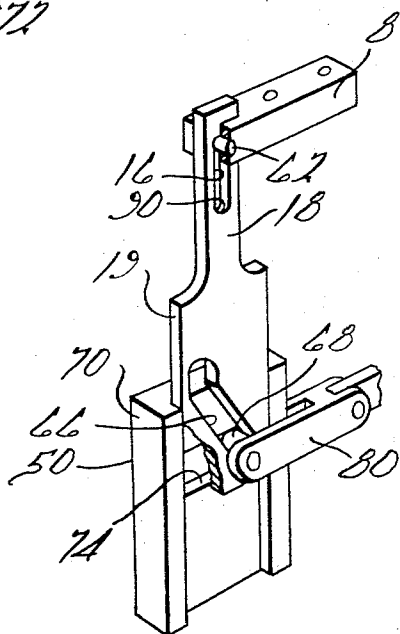
Jan. 14, 1969

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3,421,637

TRANSFER DEVICE

Filed Nov. 30, 1966



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3,421,637

TRANSFER DEVICE

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Filed Nov. 30, 1966, Ser. No. 598,081

U.S. Cl. 214—1
Int. Cl. B25j

3 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure is concerned with a transfer device for use with punch presses and the device is used basically for the purpose of moving workpieces in a continuous manner through the punch press. The transfer device carries out this function by a series of arms and levers primarily associated with the upper movable part of the punch press such that when the punch press is raised and lowered the transfer device operates in a repetitive and reciprocal manner to move the workpieces through the punch press for the various operations performed within the press.

The structure of the transfer device involved is especially adapted for relatively high speed punch press operation. The reason for this is that a special reciprocating slide mechanism is used as part of a lever system to move the carriage of the transfer device, and this enables the device to perform especially well at high speeds without allowing vibrations, slippage, etc., and hence avoids irregular or improper movement of the workpieces by the transfer device.

Background of the invention

This invention broadly relates to a transfer device or mechanism for use within a press or other machine. More particularly, the invention relates to a device or mechanism which is actuated automatically by the ram of a press to grip workpieces and thereby move them progressively through a few or a plurality of operations to be performed thereon.

In the past, transfer devices or mechanisms for use in moving workpieces through punch presses have been known, for example, see U.S. Patents Nos. 3,155,241 and 3,138,128. In U.S. Patent No. 3,138,128 a work transfer device is shown wherein during the initial upward movement of the ram two jaws are cammed into locking position against the workpieces, then during subsequent upward movement of the ram there is caused a forward movement of the locked jaws to advance the workpieces one position in the pressing operation taking place. Then during downward movement of the ram as shown in Patent No. 3,138,128 the jaws are first cammed back out of engagement with the workpieces, and then moved in a backward position to a point where the jaws are again in a placement necessary to initiate forward movement of the workpieces, during all of which downward movement of the ram there is a simultaneous punching operation being carried out on the released and stationary workpieces within the press. For certain nominal or relatively slow operating punch speeds, the device as shown in Patent No. 3,138,128 is of course adequate and satisfactory to those skilled in the art, and devices of this known type are clearly useful and very advantageous. However, there has been a definite drawback to the device shown in Patent No. 3,138,128 in that when relatively high speeds of operation are desired to be used with the punch press it has been found that the bell and crank mechanism used therein for forward and backward move-

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ment of the jaws is not satisfactory for the reason that the bell and crank and its associated actuating bar which allows a dwell period prior to forward movement of the locked jaws, all operate in such a manner as to be detrimental to relatively high speed operation of the punch press. The basis for this detriment to high speed operation has been that the entire work transfer device or mechanism was profoundly subjected to vibrations both of a vertical and horizontal nature. In addition there was a lack of positive control of the prior art device during high speed operation and the effect of the lack of positive control as well as the presence of severe vibrations caused the workpieces to be placed irregularly, to be subjected to improper movements, and in general a disarray was caused during high speed operation which was clearly disadvantageous. In view of all the above, there has been a long-felt need in the art for a transfer device which could be used at relatively high speeds of operation and this need has gone unfilled.

Accordingly, it is a primary object of the present invention to provide an improved transfer device for workpieces and the like, which device is capable of being used at relatively high speeds of operation.

Another object of the present invention is to provide an improved workpiece transfer device of relatively simple and economical construction, which device is operable by the ram of a press to progressively transfer the workpieces through various work stations within the press.

Another object of the invention is to provide an improved transfer device which utilizes a unique slide mechanism as part of a lever system for moving a carriage of the transfer device through the forward and backward movement taken thereby.

Another object of the present invention is to provide a transfer device including a carriage which moves forward and backward to progressively transfer workpieces through a punch press operation and also including movable jaws which hold the workpieces during the movement, wherein the improvement comprises moving the carriage through its backward and forward movement due to the use of a slide mechanism which prevents vibrations of either vertical or horizontal orientation, as well as allowing a unique positive control of the carriage during its forward and backward movement.

Other objects, features and advantages of the present invention will become apparent from the subsequent description and the appended claims, taken in conjunction with the accompanying drawings.

Brief description of the drawings

FIGURE 1 shows the transfer by way of a preferred embodiment in accordance with the invention; and

FIGURE 2 shows a plan view of the slide mechanism used for moving the carriage of the transfer device, said slide mechanism being shown in its fully up position.

Summary of the invention

From an apparatus aspect, the present invention comprises a transfer device for use with a punch press or like machine and including a carriage which moves both backward and forward, as well as reciprocating gripping jaws which move both inward and outward, with the function of the movable carriage and jaws being to progressively take hold of certain workpieces which are being operated upon within the press or machine, and take these workpieces in a progressive movement through the pressing or machining operation in a predetermined, predictable manner, even though the press or machine be one which operates at relatively high speeds. The transfer device is espe-

cially enabled to operate in this fashion due to the use of a heretofore unknown structural relationship between the carriage of the transfer device and a unique slide mechanism actuated by an arm connected to the movable ram or upper movable section of the press or machine. The structural relationship between the carriage and the slide mechanism in combination is such that quite unexpectedly vibrations of both a vertical and horizontal nature are done away with as well as the fact that the relationship provides for heretofore unknown controlled positive governing of the movement of the carriage and the gripping jaws throughout the transferring of the workpieces.

Description of the preferred embodiment

FIGURE 1 shows a transfer device generally designated 2 attached to a base 4 shown in phantom by any suitable means such as nuts and bolts, welding, or the like. The base 4 may suitably be provided with bolt apertures or other attaching means not shown, for supporting a plurality of dies, it being understood that the work transfer device 2 is for use in a machine such as a punch press wherein the transfer device is uniquely adapted for moving the workpieces through the pressing operation taking place within the punch press, for example, see a typical illustration of the mounting of a transfer device in a punch press as shown in U.S. Patent No. 3,155,241 already referred to above and generally known in the art.

The operation of the transfer device 2, as shown in FIGURE 1, is as follows. The arms 6, 7 and 8 of the transfer device 2 are attached by suitable means to the movable ram portion of the punch press, not shown. As shown the arms 6, 7 and 8 are in a fully down position which means that the punching operation has just been completed. As the movable ram of the punch press is withdrawn in an upward direction, the arms 6, 7 and 8 which are attached thereto are also moved in an upward direction. The initial upward movement of the arms causes no movement of the jaws 10 and 12 due to the movement of the arms through the dwell regions 14 thereon and the lost motion slot connection or dwell region 16 on the bar 18 connected to arm 8. Once the dwell regions 14 on arms 6 and 7 have been traversed the first movement of the transfer action begins and this is caused by contact of the camming surfaces 20 on arms 6 and 7 meeting with the cam followers 22 to thereby force the cam followers 22 in an upward direction toward the center of the transfer device, which in turn causes the slidable bars 24 to move inwardly through the blocks 26, and this in turn causes the jaws 10 and 12 which are attached to the rods 24 by any suitable means to also be moved in an inward direction and thereby make initial clamping action with the workpieces within the punch press.

Note that the jaws 10 and 12 have respective gripping portions thereon respectively designated 30, 32, 34, 36 and 31, 33, 35, 37. For example, gripping portions 30 and 31 would suitably make gripping contact with a new workpiece being introduced to the punch press whereas gripping portions, 32-33, 34-35, and 36-37 would each by gripping one workpiece and moving it progressively to the next operation within the punch press.

To carry out this action of moving the workpieces forward to the next step of the operation within the press, a forward movement of this type is caused by movement of the carriage 40 in a direction to the right as shown in the drawing. Carriage 40 is slidably moved to the right by sliding bars 42 through the openings 44 within the blocks 46; and the bar 22 through the openings designated 14-20-92 of the arms 6 and 7.

The carriage movement is in a forward direction, that is, to the right, is a delayed action due to the lost motion connection at dwell region 16 which takes place after the camming portions 20 on arms 6 and 7 have caused gripping engagement between the jaws and workpieces. This delayed movement of the carriage 40 to the right is effected by proper choice of the dwell portion 16 within the bar 18

constituting parts of the slide mechanism 50. In other words, the dwell portion 16 is selected such that movement of the carriage to the right does not take place portions, 32-33, 34-35, and 36-37 would each be gripping contact with the workpieces to be moved through the punch press and once this gripping contact has taken place then the carriage begins its movement to the right to advance the workpieces to their next respective stations within the punching or pressing operation.

A lever means generally designated 60 is used to effect forward, or backward, movement of the carriage 40 through the transferring action carried out by the device 2. Initial forward movement of the carriage, takes place at approximately the time the camming portions 20 on arms 6 and 7 have been transversed due to upward movement of the arms 6 and 7, concurrent with upward movement of the movable ram of the press. Upon the cam portions 20 being transversed, there is an almost simultaneous actuating of the bar 18 when the pin 62 contacts the upper end 64 within the dwell portion 16 of the bar 18. This contact by the pin 62 in connection with the arm 8 attached to the upward moving ram causes the bar 18 to begin its upward movement which in turn causes the upward movement of the cam portion 66 on a lower segment or portion 19 of the bar 18.

Cam portion 66 is a part of the slide mechanism 50 and by upward movement it makes contact with the cam follower 68 shown more clearly in FIGURE 2.

FIGURE 2 shows that when the cam portion 66 is moved upwardly, the cam follower 68 is forced to the right thereby moving the carriage 40 in a forward direction to transfer the workpieces to the right through the punch press, and this occurs during the terminal part of the ram upstroke, at which time arms 6 and 7 are traversing the dwell regions 92 and the bars 22 are sliding therethrough.

The slide mechanism 50 is unique in that it comprises mounting means or blocks 70 and 72 attached together in any suitable manner to form a slide structure for the movable slide follower segment 19 of the bar 18. Cam follower or roller 68 is mounted for back and forth lateral movement within the channel or opening 74 which may suitably be formed as a cutaway within the block 70. Since cam follower 68 is only able to traverse the lateral cutout 74 within the block 70 it is seen that the H-shaped arm 80 connected to the follower 68 cannot move in an upward and downward direction but only in a lateral direction. Movement of the H-shaped arm 80 to the right in turn causes the pivotally mounted lever 82 to rotate in a clockwise direction about the pivot pin 84. This in turn causes the lever arm 82 to move the connector arm 86 in a forward movement to the right and the carriage which is connected to the arm 86 is hence moved forward or to the right.

When the upward movement of the arms 6, 7 and 8 is completed, movement of the carriage to the right is ended since the cam follower 68 is at this time at the lower end of the camming portion 66. At this point the workpieces have been advanced to their next respective stations within the press and downward movement of the ram is initiated.

The first result of downward movement of the ram is that cam followers 22 are contacted by camming portions 20 of the bars 6 and 7 and this acts to withdraw the jaws 10 and 12 from gripping contact with the workpieces well before the workpieces are contacted by the rapidly downward moving press. At the same time once the gripping jaws 10 and 12 have been released, there is shortly thereafter initiated the backward movement of the carriage 40 and this is caused by contact of the pin 62 with the lower end 90 of the dwell portion 16 on the bar 18. This contact with the portion 90 on the bar 18 is made by the pin 62 held within the arm 8 and the effect of the contact is to initiate downward movement of the bar 18 and hence cause the camming portion 66 to force downwardly on the cam follower 68 and move it in a backward direction or to the left, as shown in the drawings. During con-

tinued downward movement of the movable ram the gripping jaws are withdrawn to a fully outward position due to the traversal of the camming portion 20 and then further outward movement of the jaws is stopped by passage through the dwell portions 14 on the arms 6 and 7, while at the same time the backward movement of the carriage to a full left position is caused by downward movement of the camming portion 66 to cause the cam follower 68 to move fully to the left. Simultaneously with the release of the workpieces by the jaws and leftward movement of the carriage, the punching operation of the press is carried out on the workpieces.

After the workpieces have been punched within the press, the carriage is at full left position, and then the cycle of moving the workpieces forward for a subsequent operation is initiated all over again by upward movement of the ram and the operation is repeated as above described to move the workpieces progressively through the punch press preparatory to carrying out the next pressing operation thereon.

A punch press or similar machine constructed and operated as above described using the apparatus of this invention is uniquely adapted for high speed operation of the press. The advantages to be obtained from high speed operation should of course be fairly apparent and it is perhaps an oversimplification to state that high speed operation from an economical and cost standpoint remarkably increases the profits and overall efficiency of a manufacturing operation which utilizes a punch press in accordance with this invention. The reason that relatively high speeds of operation are enabled by the apparatus as described above, finds its basis in the discovery that the slide mechanism as used herein unexpectedly gives complete positive control of all the actuating parts of the transfer device at all times; and particularly this is true with respect to the movement of the arms 6, 7 and 8 near the ends of their stroke in an upward and downward direction. By this it is meant that when the arms reach the end of their stroke in either an upward or downward direction, extremely high inertial forces are caused due to the weight of the ram and the fact that it is being utilized at high speeds. In prior art transfer devices this high speed movement of the rams and especially at the end of the ram strokes, has heretofore always been found to cause markedly high and unacceptable vibrations in past transfer devices. For example, in U.S. Patent No. 3,138,128 when the forward movement of the carriage is initiated by contact of the upward moving arm with the connector portion of the bell crank, the effect is to cause an initial slapping of the bell crank into an upward position which in turn starts the bell crank vibrating to a high degree and this causes a vertical bumping or vibrating of the connector and the associated arm attached to the upward moving ram. This in turn causes a highly unacceptable vibrating of the entire carriage mechanism to thereby result in displacement of the workpieces and disarrangement in general. However, in the transfer device of this invention, there is a unique structural relationship between the carriage mechanism and the slide mechanism such that the transfer device described herein has a forward and backward drive mechanism which exerts complete positive control over the drive of the carriage during all portions of the upward and downward movement of the ram. As a result of this unique and complete positive control over the movement of the carriage mechanism and also the gripping jaws, the transfer device described herein has been found uniquely suitable for high speed press operations, whereas prior art transfer devices while suitable for relatively slow speeds of operation, are not found suitable for high speed operation as discovered herein.

The advantage of the present transfer device above referred to is realized or explained on the basis that the slide mechanism 50 is always in positive contact with the cam follower 68 such that there is always exerted a control

over the movement of the cam follower 68 which in turn means that positive control is always exerted over the movement of the lever arm 82 and hence the carriage 40 whether the movement of the carriage 40 be in either a backward or forward direction. Positive control over the movement of the cam follower 68 is two fold, first, the mounting of the cam follower 68 within the lateral opening 74 of the block 72 prevents any vertical movement or vibration of the cam follower 68. Secondly, horizontal movement of the cam follower 68 may only take place when the bar 18 is moved in upward or downward direction and inertial forces caused by high speed movement of the ram have virtually negligible effect on movement of the cam follower 68 for the reason that the cam follower is always in close contact with the camming portion 66 and while the mechanical advantage for the cam portion 66 to move the cam follower 68 is favorable, the reverse of this is not true, as can be seen most clearly on the illustration of the slide mechanism in FIGURE 2.

While it will be apparent that the preferred embodiments of the invention disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation, and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. A work transfer device for use in conjunction with a press, machine, or the like having a reciprocable part, said device including:
 - stationary support means,
 - a carriage means reciprocably mounted on said support means for movement between forward and rearward positions,
 - at least two jaw means reciprocably mounted relative to said carriage and movable transversely relative to said carriage means between a closed work gripping position and an open work release position,
 - cam follower means on said jaw means,
 - cam means adapted for attachment to said part and having terminal dwell portions and an intermediate actuator portion, the latter being engageable with said cam follower means for moving said jaw means to a gripping position during an intermediate portion of the upstroke of said part and to a release position during an intermediate portion of the downstroke of said part,
 - lever means on said support means and attached by a lost motion connection to said carriage means, said lever means also being engageable with said part for actuation thereby to move said carriage means to its forward position during the terminal portion of the upstroke of said part and to its rearward position during the terminal portion of the downstroke of said part, and
 - slide means included in said lever means for positively controlling the movement of said carriage means between its forward and rearward positions, to thereby enable relatively high speed operation of the transfer device while substantially avoiding vibrations at said high speed operation.
2. A device as set forth in claim 1 further characterized as
 - said slide means including a stationary portion and a movable portion which reciprocates within the stationary portion to move
 - a second cam follower means which is actuated by second cam means on the movable portion of the slide means,
 - said second cam follower means when in movement causing the actuation of the lever means to thereby move said carriage means between its forward and rearward positions.
3. A device as set forth in claim 1 further characterized as including
 - slot means on said slide means for providing the lost

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motion connection with said carriage such that forward and rearward movement of the carriage takes place at proper predetermined times relative to the movement of said reciprocable part.

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U.S. Cl. X.R.

198—218; 74—110