Feb. 11, 1964 H. L. HOYT 3,120,770

TRANSFER MECHANISM

Filed May 5, 1961 2 Sheets-Sheet 1

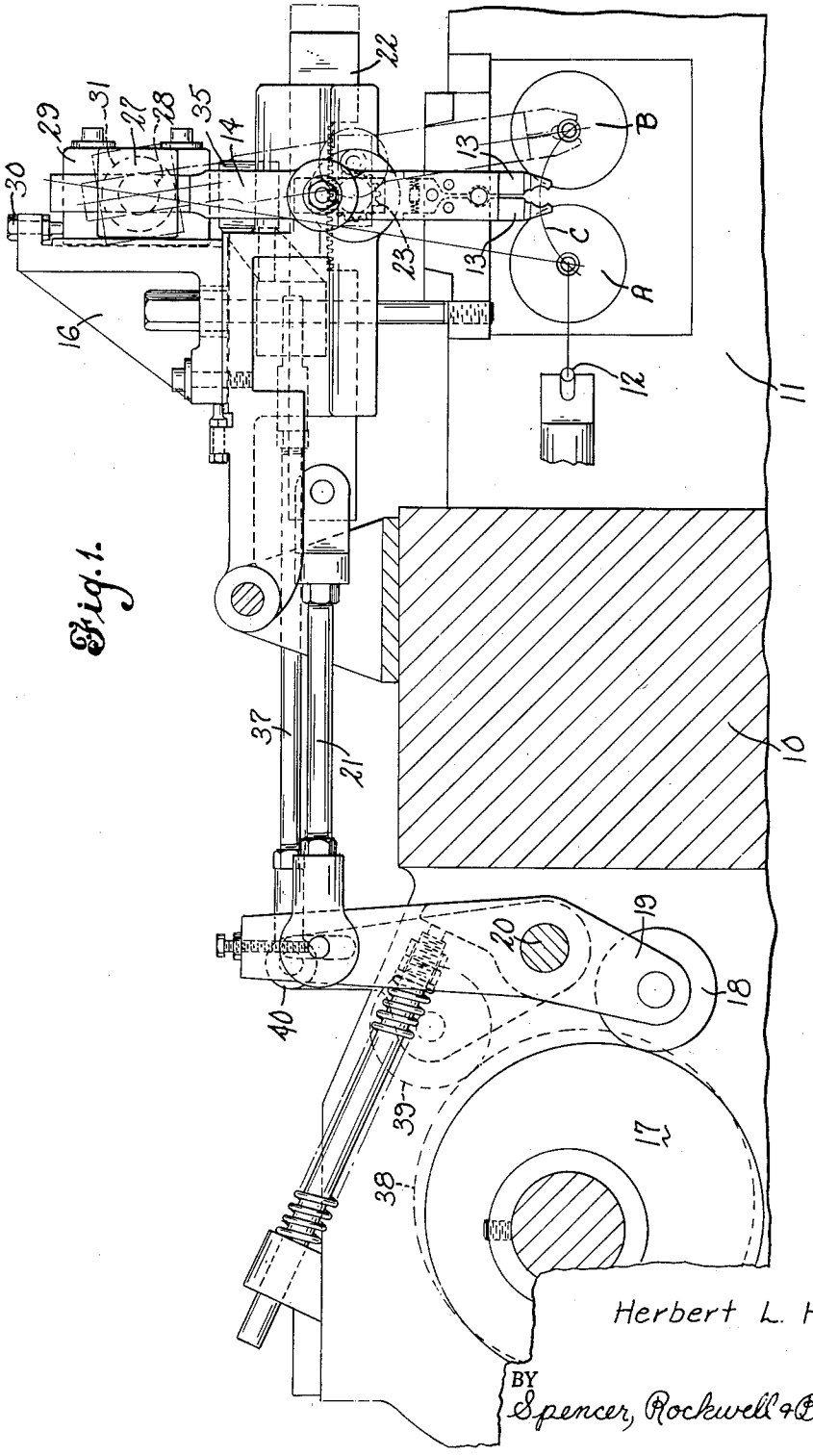


Fig. 1.

INVENTOR

Herbert L. Hoyt

BY

Spencer, Rockwell & Bartholow

ATTORNEYS

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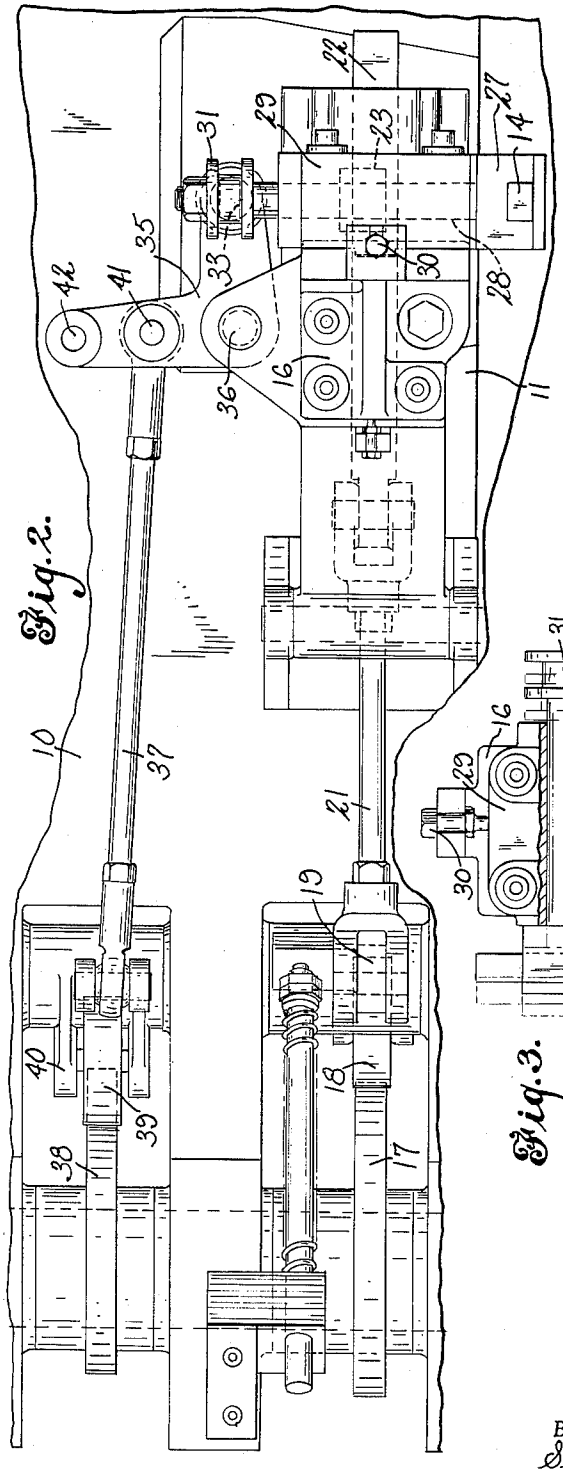


Fig. 2.

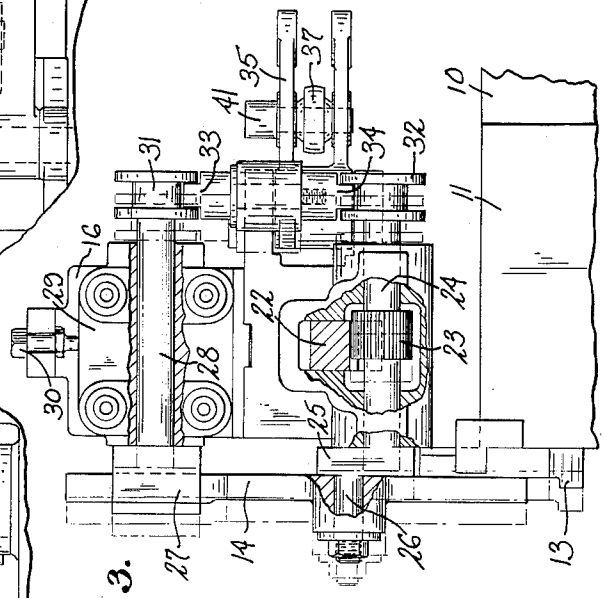


Fig. 3.

INVENTOR

Herbert L. Hoyt

BY

Spencer, Rockwell & Bartholow

ATTORNEYS

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TRANSFER MECHANISM

Herbert L. Hoyt, Waterbury, Conn., assignor, by mesne assignments, to Textron Industries, Inc., a corporation of Delaware

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This invention relates to metal working machines such as headers, nut formers and the like, and particularly to a transfer mechanism for such machines.

In machines of the type noted above, a metal blank is operated on at a number of stations to progressively work the blank. Such stations are provided with cooperating punches and dies and means are further provided for transferring the blank from one operation or station to the next. The means for transferring the blank is commonly referred to as a transfer mechanism in which fingers are arranged to receive and grip a blank ejected from a die by a knock out pin at one station, and transfer the work piece to the next station or die. At this next die the fingers position the blank so it can be pushed out of the fingers by a pusher rod in the punch and into the die, whereupon the next operation is performed.

Transfer mechanisms known to the prior art perform the above described functions quite satisfactorily except where odd shaped blanks i.e. large head to shank diameters, both lengths being equal, are encountered. When such odd shapes are forme din a die, a knock out device cannot dependably maintain control of the blank, for if the blank is knocked out of the die a distance sufficient to remove the headed portion, the narrow shank portion will enter the large diameter, or large die cavity, thus allowing the blank to tip. Control over the blank will thereby be lost.

To overcome the deficiencies noted above and provide a transfer mechanism which will dependably handle such odd shaped blanks, the present invention, briefly described, relates to a transfer mechanism in which a knock out pin partially ejects the headed portion of the blank into a position to be received by the transfer fingers while a portion of the blank remains in its associated die cavity portion to prevent possible tipping of the blank. The transfer fingers complete the removal of the blank from the die by movement in a plane normal to the die face. The blank is then transferred to the next position by an arcuate movement of the transfer fingers in a plane parallel to the die faces. The blank is inserted in the next die by a second movement of the transfer fingers in a plane normal to a die face, this time in the opposite direction or toward the die face. The blank is therefore inserted in the succeeding die without the aid, or necessity, of pusher pins in the punch. The transfer fingers next move along an arcuate path in a plane parallel to the die face in the opposite direction to that in which the blank was transferred to complete a cycle. However, the parallel plane in which the fingers move to complete the cycle is closely adjacent the die faces and therefore spaced from the plane of the fingers while transferring the blank. In the arcuate path completing the cycle the transfer fingers may assume a neutral position halfway between adjacent dies to allow both punches associated with these adjacent dies to operate on each blank simultaneously. In the neutral position, the transfer fingers will not interfere with the operation of the punches. From the neutral position the fingers move to pick up another blank and repeat the cycle described.

Means are provided to adjust the stroke of the arcuate movement of the fingers, by adjusting the effective length of the transfer arm, so that the stroke of the transfer arm is equal to the center to center distance between dies.

Adjustment is also provided in the in and out or normal movement of the transfer fingers relative to the die as fully described in connection with the description of the drawings.

In view of the foregoing, an object of this invention is to provide a transfer mechanism for handling odd shaped blanks in heading machines, nut formers and like machines.

Another object of this invention is to provide a new and useful transfer mechanism comprising a minimum number of elements, which are economically manufactured, assembled and maintained.

Still another object of this invention is to provide a new and useful transfer mechanism which is easily and accurately adjusted to handle various sized blanks.

A further object of this invention is to provide a new and useful transfer mechanism which inserts a blank in a die without the assistance of pusher pins.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

A full understanding of the invention, its objects and advantages, will be apparent from the following detailed description taken in connection with accompanying drawings of a presently preferred embodiment, in which:

FIG. 1 is a front elevational view of the die block of a header machine, or the like, showing the transfer mechanism according to the invention applied thereto;

FIG. 2 is a top plan view of the transfer mechanism illustrated in FIG. 1;

FIG. 3 is an end view of the transfer mechanism with parts in section.

Only two dies or stations, A and B, are shown in the drawings, the pair of dies being provided with transfer fingers. However, it will be appreciated that several pairs of fingers, accompanying transfer mechanisms, and associated dies may be used in practice. Only one transfer finger and mechanism is shown for a clear understanding and concise description of the invention.

To illustrate the invention, FIG. 1 shows a portion of the frame 10 of a progressive header machine having a die bed 11. A cut off station 12, wherein a blank is cut from stock, is shown in the die bed. The cut off mechanism, which forms no part of this invention, delivers a blank to the die A, the blank being operated on in known manner by a punch (not shown) cooperating with die A. The second operation is performed on the blank in die B. Operation of the punches (not shown) associated with dies A and B is performed simultaneously at which time the fingers 13 are in the position shown in FIG. 1.

FIG. 1 best illustrates the cross transfer motion or lateral motion parallel to the face of the dies, performed by the transfer fingers. As seen by the phantom view of the fingers such motion is performed by oscillating the fingers 13.

The transfer fingers 13 are biased to gripping or clamping position in any suitable manner, one of which is shown, and are secured or carried by an oscillatably mounted transfer arm 14. The free ends of the fingers are shaped so as to be automatically opened upon engagement with a blank. That is, since the fingers, travelling from die B, to the neutral position shown, and then to die A to pick up a blank, travel in an arcuate path C, the fingers approach a blank in die A in the vertical plane of the exposed headed portion of the blank. Conversely, once the fingers 13 have placed a blank in die B so that the headed portion is partially in the header die cavity, they automatically open since their travel away from die B is upwardly in the vertical plane of the headed portion of the blank.

As indicated above, the transfer arm 14, carrying fingers 13, is oscillatably mounted (as best seen in FIG. 3

and described in connection therewith) in a carrier or transfer mechanism frame **16** fixed to the base **10** of the machine.

The driving mechanism for oscillating the transfer arm **14** comprises, a cam **17** which may be adjustably secured on the side shaft of the machine in known manner. A cam roller **18**, at one end of a cam lever **19**, is urged, by a spring as shown, or other suitable means, against the cam **17**. The lever **19** is pivotally oscillated about point **20** as is well known. A link **21**, adjustably secured to the other end of the lever **19**, is pivotally secured in driving relation with a notched rack **22**. As indicated in the drawings, the link **21** is adjustable lengthwise. The rack **22** is therefore driven or reciprocated right and left as shown in FIG. 1. As best seen in FIG. 3, the rack **22** oscillatably drives a pinion **23**, a crank shaft **24**, and an offset crank **25**. The crank pin **26** is pivotally secured or journalled in the transfer arm **14** in any suitable manner. The pinion **23**, shaft **24**, crank **25** and crank pin **26** may be integral parts.

Referring again to FIG. 1, it will be seen that the crank pin **26** is secured to the transfer arm **14** intermediate the end thereof supporting fingers **13** and the other end of the transfer arm which is slidably supported in a pivotal block **27**. Block **27** is connected to or integral with shaft **28** journalled in a bearing block **29** as best seen in FIG. 3. A push-pull screw **30** is provided to adjust the position of block **29** and thus block **27** relative to the position of crank pin **26** on transfer arm **14**. Adjustment of the block **27** toward or from crank shaft **24** will vary the length of the arc C the transfer arm travels and thereby accurately adjust the stroke of the transfer arm **14** to the center to center distance between dies A and B. The length and/or pivot point of the transfer arm **14** is therefore controlled by block **27** and the arm **14** is slidably held in the block by the crank pin **26**. The extreme cross transfer positional relationships between transfer arm **14** and pivotal block **27** are shown by the full and phantom lines showing of these parts in FIG. 1. The in and out, or normal position of fingers **13**, arm **14** and block **27** is shown by the phantom lines of FIG. 3.

It will be apparent from FIG. 1 and the above description thereof that rotation of cam **17**, oscillates the lever **19** to impart reciprocal motion to the link **21** and rack **22**. Reciprocal motion of the rack **22** oscillates the crank pin **26** connected to the transfer arm **14**. The oscillating transfer arm, slideably secured in block **27** at one end and carrying fingers **13** at the other end, causes the fingers **13** to move over an arcuate, cross transfer path C between stations A and B.

The foregoing description of the drawing discloses the mechanism causing the fingers to follow a lateral, or arcuate cross transfer motion, parallel to the face of the dies.

The other basic motion of the fingers **13**, i.e. the motion normal to the face of the dies, or in and out transfer, is best illustrated in FIG. 3 and will be described in connection therewith.

Referring therefore to FIG. 3 it will be seen that pinion **23** is laterally movable relative to the rack **22** within a suitable space provided in the transfer frame **16**, between the journal portions of crank shaft **24**. Thus, the crank shaft **24**, crank offset **25**, and crank pin **26** are free to move, or reciprocate, from right to left as seen in FIG. 3. A spool **32**, integral with the free end of crank shaft **24**, is reciprocally driven by a lug **34** to impart such motion to crank **25** and therefore also reciprocate transfer arm **14** normal to the plane of the die faces. It is noted that the arrangement of spool **32** and lug **34** allows crank shaft **24** to rotate while being oscillated.

The guide block **27**, associated shaft **28** and spool **31** are similarly reciprocated by means of a lug **33** while pivoting or oscillating in unison with the transfer arm **14**, the operation of which was described above. It will be apparent therefore that transfer arm **14** is held at two

portions therealong, by the crank **25** and block **27**, during both its reciprocal and oscillatory motions to provide positive and accurate control of arm **14** and thus transfer fingers **13**.

As in FIG. 1, the phantom lines of FIG. 3 indicate extreme reciprocal positions of arm **14** and fingers **13**.

Reciprocal movement of the arm **14**, block **27** and fingers **13**, as a unit, normal to the face of dies A and B, is accomplished by reciprocation of spools **31** and **32** operatively associated with opposed lugs **33** and **34** suitably connected to right angle lever **35** best seen in FIG. 2.

As best illustrated in FIG. 2; lever **35**, also shown in part in FIGS. 1 and 3, is pivotally secured at **36** to the carrier frame **16**. One arm of the lever **35** carries the lugs **33**, **34** and the other arm of lever **35** is secured to a link **37** at **41**. Link **37** is similar to link **21** and is driven separately by a second cam **38**. Cams **38** and **17** are both adjustably fixed to the side shaft of the machine.

The cams **17** and **38** may be rotatably repositioned on the side shaft to vary the relative positions thereof and change the timing of fingers **13** in either or both of the basic movements thereof. Intermediate the cam **38** and link **37** is a cam roller **39** held against cam **38** and rotatably mounted on lever **40** which is in turn, pivotally secured in well known manner to link **37** remote from right angle lever **35**.

The movement of the transfer arm **14**, block **27** and fingers **13** may be adjusted as noted above by relative displacement of cams **17** and **38**. Additionally or alternatively, link **37** may be connected at either point **41** or **42** on lever **35**. Also, similarly separate or spaced connection points may be provided on lever **40** at the other end of link **37**.

It will be apparent from FIGS. 2 and 3, taken in the light of the foregoing description thereof, that rotation of cam **38** reciprocates link **37** to oscillate the right-angle-lever **35** which imparts simultaneous reciprocal motion to both block **27** and crank **25** by virtue of spools **31** and **32** activated by the lugs **33** and **34** reciprocally driven by the lever **35**.

It will be clear from the foregoing that the composite motion of the transfer fingers allows them to receive and grip a headed blank partially ejected from die A, move the blank normal to the face of die A to completely remove the blank therefrom. The blank may then be transferred in a plane parallel to the face of dies A and B, or if the dies are not coplanar, in an oblique angled plane over a curved path to the next station. At the succeeding station the fingers insert the blank in the associated die and withdraw to a neutral position clear of the punches and close to the die faces in a plane spaced from the arcuate transfer plane.

The fingers **13** may be given various motions by varying the surface of cams **17** and **38** of the transfer mechanism and adjusting these cams relative to one another. The versatility of the arrangement according to the invention will be apparent to those skilled in the art. The motion described above, however, is presently preferred for such machines as progressive headers, nut formers and the like.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the constructions set forth, such as indicated above, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also understood that the following claims are intended to cover all the generic and specific features of the invention described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by letters patent is:

1. In a machine having a frame and at least two dies, a transfer mechanism for transferring a workpiece between the dies comprising a transfer arm pivotally and slidably mounted to said frame, transfer fingers mounted to said transfer arm, first means cooperatively associated with said transfer arm to pivotally oscillate said arm through a continuous arc forming a plane substantially parallel to the faces of the dies, and second means cooperatively associated with said transfer arm to slidably move said transfer arm in timed relation with the pivotal oscillations along a line substantially perpendicular to the faces of the dies.

2. In a machine having a frame and at least two dies supported by the frame, a transfer mechanism for transferring a workpiece between the dies comprising an eccentric pivotally and slidably mounted to said frame, a transfer arm pivotally mounted intermediate its ends to said eccentric, transfer fingers mounted to one end of said transfer arm, a guide pivotally and slidably mounted to said frame, the other end of said transfer arm slidably engaging said guide, first means for pivotally oscillating said eccentric to move said transfer arm in a plane substantially parallel to the faces of the dies, and second means for slidably moving said transfer arm in timed relation with the pivotal oscillations along a line substantially perpendicular to the faces of the dies.

3. In a machine having a frame and at least two dies supported by the frame, a transfer mechanism for transferring a workpiece between the dies comprising an eccentric pivotally and slidably mounted to said frame, a transfer arm pivotally mounted intermediate its ends to said eccentric, transfer fingers mounted to one end of said transfer arm, a guide pivotally and slidably mounted to said frame, the other end of said transfer arm slidably engaging said guide, first means for pivotally oscillating said eccentric to move said transfer arm in a plane substantially parallel to the faces of the dies, and second means for slidably moving said eccentric and said guide in timed relation to the pivotal oscillations to effect movement of said transfer arm along a line substantially perpendicular to the faces of the dies.

4. In a machine having a frame and at least two dies supported by the frame, a transfer mechanism for transferring a workpiece between the dies comprising a shaft rotatably and slidably journalled in said frame, a pinion secured on said shaft, an eccentric mounted to said shaft, a transfer arm pivotally mounted intermediate its ends to said eccentric, transfer fingers mounted to one end of said transfer arm, a guide pivotally and slidably mounted to said frame, the other end of said transfer arm slidably engaging said guide, a rack slidably mounted in said frame and cooperatively engaging said pinion, first means for linearly reciprocating said rack to oscillate said transfer arm in a plane substantially parallel to the faces of the dies, and second means for slidably moving said shaft and said guide in timed relation with the movement of said rack to move said transfer arm along a line substantially perpendicular to the faces of the dies.

5. In a machine having a frame and at least two dies supported by the frame, a transfer mechanism for transferring a workpiece between the dies comprising an eccentric pivotally and slidably mounted to said frame, a transfer arm pivotally mounted intermediate its ends to said eccentric, transfer fingers mounted to one end of said transfer arm, a guide pivotally and slidably mounted to said frame, the other end of said transfer arm slidably engaging said guide, first means for pivotally oscillating said eccentric to move said transfer arm through a continuous arc forming a plane substantially parallel to the faces of the dies, second means for slidably moving said eccentric and said guide in timed relation to the pivotal oscillations to effect movement of said transfer arm along a line substantially perpendicular to the faces of the dies, and means for adjusting the position of said guide toward and from said eccentric to adjust the length of arc through which said transfer arm oscillates.

6. In a machine having a frame and at least two dies supported by the frame, a transfer mechanism for transferring a workpiece between the dies comprising a first shaft rotatably and slidably journalled in said frame, a pinion secured on said shaft, an eccentric mounted to said shaft, a transfer arm pivotally mounted intermediate its ends to said eccentric, transfer fingers mounted to one end of said transfer arm, a second shaft rotatably and slidably journalled in said frame, a guide mounted to said second shaft, the other end of said transfer arm slidably engaging said guide, a rack slidably mounted in said frame and cooperatively engaging said pinion, first means for linearly reciprocating said rack to oscillate said transfer arm in a plane substantially parallel to the faces of the dies, and second means for slidably moving said first and second shafts in timed relation with the movement of said rack to move said transfer arm along a line substantially perpendicular to the faces of the dies.

7. The structure defined in claim 6, and further including means for moving said second shaft and the guide mounted thereto toward and from said first shaft to adjust the distance between the ends of the oscillatory movement of said transfer arm.

8. In a machine having a frame and at least two dies supported by the frame, a transfer mechanism for transferring a workpiece between the dies comprising a first shaft rotatably and slidably journalled in said frame, a pinion secured on said first shaft, an eccentric mounted to said first shaft, a transfer arm pivotally mounted intermediate its ends to said eccentric, transfer fingers mounted to one end of said transfer arm, a second shaft rotatably and slidably journalled in said frame, a guide mounted on said second shaft, the other end of said transfer arm slidably engaging said guide, a rack slidably mounted in said frame and cooperatively engaging said pinion, first means for linearly reciprocating said rack to oscillate said transfer arm along an arc forming a plane substantially parallel to the faces of the dies, a spool mounted to each of said shafts, a single lug cooperatively engaging each spool, and second means for moving said lug along a line parallel to the axes of said first and second shafts for slidably moving said eccentric and said guide in timed relation with the movement of said rack to move said transfer arm along a line substantially perpendicular to the faces of the dies.

9. The structure defined in claim 8, and further including means for moving said second shaft toward and from said first shaft to adjust the length of arc through which said transfer arm is oscillated.

10. The structure defined in claim 8, wherein said first means comprises a link, a bell crank pivoted intermediate its ends to said frame, one end of said link being pivoted to said rack and the other end thereof being pivoted to one end of said bell crank, a cam follower pivotally mounted to the other end of said bell crank, a rotating shaft journalled in the machine, a cam secured on said rotating shaft, and means acting against said bell crank for urging said cam follower into contact with the surface of said cam.

11. The structure defined in claim 10, wherein said link further includes means for adjusting the distance between its pivotal ends for adjusting the position of said transfer fingers with relation to said dies.

12. The structure defined in claim 8, wherein said second means includes a rotating shaft journalled in the machine, a cam secured to said rotating shaft, and means cooperatively associated with said cam and said lug to linearly reciprocate said lug in response to the changing profile of said cam.

13. In a machine having a frame and a plurality of dies, a plurality of transfer mechanisms for transferring workpieces between the dies, a transfer mechanism being provided between each adjacent die pair, comprising a

transfer arm pivotally and slidably mounted to said frame, transfer fingers mounted to said transfer arm, first means cooperatively associated with said transfer arm to pivotally oscillate said arm through a continuous arc forming a plane substantially parallel to the face of the adjacent die pair, and second means cooperatively associated with said transfer arm to slidably move said transfer arm in timed relation with the pivotal oscillations along a line substantially perpendicular to the faces of the dies.

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