Sept. 21, 1954 J. M. SCHAEFFER ET AL 2,689,361

TRANSFER MECHANISM

Filed April 18, 1950

5 Sheets-Sheet 1

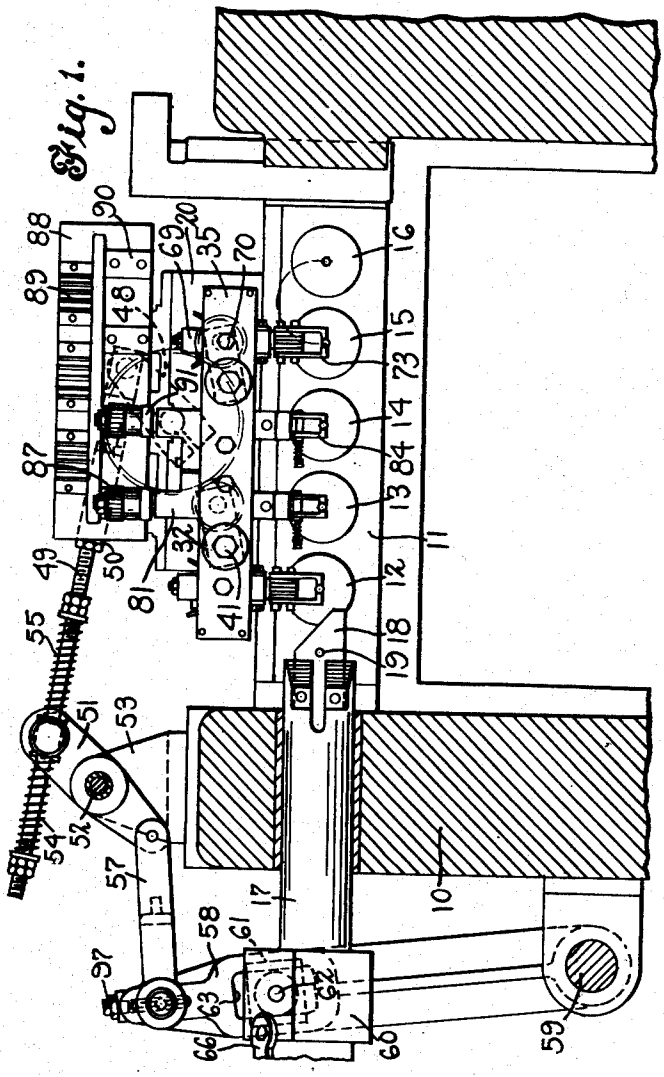

Fig. 1.

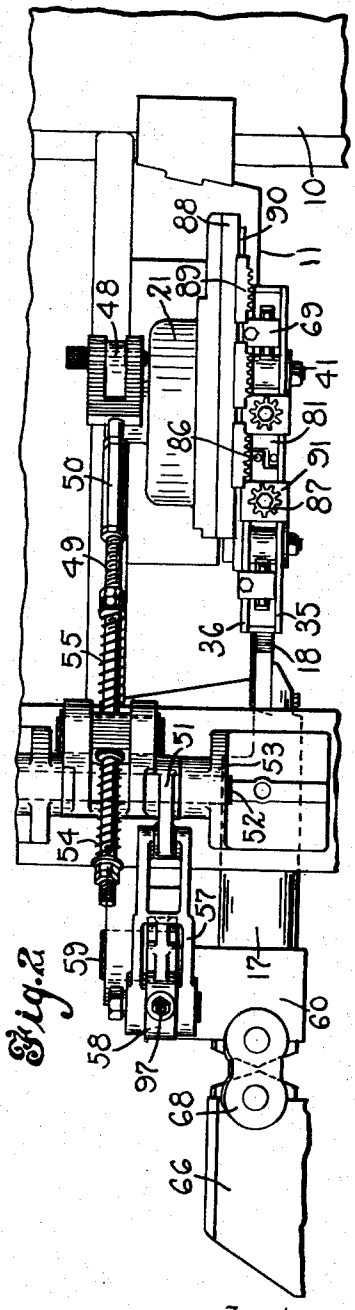

Fig. 2

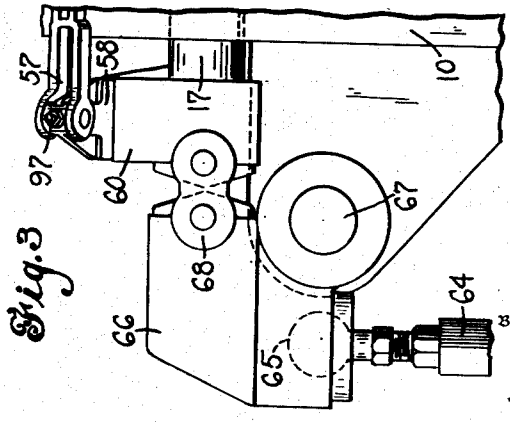

Fig. 3

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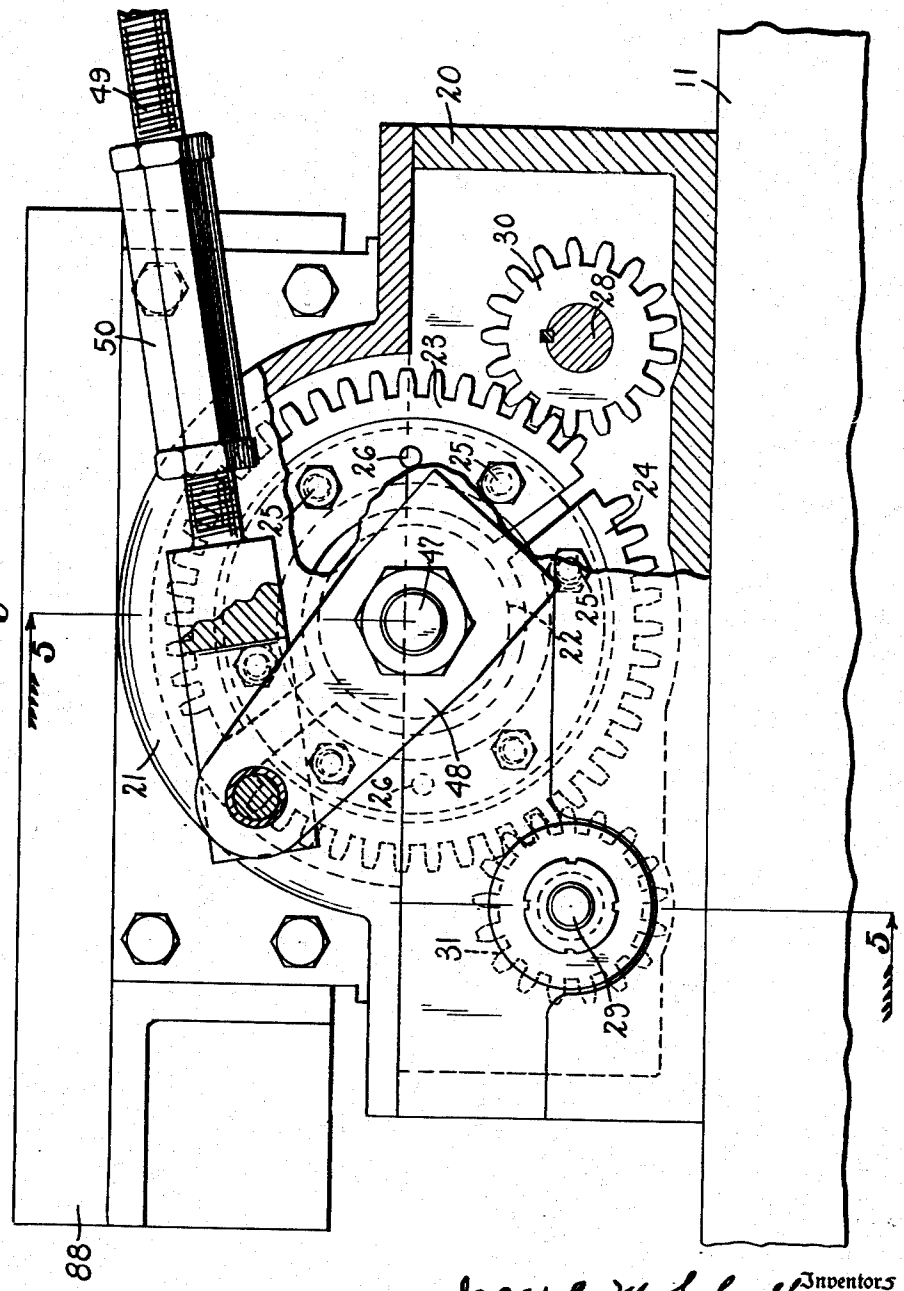
Fig. 4.



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TRANSFER MECHANISM

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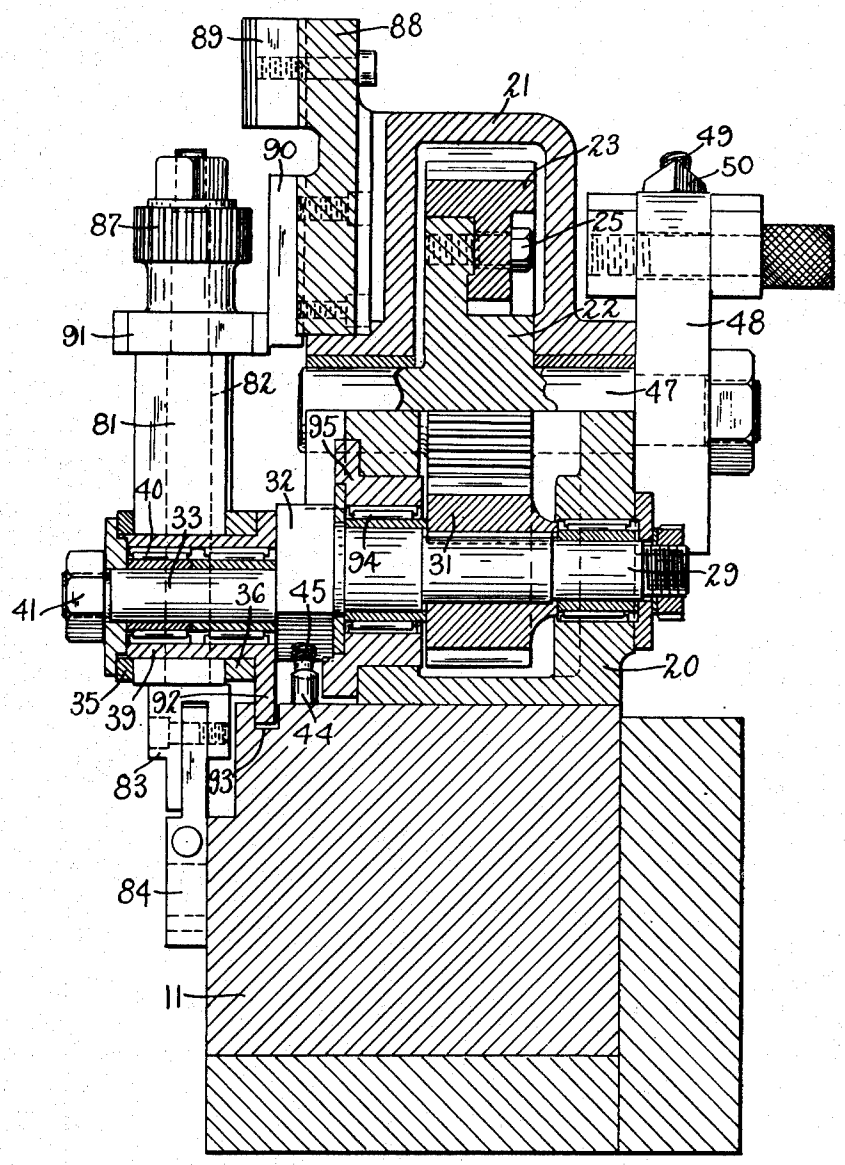
Fig. 5.



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TRANSFER MECHANISM

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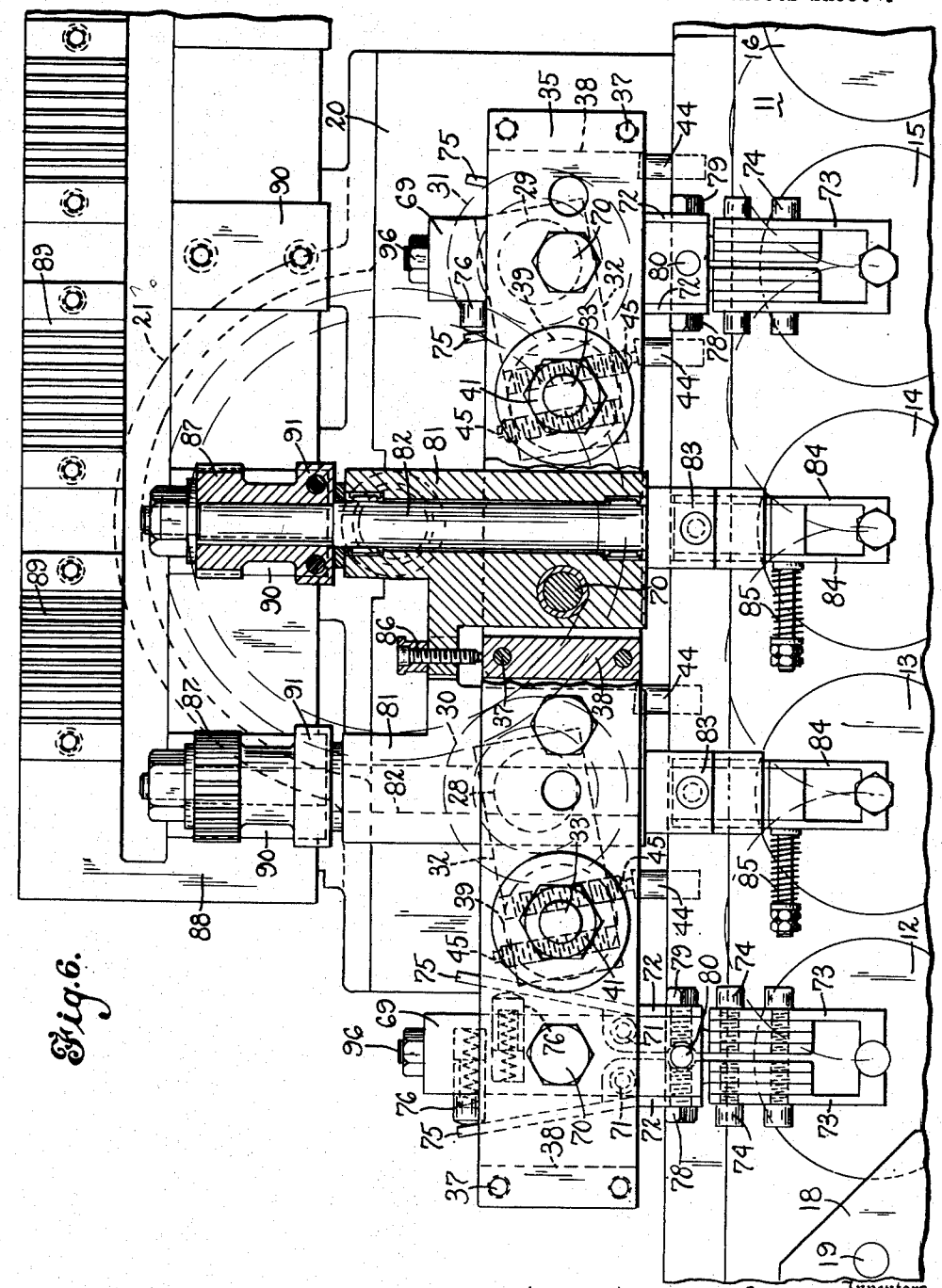

Fig. 6.

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Fig. 11a.

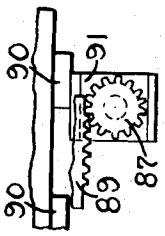


Fig. 11.

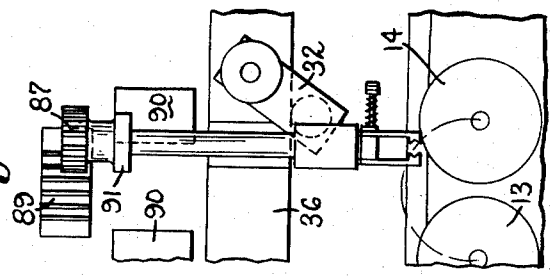


Fig. 10a.

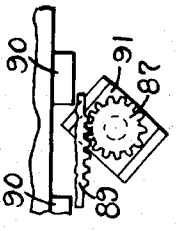


Fig. 10.

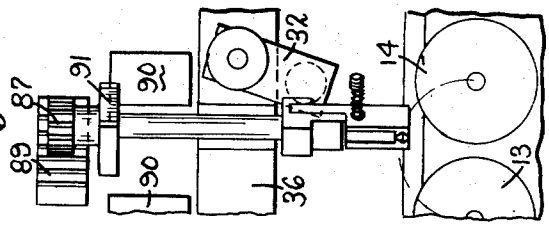


Fig. 9a.

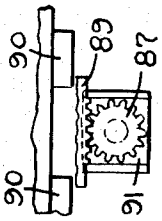


Fig. 9.

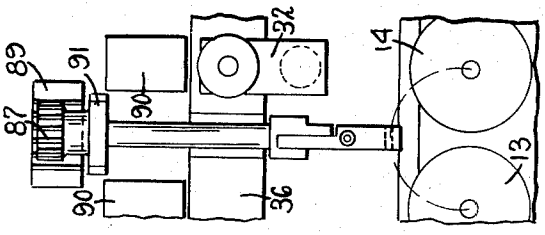


Fig. 8a.

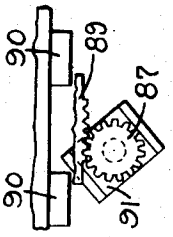


Fig. 8.

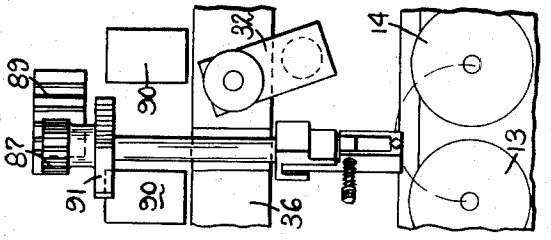


Fig. 7a.

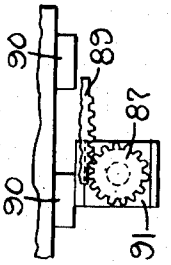
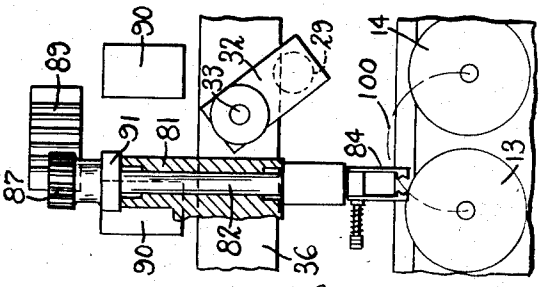


Fig. 7.



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Patented Sept. 21, 1954

2,689,361

UNITED STATES PATENT OFFICE

2,689,361

TRANSFER MECHANISM

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Application April 18, 1950, Serial No. 156,674

13 Claims. (Cl. 10—166)

1

This invention relates to transfer mechanism and more particularly to means for transferring a workpiece from one station to another in connection with machinery having several operating stations where the workpiece is operated upon by dies and punches or the like at each station in a progressive manner. The invention is particularly applicable to machines of this character for forming nuts, but it will be understood that the invention is not to be limited to such devices but may be employed in machines for forming other articles. Likewise, the invention may be employed in a multi-station machine where there are a number of tools operating successively upon a workpiece or in a two-station machine where the workpiece is merely conveyed from the first station to the second.

In machines of this character it is necessary to have transfer mechanism which will convey the work from one station to the next and accurately center the work over the die at the station to which it is transferred so that the blank will be correctly located axially of the opening in the die in order to prevent breakage or undue wear upon the tools. It is also desirable to so control the transfer mechanism that the constant pushing out of the workpiece from the die into the gripping fingers of the transfer mechanism will not cause undue wear on the parts so that play will develop, and thus result in incorrect alignment or registration of the blank with the opening in the die.

In addition, in connection with some classes of work it is desirable that the workpiece be rotated or turned end for end through an angle of 180° between one station and the next, and one feature of the present invention is the provision of transfer mechanism which will turn the workpiece end for end during its travel from one station to another, and at the same time correctly align it with the die opening at the station at which the work is received.

In a multi-station machine it may be desirable to transfer the work between certain stations without rotation thereof, but to rotate or turn the work end for end between other stations. It is contemplated by the present invention to provide mechanism by which either type of transfer mechanism may be provided selectively at any or all of the several stations. That is to say, by a relatively simple substitution of parts, the transfer mechanism may be adapted to rotate the workpiece between any two adjacent stations where rotation is desired, but to effect a transfer of the workpiece without rotation between other stations of the machine.

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One object of the present invention is to provide a blank transfer mechanism for heading, upsetting or like machines to transfer a blank from one station to a succeeding station, which mechanism will be efficient in operation and durable in use.

A further object of the invention is to provide a blank transfer mechanism for machines in which a workpiece is operated upon by tools at successive stations, the mechanism being arranged to transfer the work from one station to the next and accurately align the work axially of the die opening at the station to which it is transferred.

Another object of the invention is to provide a blank transfer mechanism for machines in which a workpiece is operated upon by tools at successive stations, the mechanism being arranged to transfer the work from one station to the next and during such transfer rotate the workpiece through an angle of 180° so as to turn it end for end with relation to the operating tools.

A still further object of the invention is to provide a blank transfer mechanism for machines in which a workpiece is operated upon by tools at successive stations, the mechanism being arranged to transfer the work from one station to the next and to turn the workpiece end for end during its transfer between any two stations where such turning movement is desired, but to effect a plain transfer of the work without turning between any two selected stations.

To these and other ends the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is an elevational view, partially in section, of a transfer mechanism embodying our invention with adjacent parts of the machine with which the mechanism may be employed;

Fig. 2 is a top plan view of the parts shown in Fig. 1;

Fig. 3 is a fragmentary view showing the mechanism for actuating the cut-off bar which in turn actuates the transfer mechanism;

Fig. 4 is an enlarged view of the gear and pinions for oscillating the carrier or frame upon which the transfer fingers are mounted;

Fig. 5 is a sectional view on line 5—5 of Fig. 4;

Fig. 6 is an enlarged front elevational view of the transfer mechanism, some parts being shown in section;

Figs. 7 to 11, inclusive, are diagrammatic elevational views showing progressive steps of operation of the transfer and turning mechanism; and

Figs. 7A to 11A, inclusive, are top plan views of

the mechanism shown in Figs. 7 to 11, respectively.

To illustrate a preferred embodiment of our invention, we have shown in Fig. 1 of the drawings a heading, upsetting or like machine comprising a frame 10 carrying a die block 11 in which are a plurality of dies (five in number as shown) 12, 13, 14, 15 and 16, each of these dies comprising a station at which work is performed on a blank, and it will be understood that although not shown in the drawing, according to usual practice, a gate will be provided having punches to cooperate with the dies 12, 13, 14, 15 and 16 to perform the various operations.

A reciprocable cut-off bar 17 is slidably mounted in the frame 10, this cut-off bar carrying a knife 18 having a cut-off opening 19 therein which registers with an opening (not shown) in the die block through which wire or equivalent stock is fed so that a length of stock may be cut off and carried by the cutter to the die 12 of the first station. As will be hereinafter explained, transfer mechanism is provided to transfer the workpiece or blank from each of the first four stations to the next succeeding station and it is with this transfer mechanism that the present invention is concerned.

Mounted upon the die block 11, as shown more especially in Figs. 4 and 5, is a gear housing 20, provided with a removable cover 21 and having rotatably mounted therein a gear hub 22.

To this gear hub is secured a split gear consisting of the two halves 23 and 24, the gear halves being secured to the hub by bolts 25 and dowels 26. Also rotatably mounted in the gear housing 20 are crank shafts 28 and 29 having secured thereto pinions 30 and 31, the teeth of the former of these pinions being engaged with the segment 23, while those of the pinion 31 are engaged with the segment 24.

These shafts extend forwardly from the gear housing and upon their forwardly projecting ends are provided with cranks 32 having crank pins 33 formed integrally therewith (Figs. 5 and 6). The crank pins 33 extend through, and are secured rotatably to, a transfer carrier frame comprising spaced bars or plates 35 and 36, these plates being riveted together as at 37 through spacer blocks 38 so that they are held in rigid spaced relation with each other. The crank pins 33 pass through spacing sleeves 39 within which are suitable bearings 40, the sleeves being locked in the frame by the nuts 41. From this construction it will be apparent that upon oscillation of the crank shafts the carrying frame for the transfer fingers will also be oscillated, as will be referred to hereinafter.

As shown more especially in Fig. 6 of the drawings, stop pins 44 are secured in the die block at each side of the crank shafts 28 and 29 and in each of the cranks are adjustable positioning screws 45, one projecting from the crank in one direction and the other projecting from the crank in the other direction. These stop screws are adapted to contact one or the other of the pins 44 at the two limits of the stroke of the crank so that the end positions of the transfer fingers will be such as to correctly align with the die openings.

The gear hub 22 is provided with trunnions 47 and to one of the trunnions is secured a rock arm 48 to which is attached a connection consisting of a rod 49 and turnbuckle 50. To the rod 49 is adjustably connected a lever 51 pivoted at 52 to a standard 53 supported by the frame, this lever being connected to the member 49 between compensating springs 54 and 55 which permit overthrow of the lever 51 in either direction.

To the other end of the lever 51 is pivoted one end of a link 57, the other end of which is pivoted to a stroke arm or lever 58, the latter in turn being pivoted at 59 to the frame 10.

A head 60 is provided on the cut-off bar 17 and a bronze block 61 mounted upon a stud 62 driven into the head 60 of the cut-off bar slides in an opening 63 in the lever 58. With this construction it will be seen that the reciprocation of the cut-off bar also effects reciprocation of the lever 58, the sliding of the block 61 in the opening 63 allowing for pivotal motion of the lever 58 while the cut-off bar moves in a straight line. This reciprocation of the lever 58 effects oscillation of the arm 48 and through the gear segments 23 and 24 and pinions 30 and 31 oscillates the crank shafts 28 and 29 and, thus, oscillates the frame which carries the transfer fingers.

The cut-off bar may be reciprocated from the main shaft of the machine in any of the usual ways. As illustrated, this bar is actuated by a rod 64 reciprocated by the usual cams (not shown), the rod 64 being connected by the ball joint 65 to a bell crank 66 pivoted at 67 to the frame, the bell crank being connected by a linkage 68 to the head 60 of the cut-off bar. The transfer carrier frame, comprising the spaced plates 35 and 36, serves as the carrier for the transfer fingers and associated mechanism, as will now be described.

Two types of finger holders may be employed with this carrier, one of which transfers the blank from one station to the next without rotation thereof, while the other turns the blank end for end. One finger mechanism comprises a finger block 69 mounted between the spaced plates and held in place by a screw 70, the block being mortised into the rear plate 36 so that it will be held rigidly in place. To this block are pivoted at 71 a pair of finger holders 72, the fingers 73 being secured to the finger holders by the screws 74. An extension 75 in each of the finger holders bears against a plunger and spring assembly 76 so as to urge the fingers toward each other or into gripping relation with the work. The horizontal adjustment of the fingers with respect to the center of the die is effected by adjustment screws 78 and 79 threaded into the finger holders 72 and engaging at their inner ends a fixed pin or block 80.

The type of finger holder just described is shown at the first and the fourth stations on Figs. 1 and 6 of the drawing, while the finger mechanisms shown at the second and third stations are designed to turn the blank end for end while transferring it from one station to the next. As illustrated in Fig. 6 of the drawings, a finger block 81 is secured in the carrying frame consisting of the plates 35 and 36, this block being held in place by a screw 70 as before. In this block a vertical spindle 82 is rotatably mounted, the spindle projecting from the plate at its lower end and carrying thereon a finger holder 83, having fingers 84 thereon, spring pressed toward each other by the spring 85 in a usual manner. The vertical positions of the blocks 81 may be adjusted with respect to the carrier frame by means of screws 86.

At the upper end of each of the spindles 82 is secured a pinion 87, and a plate 88 secured to the housing cover 21 carries a plurality of spaced racks 89. Below the racks a plurality of spaced

bearing plates 90 are provided upon the plate 88, these bearing plates being adapted to cooperate with square blocks 91, one of which is formed integrally with each pinion 87. As shown more especially in Fig. 5, the plates 90 project outwardly from the face of the back plate 88 so that a space remains between adjacent ones of the bearing or wear plates 90. As will be described hereinafter, upon oscillation of the cranks 32 the pinions 87 and the blocks 91 formed integrally therewith will be raised and moved toward the right, as shown in Fig. 6. The square blocks will ride upwardly upon the wear plates 90 and the pinions will be caused to engage the racks 89 and will thereby be caused to rotate, as will be explained in greater detail hereinafter.

As shown more especially in Fig. 5 of the drawings, a plate or lug 92 is secured to and depends from each of the spacing sleeves 39, this lug extending into a slot 93 in the die block, which engagement assists in keeping the fingers in alignment with the die openings by preventing movement of the finger holders away from the face of the die block when a workpiece is ejected from a die into the transfer fingers. The engagement of these lugs 92 in the groove of the die block holds the carrier frame of the transfer fingers rigidly in place against movement outwardly from the die face.

It will be noted that the forward ends of the crank shafts 28 and 29 are each mounted in bearings 94 in a block or casing 95 mounted in the gear casing 20 and that the pinions 30 and 31 are slightly smaller than the members 95 so that the crank shafts with the bearing assembly thereon, including the casings 95, may be inserted into the gear casing from the front side thereof. This is of importance in correctly aligning the cranks 32. In assembling the parts, the gear halves or segments 23 and 24 are loosely bolted to the hub 22 by the bolts 25 and these members are assembled in the casing 20 when the cap 21 is removed. Thereafter, the crank shafts 28 and 29, with the bearings and the members 95 assembled thereon, are inserted into the casing 20, the pinions being keyed to the cranks. The opening between the gear segments should be in a vertical position when the cranks are pushed into the casing 20 and each crank assembly can be turned a trifle until a mesh is made between the teeth of the pinions and those of the respective gear segments. When the opening between the gears, and also the cranks 32, are in approximate vertical positions adjustment may be easily made by tapping one or both of the gear halves about until both cranks are in perfect alignment. The screws 25 are then tightened and the gear segments are rigidly secured to the hub by the dowels 26.

The finger blocks 69 may be properly adjusted by the adjusting screws 96 as to their vertical positions, while the finger blocks 81 are limited to their vertical position by the adjusting screws 86 as has already been described. An adjusting stud 97 permits adjustment of the throw of the lever 51 so as to adjust the stroke of the cranks 32 from one station to another, the setting of the cranks being also adjusted by the turnbuckle 50 which, as is usual, is provided with right and left-hand threads.

The operation of the transfer mechanism may be readily understood from the illustrations in Figs. 7 to 11 and 7A to 11A, inclusive. The path of the blank in its passage from one station to the next is shown by the dotted lines 100 and it will be apparent that this is a substantially semicircular path in a vertical plane, or a plane parallel to the face of the dies, as the cranks 32 move through an arc of substantially 180°. This same path is described both by the fingers 73 and the fingers 84 although the operation is shown only with the latter fingers as these are the ones which effect the turning movement of the blanks.

As shown in Figs. 7 to 11, when the cranks 32 begin their rotation in a clockwise direction, from the position shown in Fig. 6, the carrier of the transfer mechanism consisting of the spaced plates 35 and 36 and attached parts is moved upwardly and to the right. The square block 91 rides upwardly along the front surface of the bearing plate 90 and also moves horizontally to the right over this surface until the parts reach the position shown in Fig. 7 wherein the pinion 87 first makes engagement with the teeth of the adjacent rack 89. It will be seen that the motion of the carrier is principally a lateral one or horizontal one as the crank continues to rotate from this point, so that upon continued rotation of the crank the parts move from the position shown in Fig. 7 to that shown in Fig. 8. It will be seen that the spindle or shaft 82 has been rotated through an angle of approximately 45° as the parts are shown in the latter figure, and as shown in Fig. 8A the corner of the square block 91 has been permitted to move into the space between adjacent wear plates 90. Upon continued rotation of the cranks 32 the parts move respectively to the positions shown in Figs. 9 and 10. In the former of these figures the spindle 82 and hence the blank has been rotated through an angle of substantially 90°, this being the mid-stroke of the cranks, while in Fig. 10 the spindle 82 has been rotated through an angle of substantially 135°, and as shown in Fig. 10A, the block 91 is about to contact with the next adjacent wear plate 90.

As shown in Figs. 11 and 11A the pinion 87 has just been disengaged from the rack 89 and the spindle 82 and the workpiece has been rotated through an angle of 180°. The block 91 is now in engagement with the surface of the next adjacent wear plate 90 and continued movement of the cranks 32 from this point moves the carrier of the transfer mechanism principally downwardly until the blank carried by the transfer fingers 84 is in alignment with the opening in the die 14 which completes the operation of transferring a blank from the die 13 to the die 14 and during such transfer, turning the blank end for end or rotating it through an angle of 180°. The blank is then moved out of the transfer fingers into the die by the usual tools which operate upon the blank and the motion of the cranks is reversed to move the transfer mechanism back to its original position. It will be apparent, therefore, that the transfer fingers 84 not only move the work in a curved path parallel to the plane of the face of the die in transferring the work from one station to the next, but also rotate the work about an axis parallel to the face of the die during the transfer movement.

It will also be obvious that the construction of the frame or carrier for the transfer fingers is such that it may be readily adjusted to correctly align the work with the die openings and will be held in place and prevented from excessive wear during the movement of the workpieces or blanks into and out of the transfer fingers during the operation of the machine.

It will also be understood that the finger mechanism shown at stations 2 and 3 of Fig. 6, which turn the blank end for end, may be used at any of the stations in the machine where rotation of the blank is desired, and also the finger mechanism shown at stations 1 and 4 may be substituted for that shown at stations 2 and 3 where it is not desired to turn the blank end for end. Hence, by merely placing the proper finger mechanism in the carrier frame at any station in the frame, the blank may or may not be rotated as is desired. The racks 89 may be furnished for each of the stations in the machine but, as will be apparent, these racks are sufficiently distant from the axis of the crank shaft 32 that they will not interfere with the use of the finger mechanism shown at stations 1 and 4.

While we have shown and described a preferred embodiment of our invention, it will be understood that it is not to be limited to all of the details shown, but is capable of modification and variation within the spirit of the invention and within the scope of the claims.

What we claim is:

1. A metal-working machine having a plurality of dies and means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier provided with spaced frame members, finger supports mounted between said members, blank gripping fingers supported by said supports, means for effecting movement of the carrier, said means comprising a pair of crank shafts on which the carrier is mounted, a pinion on each of said shafts, a drive shaft having a gear hub thereon, a split gear carried by said hub providing distinct portions separately secured to the hub, each of said portions meshing with one of said pinions, and means for oscillating said drive shaft.

2. A metal-working machine having a plurality of dies and means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier provided with spaced frame members, finger supports mounted between said members, blank gripping fingers supported by said supports, means for effecting movement of the carrier, said means comprising a pair of crank shafts on which the carrier is mounted, a pinion on each of said shafts, a drive shaft having a gear hub thereon, gear segments carried by said hub each of which meshes with one of said pinions, means for adjustably securing said segments to the hub, and means for locking said segments to the hub in an adjusted position, and means for oscillating said drive shaft.

3. A metal-working machine having a plurality of dies and means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier provided with spaced frame members, finger supports mounted between said members, blank gripping fingers supported by said supports, means for effecting movement of the carrier, said means comprising a pair of crank shafts on which the carrier is mounted, a pinion on each of said shafts, a drive shaft having a gear hub thereon, gear segments carried by said hub each of which meshes with one of said pinions, means for adjustably securing said segments to the hub, and means for locking said segments to the hub in an adjusted position, means for oscillating said drive shaft, and means for adjusting the angle of oscillation of said drive shaft.

4. In a metal-working machine having a plurality of dies, means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier, a spindle rotatably mounted in the carrier but restrained from axial movement with respect thereto, gripping fingers carried by said spindle substantially in line with the axis of the spindle, means for oscillating said carrier to move said fingers in an arcuate path parallel to the face of the dies to move the blank clear of the dies and from one die to the next, and means for rotating said spindle about an axis in said plane during such movement to present the blank to the next die in reversed position.

5. In a metal-working machine having a plurality of dies, means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier, a spindle rotatably mounted in the carrier but restrained from axial movement with respect thereto, gripping fingers carried by said spindle substantially in line with the axis of the spindle, means for oscillating said carrier to move said fingers in an arcuate path parallel to the face of the dies to move the blank clear of the dies and from one die to the next, and means for rotating said spindle about an axis in said plane during the oscillating movement to present a different predetermined portion of the blank to the die.

6. In a metal-working machine having a plurality of dies, means for transferring the workpiece from one die to an adjacent die, said means comprising a carrier, a spindle rotatably mounted in the carrier, gripping fingers carried by said spindle substantially in line with the axis of the spindle, means for oscillating said carrier to move said fingers in an arcuate path parallel to that of the face of the dies to move the blank clear of the dies and from one die to the next, and means for rotating said spindle about its axis during a part only of said oscillating movement to reverse the blank during such movement.

7. In a metal-working machine having a plurality of dies, means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier, a spindle rotatably mounted in the carrier, gripping fingers carried by said spindle substantially in line with the axis of the spindle, means for oscillating said carrier in an arcuate path in a plane substantially parallel to that of the face of the dies to move said fingers from one die to the other, and means for rotating said spindle about its axis through an angle of substantially 180 degrees during a part only of said movement.

8. In a metal-working machine having a plurality of dies, means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier, a spindle rotatably mounted in the carrier, work-gripping fingers carried by said spindle substantially in line with the axis of the spindle, means for oscillating said carrier in an arcuate path in a plane substantially parallel to that of the face of the dies to carry the work clear of the dies and move it from one die to the next, means for restraining said spindle against rotation during the first and last portions of the movement of the carrier and means for effecting rotation of the spindle about an axis in the plane of movement of the carrier during the intermediate portion of such movement to present a different predetermined portion of the blank to the die.

9. In a metal-working machine having a plurality of dies, means for transferring a workpiece from one die to an adjacent die, said means

comprising a carrier, a spindle rotatably mounted in the carrier, gripping fingers carried by said spindle substantially in line with the axis of the spindle, means for oscillating said carrier in an arcuate path in a plane substantially parallel to that of the face of the dies to move said fingers from one die to the other, and means for rotating said spindle about its axis during a part only of said movement comprising a pinion on said spindle and a rack mounted in a position normally out of engagement with said pinion, said pinion being moved into engagement with the rack during movement of the carrier.

10. In a metal-working machine having a frame and a plurality of dies carried thereby, means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier, a spindle rotatably mounted in the carrier, gripping fingers carried by said spindle substantially in line with the axis of the spindle, means for oscillating said carrier in an arcuate path in a plane substantially parallel to that of the face of the dies to move said fingers from one die to the other, means for rotating said spindle about its axis during a part only of said movement comprising a pinion on said spindle and a rack mounted in a position normally out of engagement with said pinion, said pinion being moved into engagement with the rack during movement of the carrier, and cooperating means on the frame and spindle for holding said spindle against movement when the pinion is disengaged from the rack.

11. A metal-working machine having a plurality of dies, said machine comprising means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier, finger supports on said carrier and gripping fingers carried by said supports, means for oscillating said carrier in a plane parallel to the plane of the face of the dies to transfer the blank from one die to the other and to move the fingers and work to a position clear of the dies, and means for rotating said fingers about an axis passing through the blank to turn the blank end for end during such transfer, said rotation being effected during the intermediate part of said oscillating movement.

12. A metal-working machine having a frame and a plurality of dies, said machine comprising means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier, finger supports on said carrier and gripping fingers carried by said supports, means for oscillating said carrier in a plane parallel to the plane of the face of the dies to transfer the blank from one die to the other, and cooperating, engaging means on said frame and finger supports for rotating the latter about an axis passing through the blank and parallel to the plane of movement of the carrier, said means being out of engagement during a part of said oscillating movement.

13. A metal-working machine having a frame and a plurality of dies, said machine comprising means for transferring a workpiece from one die to an adjacent die, said means comprising a carrier, finger supports on said carrier and gripping fingers carried by said supports, means for oscillating said carrier in a plane parallel to the plane of the face of the dies to transfer the blank from one die to the other and to carry the work clear of the dies, cooperating means on said frame and finger supports to rotate the latter about an axis passing through the blank and parallel to the plane of movement of the carrier to turn the blank end for end during such transfer, and said cooperating means being adapted to be interengaged to effect such rotation only during an intermediate part of the transfer movement.

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