May 22, 1945. F. W. BRAENDEL ET AL 2,376,335

ART OF MAKING GROOVED PINS AND THE LIKE

Filed July 22, 1942 4 Sheets-Sheet 1

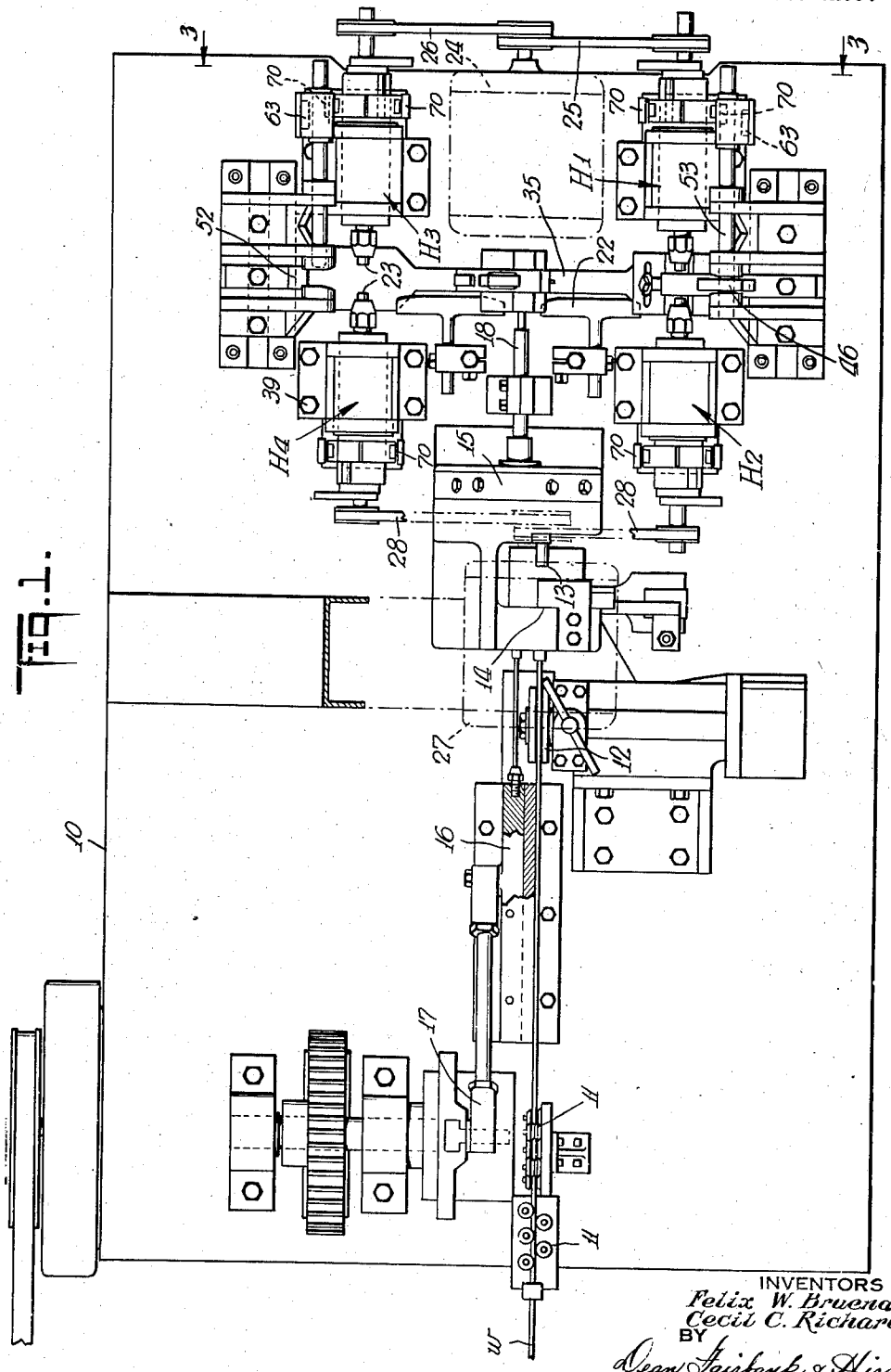


Fig. 1.

INVENTORS
Felix W. Braendel
Cecil C. Richards
BY
Dean Fairbank & Hirsch
ATTORNEYS

42-77

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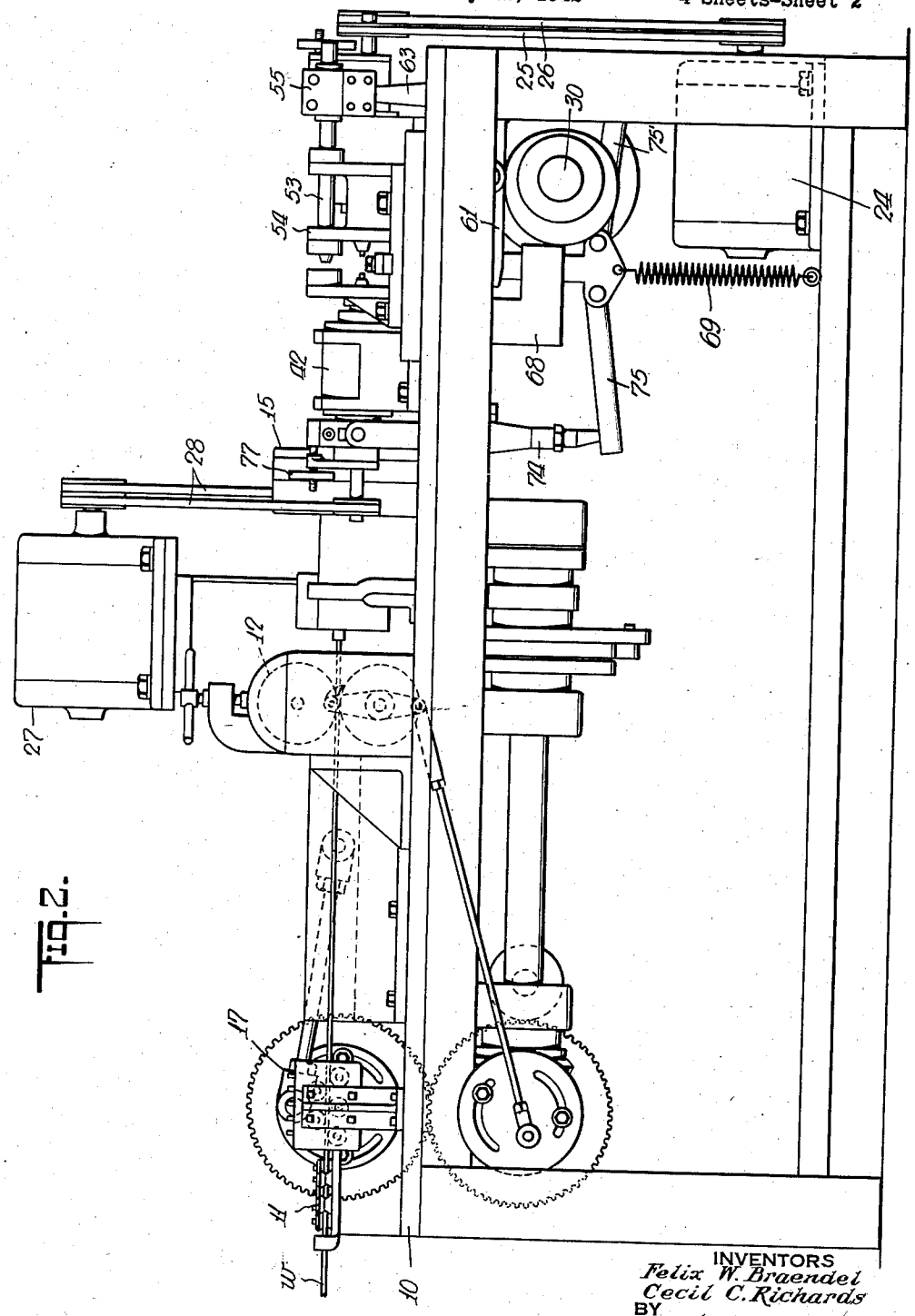


FIG. 2.

INVENTORS
Felix W. Braendel
Cecil C. Richards
BY
Dean Fairbank & Hirsch
ATTORNEYS

May 22, 1945. F. W. BRAENDEL ET AL 2,376,335

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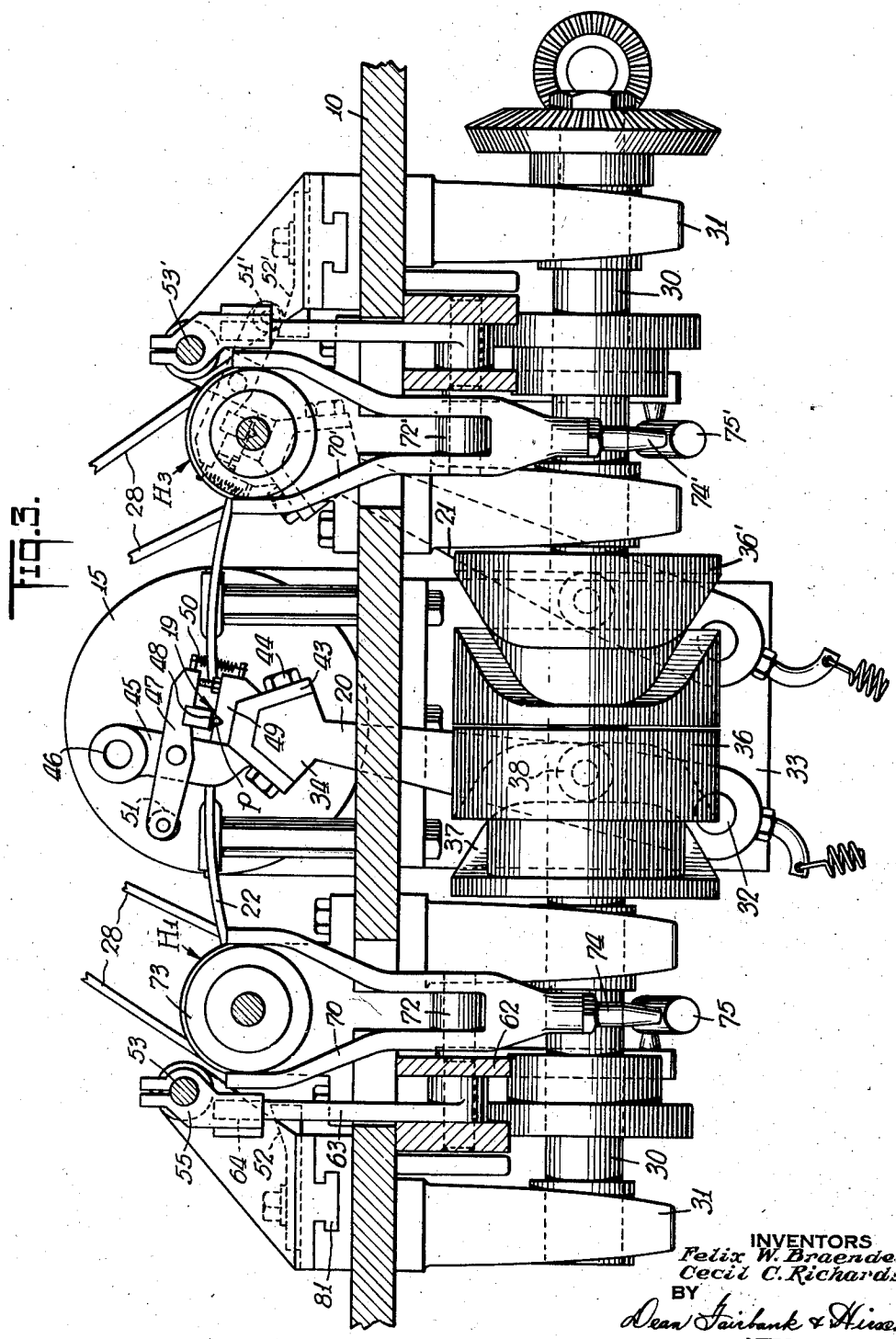


Fig. 3.

INVENTORS
Felix W. Braendel
Cecil C. Richards
BY
Dean Fairbank & Hirsel
ATTORNEYS

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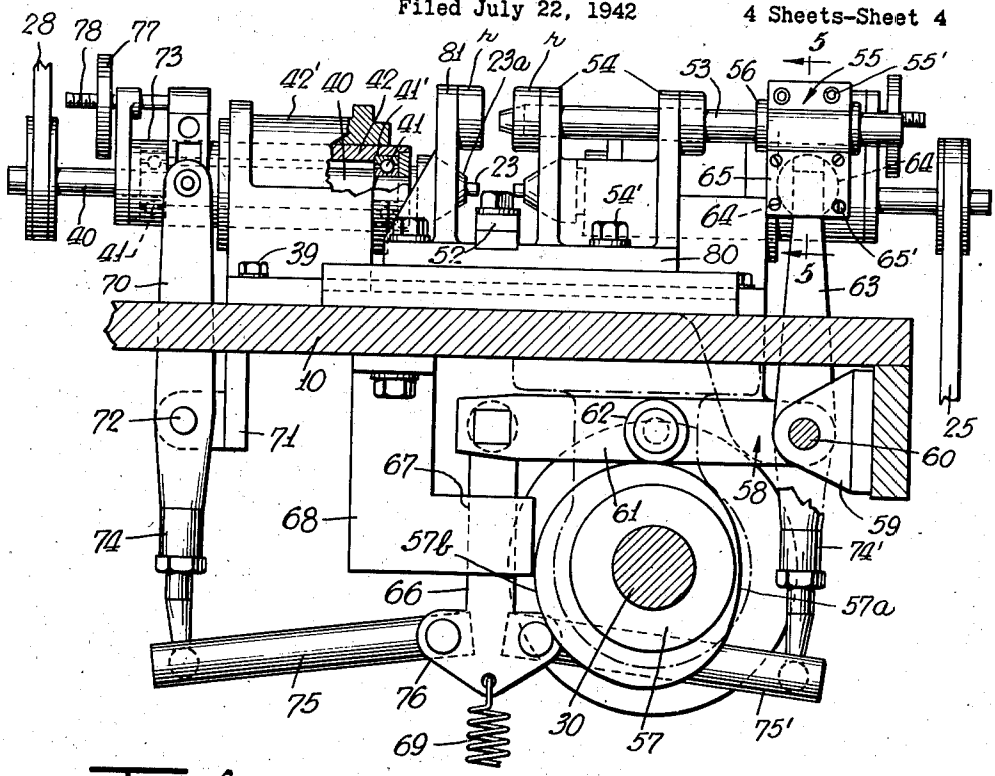


Fig. 4.

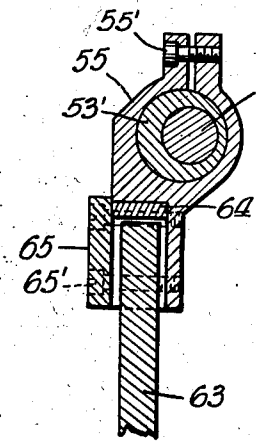


Fig. 5.

INVENTORS
Felix W. Braendel
Cecil C. Richards
BY
Dean Fairbank & Hirsch
ATTORNEYS

42-77

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UNITED STATES PATENT OFFICE

2,376,335

ART OF MAKING GROOVED PINS AND THE LIKE

Felix W. Braendel, Union City, and Cecil Charles Richards, West New York, N. J., assignors to Groov-Pin Corporation, Union City, N. J., a corporation of New York

Application July 22, 1942, Serial No. 451,890

22 Claims. (Cl. 29—34)

The present invention relates to automatic machinery for the quantity production of machined pieces, by a sequence of steps which may include some inherently fast and at least one inherently slow machining operation and the specific application disclosed relates to the manufacture of longitudinally grooved and end milled fastening pins or rods widely known as "Groov-Pins."

The invention is an improvement upon that of our copending application, Serial No. 412,132, filed September 24, 1941. The improvement is more especially concerned with the construction, and control of the transfer mechanism which picks up the work and moves it to the milling equipment, securely retains it during the milling operation and then returns and releases the finished piece, as a fresh piece is picked up by the transfer mechanism.

It is among the objects of the invention, greatly to improve the transfer carriage and associated holding mechanism by considerable simplification in the construction thereof and reduction in the weight and inertia of the moving parts to render the machine more speedy in operation, and also to simplify and render more secure and accurate the locking or chucking of the work in the milling operation, to eliminate sliding parts of large area and the difficulty of lubricating the same, to eliminate the disturbance in operation due to the accumulation of metal chips on the bed of the machine, and finally to render the parts of the machine more readily accessible, without increase in its overall dimensions.

While the invention finds its preferred application as an improvement of the machine set forth, it will be understood that its principle and construction are applicable to other machines.

In the drawings in which is shown one of various possible embodiments of the several features of this invention,

Fig. 1 is a plan view of the machine,

Fig. 2 is a side elevation thereof,

Fig. 3 is a transverse sectional view on an enlarged scale, taken on line 3—3 of Fig. 1,

Fig. 4 is a view on a larger scale with portions in section of the parts shown at the right of Fig. 2, and

Fig. 5 is a sectional detail on an enlarged scale taken on line 5—5 of Fig. 4.

Referring now to the drawings, the machine in its general outline follows closely that of the prior application above-identified. Briefly described, the machine comprises a bed 10 upon which wire w from a suitable reel (not shown) is drawn past a wire straightener 11 of conventional construction, by a wire feed 12 for the end to abut the stop gauge 13. Shearing mechanism 14 cuts off desired lengths of wire and shifts the same into alignment with the grooving die 15 into which it is pushed by pusher mechanism 16 operated from crank 17. The successive severed lengths of wire or other work pieces are routed in regular sequence to a plurality of milling equipments which inherently operate more slowly than the cutting and grooving instrumentalities, and conjointly or collectively operate at the speed of said faster operating instrumentalities.

In the particular embodiment shown, the severed and grooved pins emerge from the grooving die through a discharge tube 18 to be taken up by the chuck 19 on the transfer carriage 20 or 21. Transfer carriage 20 shifts every other pin (i. e. the first, third, fifth, etc.) from the grooving die discharge 18 to be end milled between the opposed pair of end milling heads H_1 and H_2 at one side of the grooving die discharge. The other transfer carriage 21 shifts the intervening alternate pins (i. e., the second, fourth, sixth, etc.) from the grooving die discharge 18 to be end milled between a corresponding pair of like end milling heads H_3 and H_4 similarly arranged at the other side of said discharge. As in the companion case, guide tracks 22 laterally of the grooving die discharge serve to shift the respective pins longitudinally in the chuck to dispose the same symmetrically of the chuck (hereafter to be described) so that they become properly centered between the end milling cutters 23.

The invention as thus far described is not per se claimed herein as it is part of the subject matter of the earlier application above-identified.

In the present application, a single electric motor 24 constantly drives the two end milling heads H_1, H_3 at the extremity of the bed and does this through belts 25 and 26 respectively. A companion electric motor 27 similarly drives the remaining two end milling heads, H_2 and H_4 respectively opposed to those just set forth by a similar arrangement of belts 28. The two milling heads that operate on opposite ends of one pin (i. e., H_1 and H_2 as well as H_3 and H_4) are driven in opposed directions.

The particular pin transfer and end milling arrangement with which this invention is especially concerned will now be set forth.

According to the invention the cam shaft 30 from which the pin transfer and the milling head movement and the various locking actions are controlled, is supported in hangers 31 under the bed 10 of the machine, and is driven from an

electric motor (not shown). The pin transfer carriage in the present invention comprises a lever or arm 20 fulcrumed or pivoted at its lower end at 32 in bracket 33, its upper end protruding above the bed through a longitudinal slot 35 therein. A drum-type cam 36 upon the cam shaft 30 affords a track 37 for cam roller 38 upon the transfer lever 20, thereby to bring about the oscillation of said lever from the position shown in full lines (Fig. 3) in which it takes on the work, to transfer it to a position of axial alignment between the end milling heads H_1 and H_2. As indicated, there are two companion cams 36 and 36' and transfer carriage levers 20 and 21 are so relatively arranged and timed that the movement of each lever from the end milling position to the work pick-up position and return to the end milling position occurs while the companion transfer lever is in stationary position for end milling of the pin carried thereby.

Each end milling head (H_1, H_2, H_3 and H_4) includes a rotating shaft 40 driven from the corresponding drive belt and carrying the end milling tool 23 in a chuck 23a at the milling end. The shaft 40 is lodged in a journal 42 presenting shoulders 41' that mount the ball bearings 41 and said journal is slidably lodged in a jacket 42'.

A work gripping base 43 that includes an anvil plate 49 is bolted at 44 upon the correspondingly shaped upper end 34 of the transfer lever. Said base 43 has a unitary upstanding lug 45 with means, desirably an eye 46 at its upper end that serves for locking the transfer carriage in end milling position in manner to be described hereinafter. Pivoted to the lug 45 is a lever 47 which carries a chuck piece 48 and a connecting coil spring 50 urges the chuck to closed position, resiliently to grip the pin p or other work when the same is fed into the chuck from the discharge outlet 18 of the grooving die 15 or other working tool or work delivery appurtenance.

The free end of the lever 47 has a roller 51 which engages the cam stop 52 shown as an inclined surface upon the bed 10 at the final portion of the transfer lever movement. Thereby the lever is pivoted slightly in clockwise direction, firmly to grip the pin p or other work at that stage in order to retain it against displacement during the end milling operation.

Means is provided for locking the transfer lever when in machining position against rocking about its fulcrum, and it is also held against shifting or bending in direction at right angles to its fulcrum axis.

For locking the transfer carriage lever itself in end milling position, there is provided a cam positioned member, desirably a latching bolt 53 mounted in bearings 54. Said bearings are on standards rising from base 80 from which rises also the standard 81 that serves as a support for the extreme end of the bolt 53 when in latched position. When the transfer lever is in its extreme outermost or end milling position, its eye 46 is interposed between standard 81 and the contiguous standard 54, for the bolt end to pass through said eye in its traverse from the bearing in said standard 54 to the bearing in standard 81.

The right face of standard 81 and the left face of contiguous standard 54 are provided with rings r through which the latching bolt 53 extends, which rings afford but slight clearance with respect to the sides of eye 46 on lever 20, so that any rocking or bending of the latter about an axis at right angles to its pivot 32 is substantially prevented. The rings r are beveled as shown, so that the upper part of the lever readily enters between them. The chuck carried by the lever is thus securely retained against movement in any direction during the end milling operation, for it is held by bolt 53 against shifting about the pivot 32 and by rings r against shifting along the bolt 53.

For operating the latch bolt 53 in timed relation, it is provided with a head 55 tightly clamped at 55', about the bolt 53. An operating cam 57 upon the shaft 30 serves to move the latching bolt through a bell crank lever 58 pivoted at 60 upon bracket 59, one arm 61 of which comprises a cam follower, and to that end has a roller 62 riding upon the cam, the other arm 63 thereof having a pair of segment shaped plates 64 fitting into a corresponding flat circular recess in the lower end of bolt head 55 and held in place by screws 65' through a cover 65 against the lower face of said head.

At the outer end of the cam follower arm 61 is pivoted a drawbar 66 arranged to slide through a corresponding bore 67 in bracket 68 and a powerful coil spring 69 hooked to said drawbar urges the same downward to press the follower roller 62 against the cam 57. Thus, as the cam rotates the spring 69 pulls the bell crank lever 58 downward against its depressed part 57a and correspondingly pivots lever 63 counterclockwise in Fig. 4 to move the bolt 53 into and through the eye 46 of the transfer lever 20 which had previously been moved to its extreme or end milling position snugly between disks r, for entry of the extremity of said bolt 53 into the bearing in standard 81. The curve of the cam 57 is such that the transfer lever is kept in latched position throughout the end milling operation.

The end milling is controlled by the movement toward each other of the end milling heads H_1 and H_2 between which the workpiece is held for such end milling. Desirably, the same cam 57 which effects the latching also controls this movement of the end milling heads. To this end a yoke 70 pivoted at 72 on a bracket 71 straddles the extension 73 of the journal 42. The stem 74 of the yoke extends downward below its pivot bearing 72 and is pivotally connected by means of a link 75 to a wing 76 on the lower end of the drawbar 66. A like construction of link 75' and yoke 74' shown broken away, is symmetrically arranged for control of the other end milling equipment H_3, H_4. It will immediately be seen that as the follower arm 61 is urged downward by spring 69 to keep the cam roller 62 in contact with the depressed part of the cam the downward movement of the drawbar 66 causes the links 75 and 75' to push the stems 74 and 74', of the yokes 70 and 70' apart and correspondingly to move the forks of said yokes inward about their respective pivots 72 to bring the end milling tools in engagement with the work and to advance the same toward each other as the end milling occurs in the continued rotation of the milling tools. As the rise 57b of the cam 57 reaches the cam roller 62, the cam follower arm 61 is lifted about pivot 60 and arm 63 moves outward to withdraw bolt 53 from the bearing in standard 81 and from the eye 46 on the transfer carriage. The simultaneous lifting of drawbar 66 will cause the milling heads H_1, and H_2 at the same time to recede from each other away from the interposed end-milled pin p. The drum cam 36 now becomes

effective to withdraw the transfer carriage lever 20 from milling position, to pick-up position aligned with the grooving die discharge 18. As best shown in Fig. 3, the construction of cam, bolt and yoke described and shown at the left is duplicated at the right side of the machine, corresponding parts bearing the same reference numerals primed.

At 77 is shown an adjustment for determining the initial position of the extension 73 of journal 42 and the end milling head carried thereby. The details need not be described, since they correspond closely to the showing in our copending application.

Means is provided for adjustment of the latching bolt 53 to assure accurate centering thereof with respect to the eye 46. The bolts 54' pass through transverse elongated slots (not shown) in base 80 to permit such adjusting. Adjustment at the shift lever end 63 is effected by a hub 53' in the head 55, which has an eccentric bore that houses the bolt 53. Hub 53' is turned from its flange 56 to permit adjustment conforming to that of base 80.

Means is provided for adjusting the machine for producing pins of any desired length. To this end the work gripping base 43 is adjustable to set the distance of the chuck on the transfer lever with respect to the grooving die discharge 18. To this end gripping base 43 has elongated slots (not shown) for screws 44. The base 80 has a longitudinal key mount 81 on the bed 10, so that said base may be moved longitudinally and tightened in adjusted position in which disks r will flank the eye 46 when the transfer lever is in end milling position, and cam stop 52 on said base will be in the path of roller 51.

The operation will be obvious from the foregoing description, but will be briefly summarized.

As a result of the operation of those parts of the machine that were briefly described in the foregoing, when the transfer lever 20 is in its extreme or take-on position, the work, shown in the form of a short pin p, is pushed into place between anvil plate 49 and gripping lever 47. The spring 50 keeps the pin in position as the drum cam 36 pivots said transfer lever outward to interpose the pin p into alignment between the opposed end milling tools 23 of heads H_1 and H_2. In the traverse of the transfer lever outward to end milling position the ends of the spring-held grooved pin or workpiece move along the inclined tracks 22 and are thereby pushed into symmetrical position with respect to the transfer lever by which they are carried. As the transfer lever reaches its extreme position, roller 51 thereon reaches the cam stop 52 to be thereby pivoted slightly, firmly to clamp the pin in position.

As the transfer carriage reaches its outermost position, its eye 46 enters between the disks r as the depressed portion 57a of the cam 57 moves toward the roller 62 and the spring 69 pivots the bell crank lever 58 to move the bolt 53 as shown in Fig. 4 to the left to traverse and bolt the eye 46, the extremity of bolt 53 entering the bore in standard 81, thereby to lock the transfer lever carriage firmly in position, so that there is no possibility of displacing the pin p locked thereon in the course of the end milling operation.

As the drawbar 66 is spring-urged downward in the rotation of the cam 57 it spreads the links 75, 75' apart, causing the forks of the yokes 70, 70' to pivot inward toward each other and to move the end milling heads into engagement with the interposed pin p and to keep that engagement in the continued movement thereof as the end milling is performed by the continuous belt drive of the end milling tools from motors 24 and 27. As the end milling takes place on pin p the companion transfer lever 21 will have moved from its end milling position toward the left back to take-on position for picking up a pin (which latter incidentally ejects the previously finished end milled pin) and transports the pin just taken on to the end milling position at the right.

It will be understood that in the operation set forth, the rotation of the cam 57 causes the enlargement thereof to reach the roller 62 and to raise the latter against the resistance of spring 69, thereby to withdraw the latch bolt 53 from standard 81 and the eye 46 and to withdraw the end milling heads outward for release of the transfer carriage therebetween to permit its return to take-on position under the continued operation of cam 57 and against the resistance of spring 69.

It will be seen that the transfer carriages are levers that are light in weight compared to the sliding transfer carriages used in the earlier application, so that the inertia of the moving parts is considerably reduced. Accordingly, the machine may be operated at greater speed, as much as fifty per cent faster than the machine disclosed in the copending application above identified, for higher production and this with a minimum of shock, impact and wear of the machine parts. The latch bolt construction for locking the transfer carriage in end milling position is also considerably simplified as compared to the prior construction and is inherently accurate and precise. The simple bolt 53 by coaction with the eye 46 of the pivoted transfer carriage lever, in turn positioned between disks r inherently affords a secure lock in all directions. The transfer carriages moving freely through slot 35 in the bed 10, there is no danger of fouling sliding bearing parts with chips of metal and the problem of lubricating such sliding carriage parts is eliminated. The machine presents a relatively open and uncrowded bed affording ready access to various parts, and without increase in the overall dimensions of the machine shown in the earlier application.

It will, of course, be understood that while two sets of machining tools are shown and are ordinarily sufficient, the invention could be embodied in a machine having three, four or more sets of such machining equipments.

The invention is not limited to the fabrication of units from round wire, but is likewise applicable to the preparation of units from tubular stock and the cross section of the solid or tubular stock may be square, hexagonal or of any polygonal, oval or other shape required for the particular performance in hand.

It will be understood that the term "machining" used in many of the claims is intended to embrace within its scope a wide variety of operations including milling, grinding, upsetting, swaging, spinning, drilling, broaching, tapping, finishing and buffing, as well as such operations as the production of flats and of slots including tangential and filister slots.

The term "end milling" as used in many of the claims is not necessarily limited to the application of the tool against the extremity of the

work, but operations along the side face of the work adjacent the end are embraced within its scope, such operations including, for instance, the machining of taper ends or reduced cylindrical tips or the threading of the end portion of the work.

It is of course within the scope of the invention to machine the work at or near only one end thereof, or to perform operations of different or distinct character at or near the opposite ends of the pin or other work.

From the foregoing it will appear that the invention is not limited in its application to the preparation of units that serve as fasteners such as the "Groov-Pins" above identified, but is applicable to the fabrication of a wide variety of products including rollers for roller bearings, shoulder studs, threaded or unthreaded, door knob spindles and the like.

It will also be understood that if desired the product after it leaves the machine may be fed to another machine of like or different construction for further machining or processing.

As many changes could be made in the above mechanism and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

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

1. In an automatic machine of the type for performing a sequence of machining operations including an inherently fast operation and a relatively slower machining operation, and having a single equipment for performing the relatively fast operation, and a plurality of machining equipments for operating conjointly at substantially the rate of the fast operating equipment, and means for selectively routing the work in regular succession between the plurality of slow machining equipments and the single fast operating equipment; the combination in which the selective routing means comprises a plurality of levers each equipped with a work holding chuck rigidly mounted thereon and means for moving said levers about the respective fulcrums thereof in timed sequence between the fast operating equipment and the respective more slowly operating machining equipments, said means being constructed and arranged to position the chuck for each machining operation.

2. In an automatic machine of the type for performing a sequence of machining operations, including an inherently fast operation and a relatively slower machining operation, and having a single equipment for performing the relatively fast operation, and a pair of machining equipments for operating conjointly at substantially the rate of the single fast operating equipment, and means for selectively routing the work alternately between the pair of machining equipments and the single fast operating equipment; the combination in which the routing means comprises a pair of levers, each fulcrumed at one end thereof, work holding chucks each rigidly affixed to the other end of the corresponding lever, cam means for oscillating said levers in sequence between the associated machining equipment and the single fast operating equipment, said cam means affording a dwell for maintaining the work on the end of the lever in position for the slow machining operation.

3. In an automatic machine for performing a sequence of machining operations including an inherently fast operation and a relatively slower machining operation, said machine having equipment for performing the inherently fast operation and having a pair of machining equipments for operating conjointly at substantially the rate of the fast operating equipment; the combination in which a pair of levers each fulcrumed near one end thereof each has a work carrying chuck rigidly carried by the other end thereof, a work feeder interposed midway between the pair of machining equipments for delivering the work pieces alternately to the chucks, as the latter are alternately aligned therewith, cams coacting with the respective levers to cause the latter to oscillate between the work feeder and the respective machining equipments, and automatic means for affixing the outer end of each chuck holding lever while in machining position.

4. An automatic machine of the character described, comprising a bed, a pair of machining equipments upon said bed, a work feeder midway between said machining equipments and transfer mechanism for picking up the successive pieces of work from said feeder and routing the alternate pieces to the respective machining equipments, said transfer mechanism comprising a pair of levers each fulcrumed at one end thereof, having work-holding chucks rigidly mounted upon the other end thereof, and cams coacting with the respective levers for pivotally moving each from the pick-up position to the machining position, the cams affording a dwell for the latter position during which movement of the companion lever is effected from machining position to pick-up position and return.

5. An automatic machine of the character described comprising a bed, two sets of machining equipments thereon in substantially parallel relation, a supply of work pieces to be machined, delivering midway between said machining equipments and transfer mechanism for picking up and delivering alternate work pieces from the supply to the respective machining equipments, said transfer mechanism comprising a pair of levers pivoted below the bed and extending upward through a corresponding slot in the bed, each of said levers having a work-holding spring-closed chuck rigidly affixed upon the upper end thereof, cam means for oscillating said levers in timed relation between the associated machining equipment and the pick-up position, said cam means being arranged to permit substantially the complete oscillating stroke of each lever to occur during the machining operation upon the work held in the other.

6. An automatic machine of the character described, comprising a bed, two sets of machining equipments thereon, in substantially parallel relation, a supply of work pieces to be machined, delivering midway between said pairs of machining equipments and transfer mechanism for picking up and delivering alternate work pieces to the respective machining equipments, said transfer mechanism comprising a pair of levers fulcrumed below the bed and extending upward through a corresponding slot in the bed, each of said levers having a work-holding spring-closed chuck rigidly affixed upon the upper end thereof, cam means for oscillating said levers between the pick-up position and the respective machining equipments, said cam means and the

corresponding movement of said levers being in timed relation, to permit substantially the entire oscillating stroke of each lever to occur during the machining operation upon the work held in the other, and automatically releasable means to secure the upper part of the work transfer lever in fixed position during the machining operation.

7. An automatic machine of the character described, comprising a bed, two sets of machining equipments thereon, in substantially parallel relation, a supply of work pieces to be machined, delivering midway between said pairs of machining equipments, and transfer mechanism for picking up and delivering alternate work pieces to the respective machining equipments, said transfer mechanism comprising a pair of levers pivoted below the bed and extending upward through a corresponding slot in the bed, each of said levers having a work-holding spring-closed chuck rigidly affixed upon the upper end thereof, cam means for oscillating said levers in timed relation between the pick-up position and the respective machining equipments, said cam means and the corresponding movement of said levers being in timed relation to permit substantially the entire oscillating stroke of each lever to occur during the machining operation upon the work held in the other, and means to tighten the gripping effectiveness of the chuck upon the work preparatory to and to maintain it tight during the machining operation.

8. In apparatus of the character described, a bed, machining equipment thereon, a chuck for holding the work to be machined, means for transferring said chuck to bring the work into coaction with the machining equipment, said means comprising a rocking lever fulcrumed at one end with said chuck rigidly affixed at the other, and means for securely retaining said lever at one end of its rocking movement in machining position, said means comprising a cam positioned member blocking the movement of the lever about its fulcrum, and means laterally of and adjacent both faces of said lever and near the outer end thereof for blocking the displacement of said chuck in a direction at right angles to the pivoting movement of the lever.

9. In apparatus of the character described, a bed, machining equipment thereon, a chuck for holding the work to be machined, means for transferring said chuck to bring the work into coaction with the machining equipment, said means comprising a rocking lever fulcrumed at one end and carrying the chuck at the other, a cam operated bolt rod, means rigid with said lever and near said chuck coacting with said bolt rod for locking said lever against movement about its fulcrum when in machining position, and flanking pieces mounted upon said bed and disposed near said bolt and between which the lever enters with small clearance, for preventing displacement of the chuck end of said lever in a direction lengthwise of said bolt.

10. In apparatus of the character described, a bed, machining equipment thereon, a chuck for holding the work to be machined, means for transferring said chuck to bring the work into coaction with the machining equipment, said means comprising a rocking lever fulcrumed at one end and carrying the chuck at the other, a bolt rod upon said bed, means for shifting said rod to extend through said lever for bolting the lever and the chuck thereon against movement about said fulcrum, and upstanding disks affixed to said bed, aligned with said bolt and closely adjacent to the faces of said lever to block the chuck thereon against displacement in direction lengthwise of the bolt rod.

11. In apparatus of the character described, a bed, machining equipment thereon, transfer means including a chuck for automatically taking the work to be machined, means for transferring said chuck to bring the work into coaction with the machining equipment, said means comprising a rocking lever fulcrumed at one end and presenting an eye at the other, a bolt rod upon said bed and parallel to the fulcrum of said lever, and means for shifting said rod to plug said eye for positioning the lever with its work holding chuck in fixed position during machining.

12. In an automatic machine of the character described, the combination of a bed, two sets of machining equipments upon said bed and in parallel relation, a source of work to be machined, transfer mechanism for transporting alternate pieces of work to the respective machining equipments, said transfer mechanism comprising a pair of levers, each fulcrumed at its lower end below the bed, said levers extending through a corresponding slot in the bed, each of said levers having a chuck rigidly affixed upon the upper end thereof for picking up and retaining a piece of work, and an eye rigid with each lever, cams below the bed coacting with the respective levers for shifting the same alternately between said pick-up position and the respective machining equipments, each of said chucks including a spring-closed jaw member, means on the bed coacting with said jaw member for tightening the work in the chuck when the lever reaches machining position, and means coacting with the outer part of said lever at its said machining position to retain said lever against displacement, said means comprising a latching rod coacting with said eye.

13. In apparatus of the character described, a bed, a pair of machining equipments thereon in parallel relation, each equipment having two opposed heads, a supply of work pieces parallel to and midway between said machining equipments, transfer levers fulcrumed at the respective lower ends thereof, each having rigidly mounted thereon a chuck for picking up and retaining work derived from said supply, and means for moving the respective levers between the pick-up position thereof and the associated machining equipment therefor, each of said levers having an eye rigid therewith near the upper end thereof, a reciprocable latch rod upon said bed, and means to operate said rod to plug said eye, for rigidly positioning the lever in the end machining position of the transfer lever, flanking pieces mounted upon said bed between which said transfer lever extends with small clearance to prevent displacement of the chuck lengthwise of the rod, and means for causing the associated machining equipment to coact with the work thus positioned.

14. In apparatus of the character described, a bed, a pair of end milling equipments thereon, in parallel relation, each equipment having two opposed heads, a supply of work pieces parallel to and midway between said end milling equipments, transfer levers fulcrumed at the respective lower ends thereof, each having rigidly mounted thereon a chuck for picking up and retaining work derived from said supply, and means for moving the respective levers between the pick-up position thereof and the associated end

milling equipment therefor, each of said levers having an eye rigid therewith near the upper end thereof, a reciprocable latch rod upon said bed, and means to operate said rod to plug said eye for rigidly positioning the transfer lever in the end milling position thereof, means for automatically tightening the work in said chuck while in end milling position, and means for thereupon causing the associated end milling equipment to coact with the work thus positioned.

15. In apparatus of the character described, a bed, a pair of opposed end milling heads thereon, a rocking transfer lever having an aperture therein, a chuck rigidly mounted on said lever, means for moving said lever to convey the work and interpose and hold it between said heads for end milling, said means comprising plugging means parallel to said bed, means to operate the same for locking the transfer lever against pivotal movement during end milling operation, means flanking said lever in end milling position to prevent displacement of the chuck in direction at right angles to the pivotal movement of the lever, and means in timed relation with said plugging means for engaging the end milling heads with the ends of the interposed work piece to be milled.

16. In apparatus of the character described a bed, machining equipment thereon, a chuck for holding the work to be machined, means for transferring said chuck to bring the work into coaction with the machining equipment, said means comprising a lever fulcrumed at one end, said chuck being adjustably mounted upon the other end of said lever for varying the position thereof in direction lengthwise of the fulcrum for adaptation to the length of the work to be machined, said lever having a locking eye rigid with the upper end thereof, a base on said bed having standards rising therefrom, a bolt rod in said standards, two of said standards having disks on adjacent faces thereof between which said lever eye extends with small clearance when in bolted position, and means for adjusting said base and with it the position of said disks for proper registry thereof with the adjusted chuck on the lever.

17. The combination recited in claim 16 in which said bed has an inclined cam stop and in which the chuck includes a spring-urged lever having a roller at its outer end operated by said cam stop to tighten the chuck when the lever is in machining position.

18. In a machine of the character described, a bed, a rocking work transfer lever fulcrumed near its lower end, extending upward through a slot in the bed and having rigidly mounted thereon a spring-closed chuck for resiliently gripping a piece of work to be introduced therein at one end of its stroke, a pair of opposed end milling heads on said bed, cam means for shifting the lever from work pick-up position to alignment of the work between the end milling heads, means for driving said end milling heads, means for firmly gripping the transfer lever in end milling position, means for securely tightening the work in end milling position upon the transfer lever, means for advancing the driven end milling heads into milling relation with the ends of the interposed work and a common source of power for operating said chuck positioning, chuck tightening and end miller advancing elements in timed relation.

19. In an automatic machine of the type in which work pieces to be end milled are successively transferred to end milling position and securely locked in place throughout end milling operation, the combination of a bed, a transfer lever fulcrumed near its lower end below said bed, and having a spring-closed chuck affixed upon its upper end, cam means for oscillating said lever from work pick-up position to end milling position, an eye near the upper end of said transfer lever and rigid therewith, means including a latching rod on said bed adapted to plug said eye for fixedly positioning said transfer lever in milling position, a single cam for locking the transfer lever and then shifting the end milling heads against the interposed work, said means comprising a bell crank lever having a fixed pivot, a cam follower carried by one arm thereof, the other arm being anchored with respect to the latching rod, a drawbar pivoted to the free end of said cam follower arm, and a pivoted yoke coacting with the end milling head and connected with said drawbar to move said end milling head into engagement with the work after the transfer lever has been locked in fixed position.

20. In a machine of the character described, a bed, a pair of opposed end milling heads thereon, means for driving the latter, a source of stock upon said bed, spaced from said end milling heads, a transfer carriage comprising a lever fulcrumed at its lower end, a chuck fixedly mounted near the upper part of said lever, cam means for operating said lever and the end milling heads in order to pick up a piece of work from the source of stock and axially position it between the end milling heads and means for securing the stock in position and causing the end milling heads to move toward each other in the end milling operation, said means comprising a cam below the bed, a bell crank lever pivoted below the bed and having a horizontal arm riding on said cam and an upstanding arm, a horizontal latch rod upon said bed, said rod having a head structure coacting with the upper end of said upstanding arm for sliding shift of said rod under the action of said cam, said transfer lever having an eye plugged by said latch rod after said transfer lever reaches milling position, thereby to lock said transfer lever against displacement, a drawbar pivoted at its upper end with respect to the outer part of said horizontal bell crank lever arm, yokes straddling the respective end milling heads, said yokes being pivoted with respect to said bed, and a pair of links connecting said drawbar with respect to the lower extremities of said yokes to cause said yokes to pivot toward each other as the drawbar is moved downward.

21. In apparatus of the character described, a bed, two sets of mutually opposed slidable end milling heads, a source of pins midway between said pairs of end milling heads, means for engaging and transferring alternate pins from said source to position between the respective end milling pairs, means for locking the respective pins in end milling position and for performing the end milling operation, said means comprising a pair of transfer levers, each fulcrumed near its lower end below the bed and each extending upward through a longitudinal slot in the bed, each having a spring-closed chuck affixed near its upper end, each having an associated operating cam for pivoting the lever from pin take-up position midway between the end milling pairs to end milling position, each of said transfer levers having a latching eye near the upper end thereof, an eye latching rod having a slide bearing, means

for shifting said rod to locking position when the transfer lever is in end milling position and means for thereupon sliding the opposing end milling heads toward each other for end milling operation, the transfer lever locking means and the end milling carriage, sliding means comprising a cam below the bed, a bell crank lever pivoted below the bed and having a horizontal arm riding upon said cam and an upstanding arm, a socket rigid with said eye latching rod and housing the upper end of said upstanding arm, a drawbar pivoted to the outer end of the horizontal bell crank lever arm, a spring urging said drawbar downward, yokes straddling the respective end milling heads, each yoke being pivoted below the bed and having a stem below said pivot and links connected between the respective yoke stems and and the lower end of the drawbar.

22. In apparatus of the character described, a work holding transfer carriage having a latch eye thereon, a latch rod, a bearing frame therefor, a cam operated arm for sliding said rod into and out of latching engagement and means for adjusting the position of said rod for axial alignment with said latch eye when the latter is in operating position, said means comprising an adjustment for the position of said bearing frame, a head affixed to said rod and an eccentric hub accommodating said rod in said head.

FELIX W. BRAENDEL.
CECIL C. RICHARDS.