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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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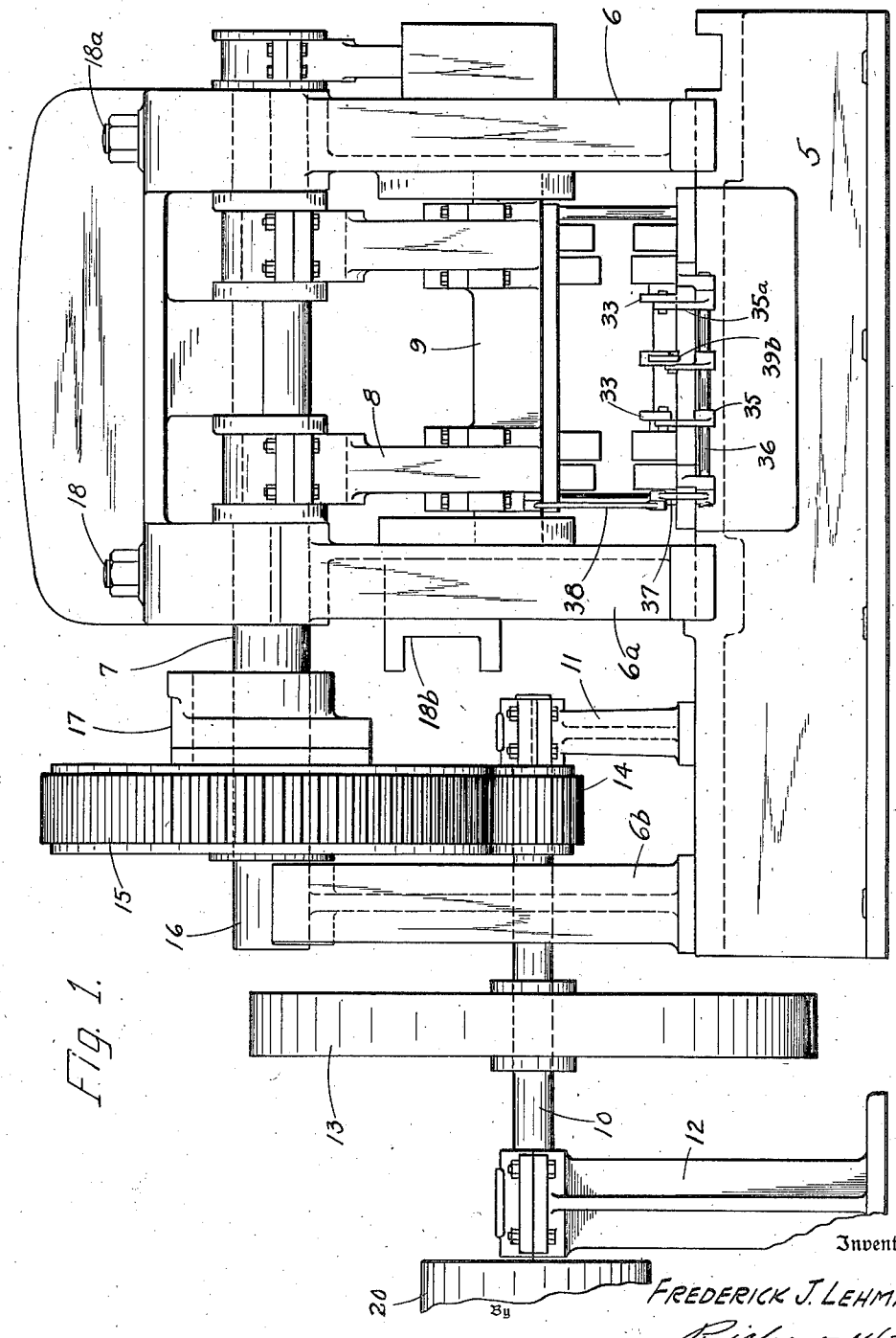


Fig. 1.

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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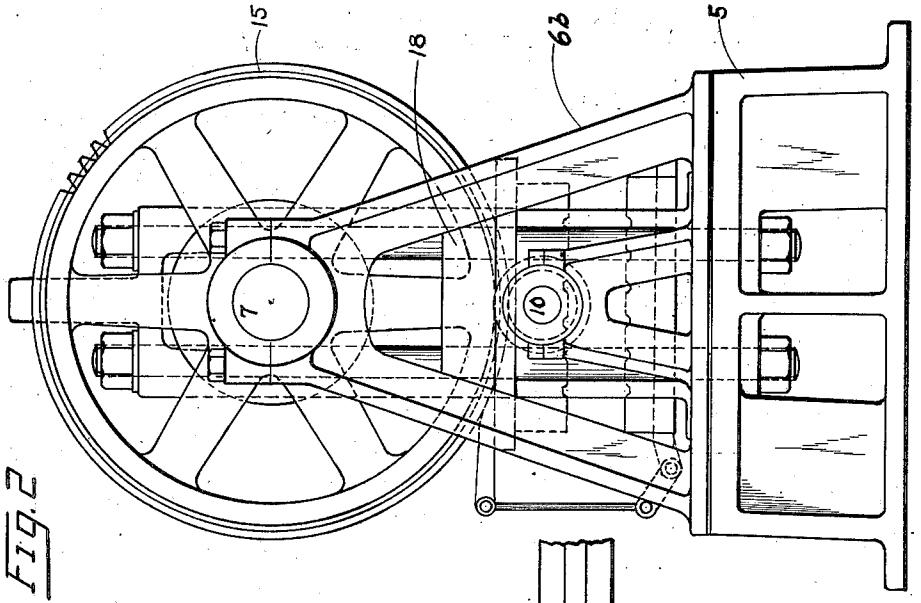


Fig. 2

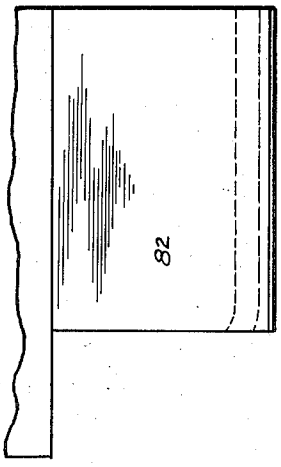
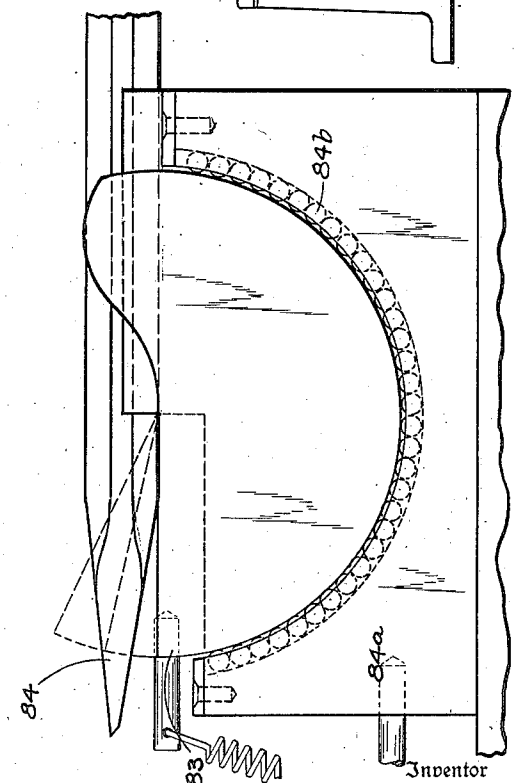


Fig. 12c



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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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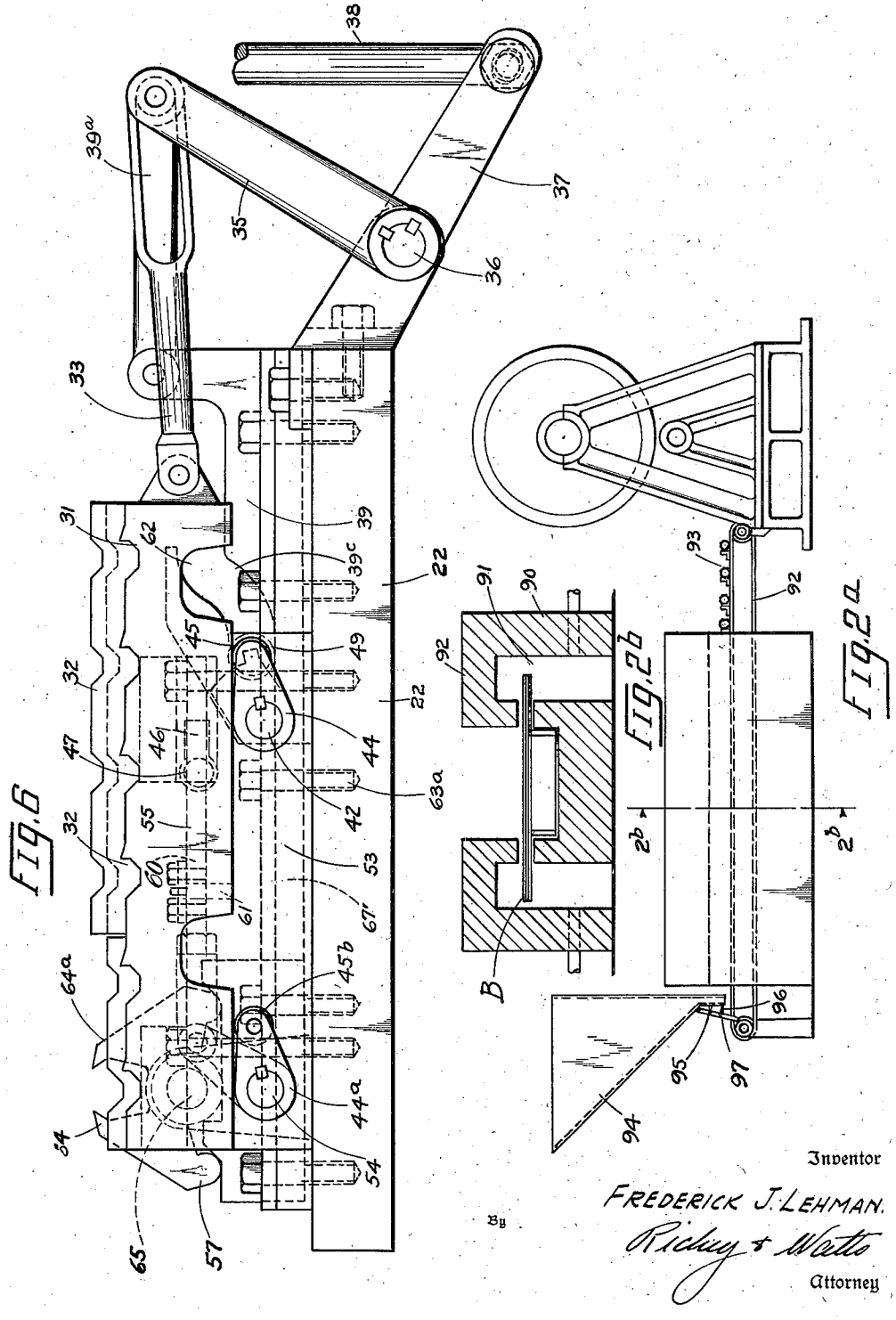


FIG. 6

FIG. 2b

FIG. 2a

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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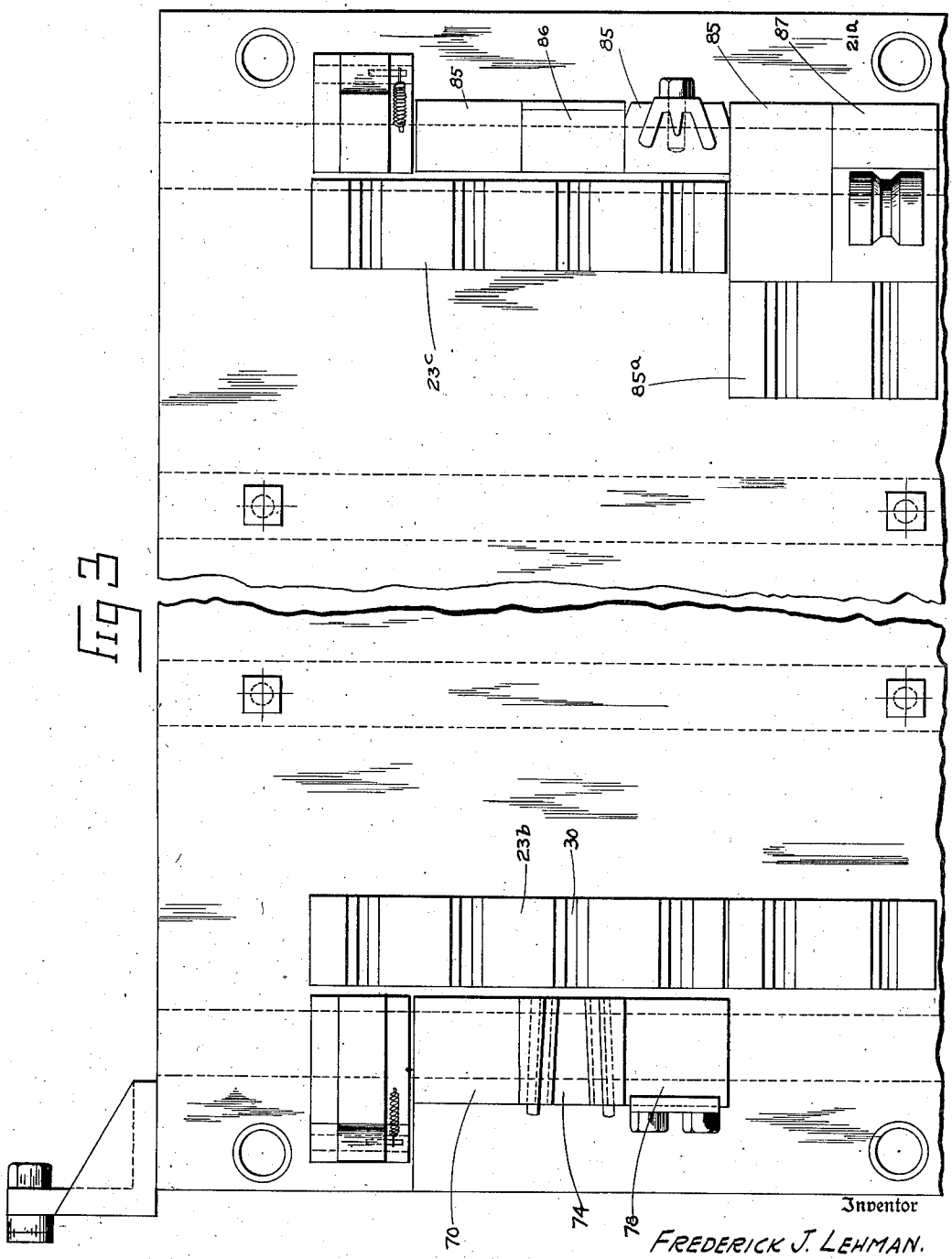


Fig 3

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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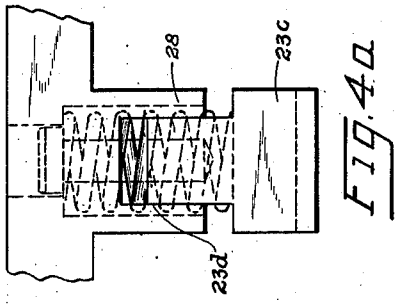


Fig. 4a

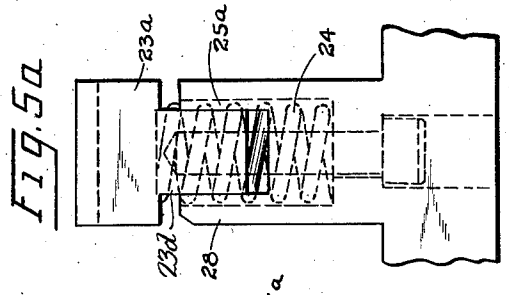


Fig. 5a

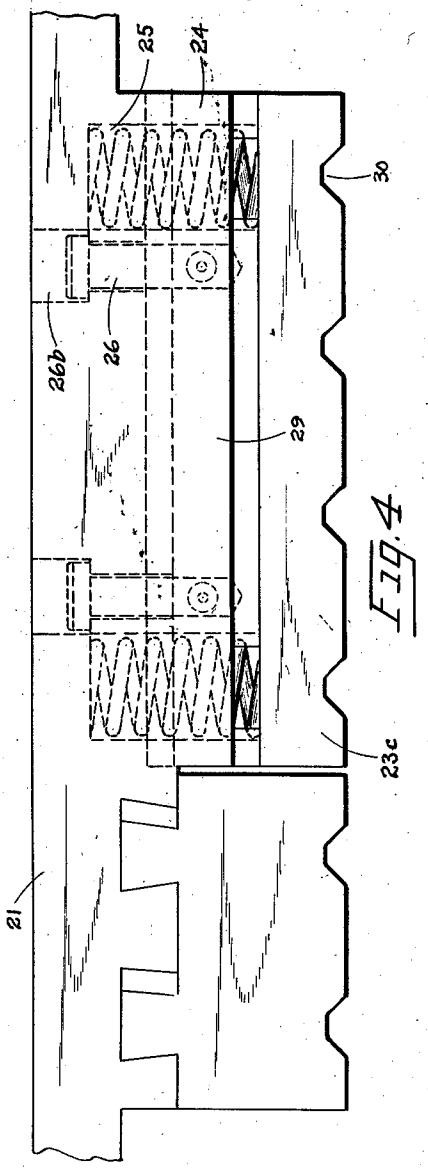


Fig. 4

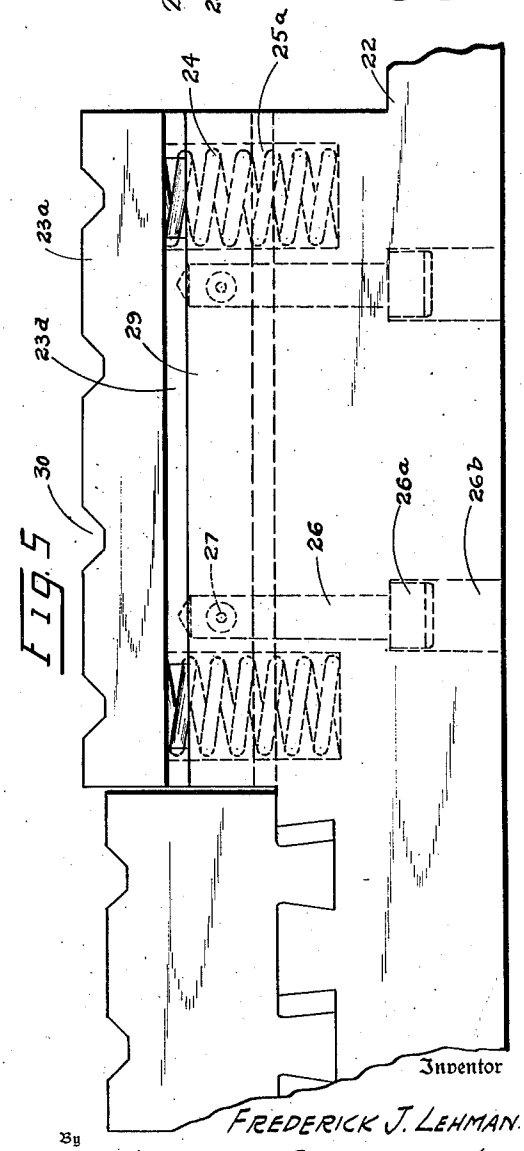


Fig. 5

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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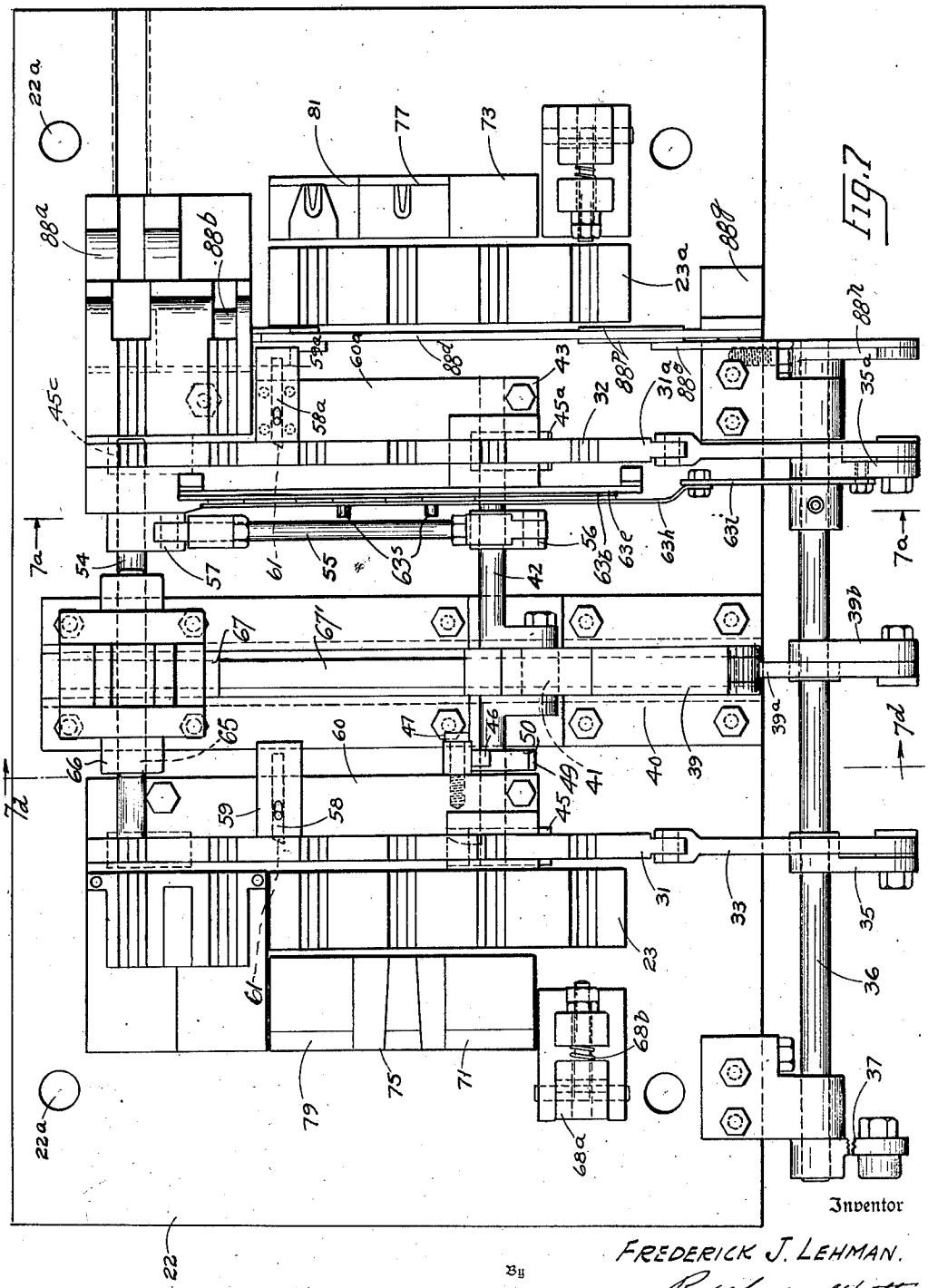


Fig. 7

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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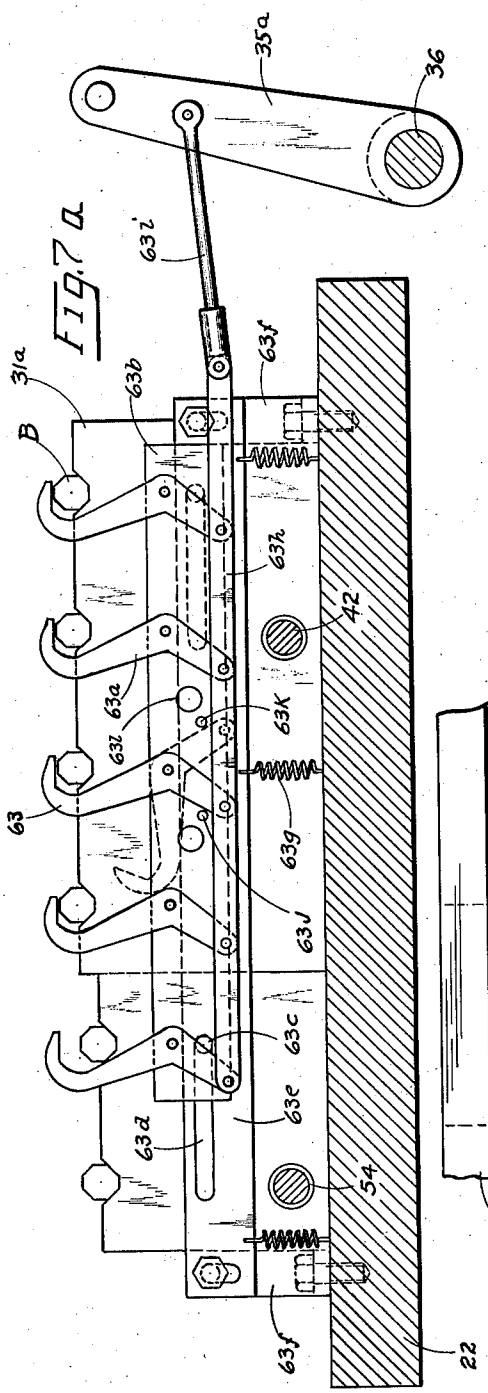


Fig. 7a

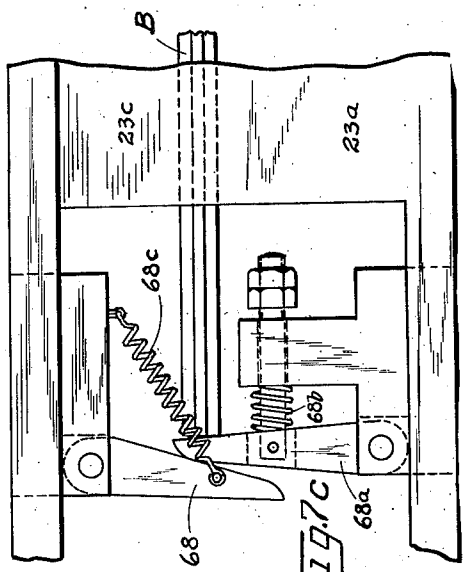


Fig. 7c

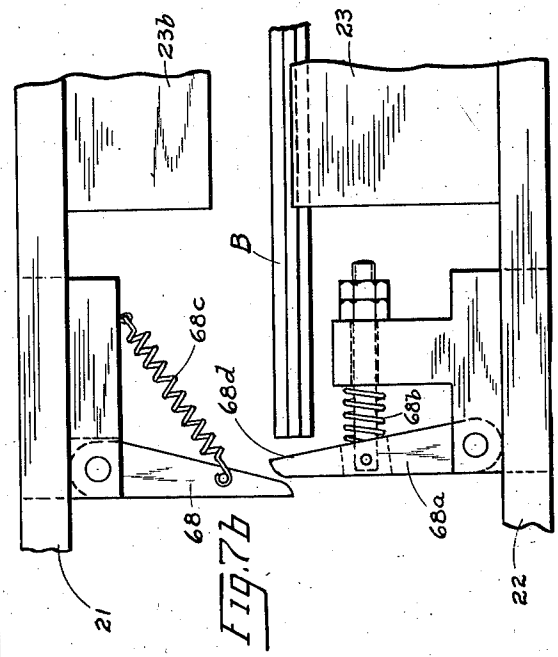


Fig. 7b

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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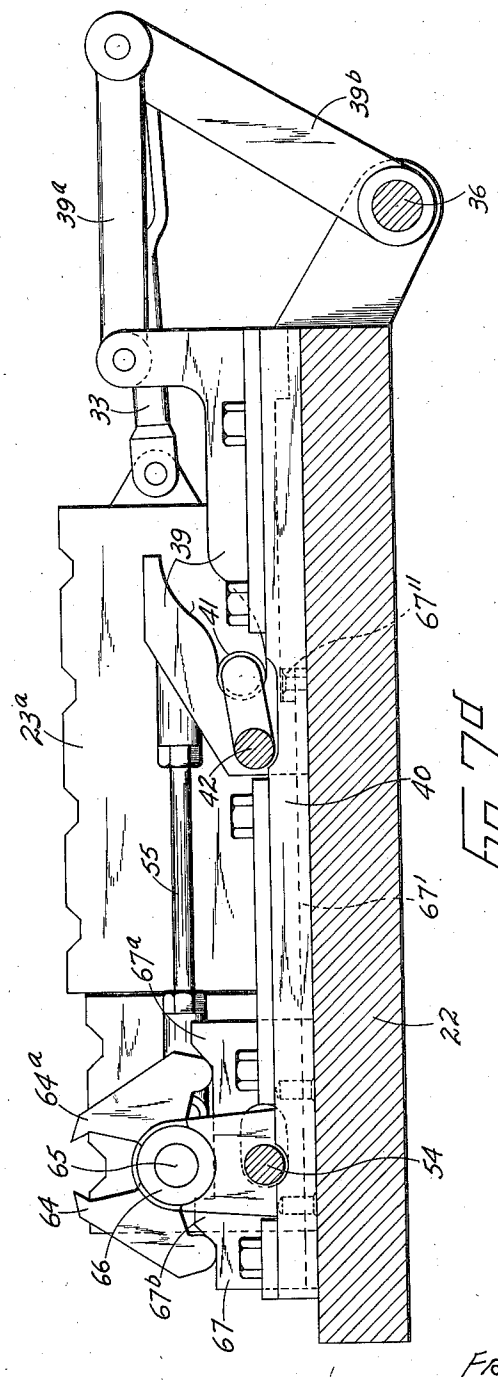


Fig 7a

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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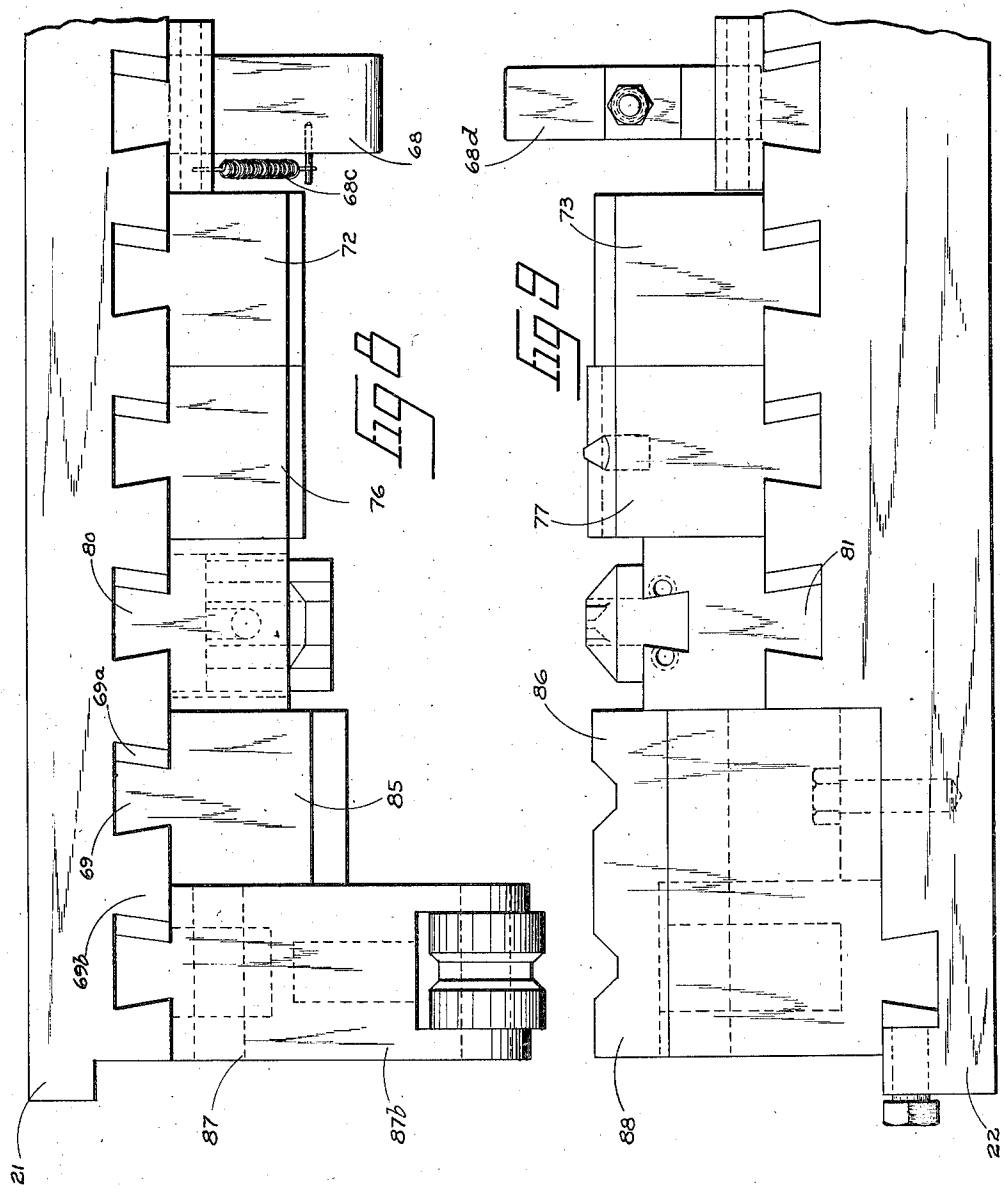


Fig 8

Fig 9

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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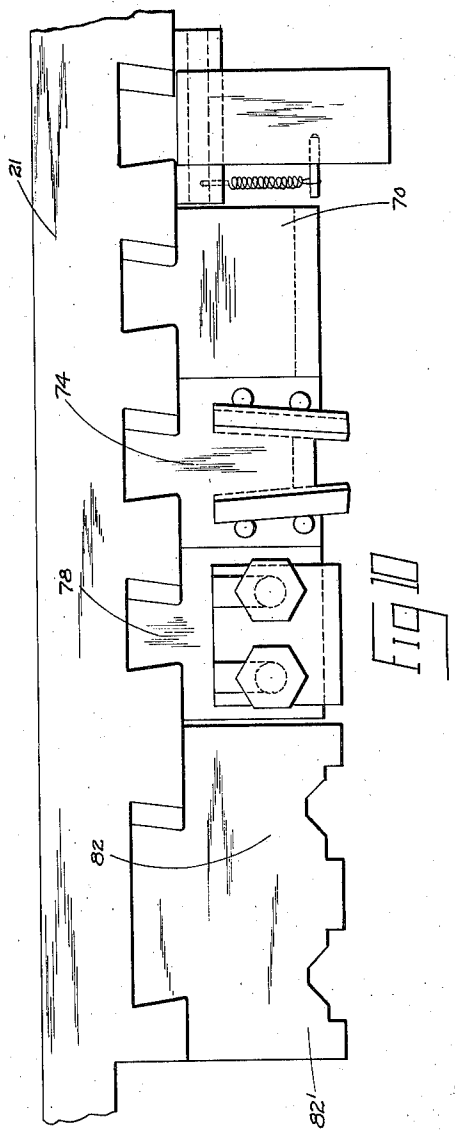


Fig 10

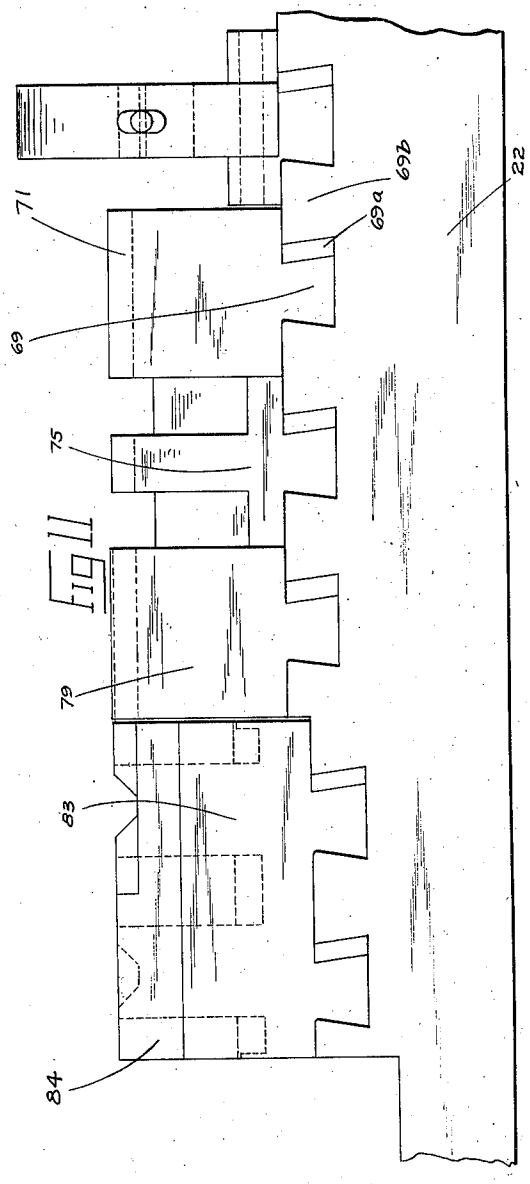


Fig 11

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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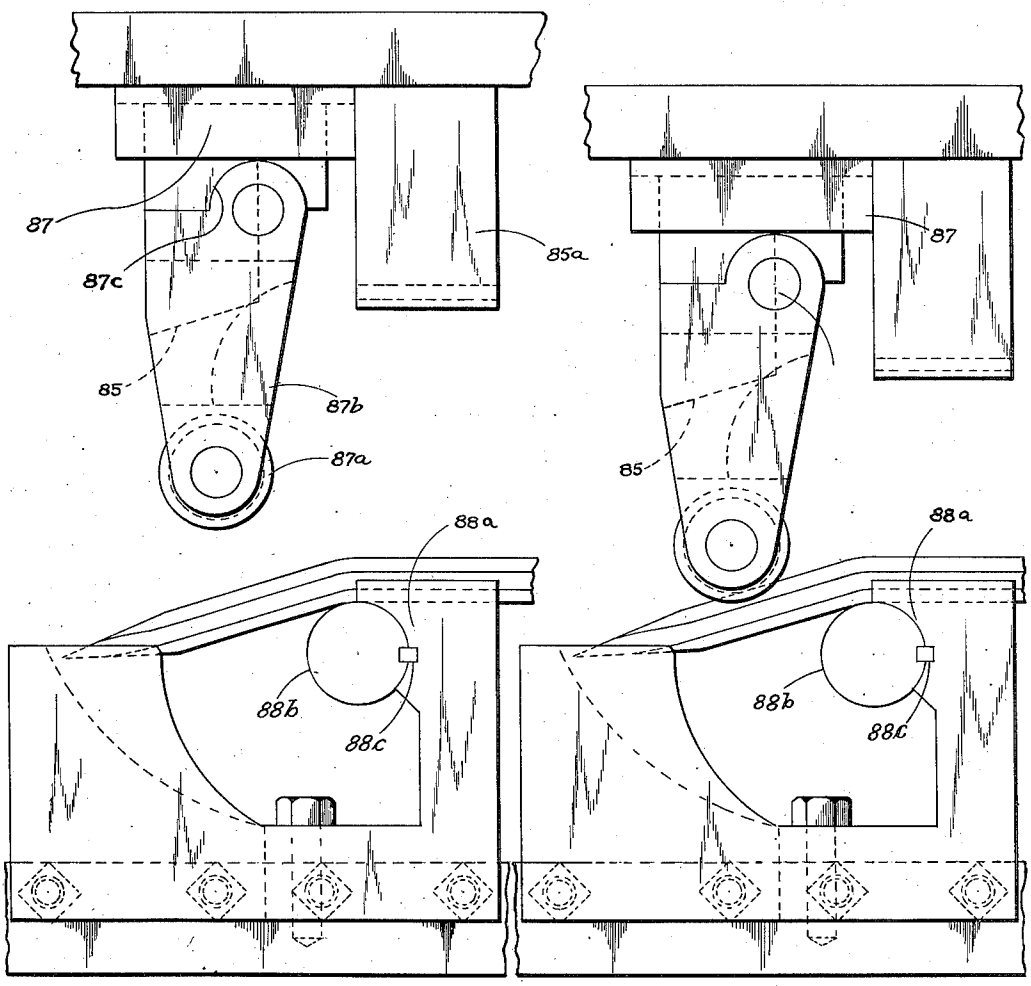


Fig 12 Fig 12a

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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

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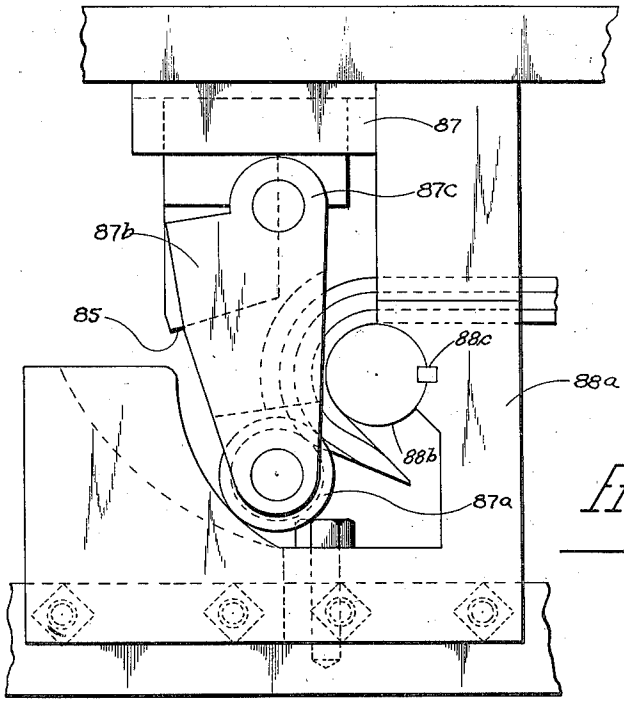


Fig 12b

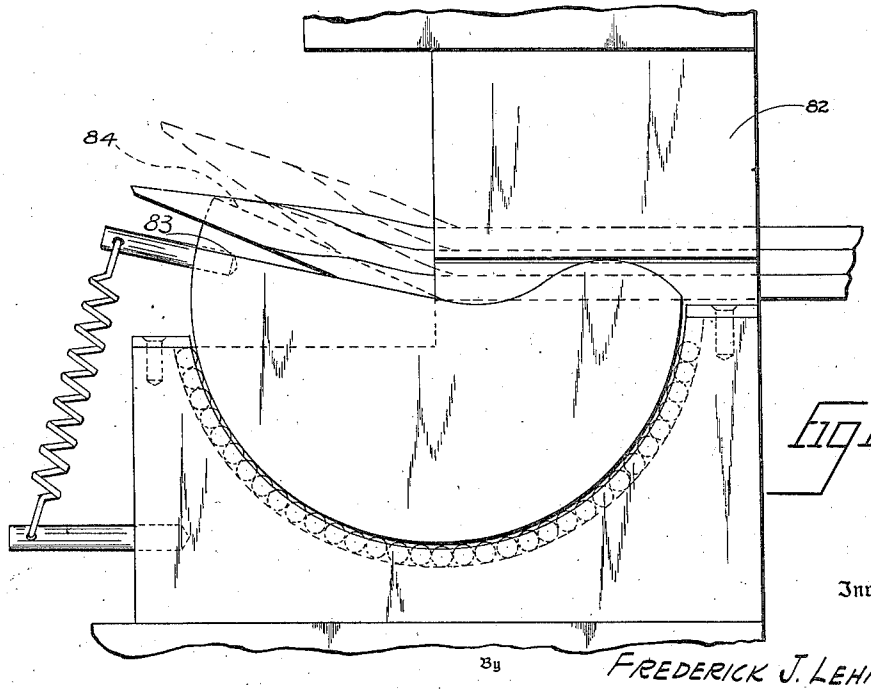


Fig 12d

Inventor

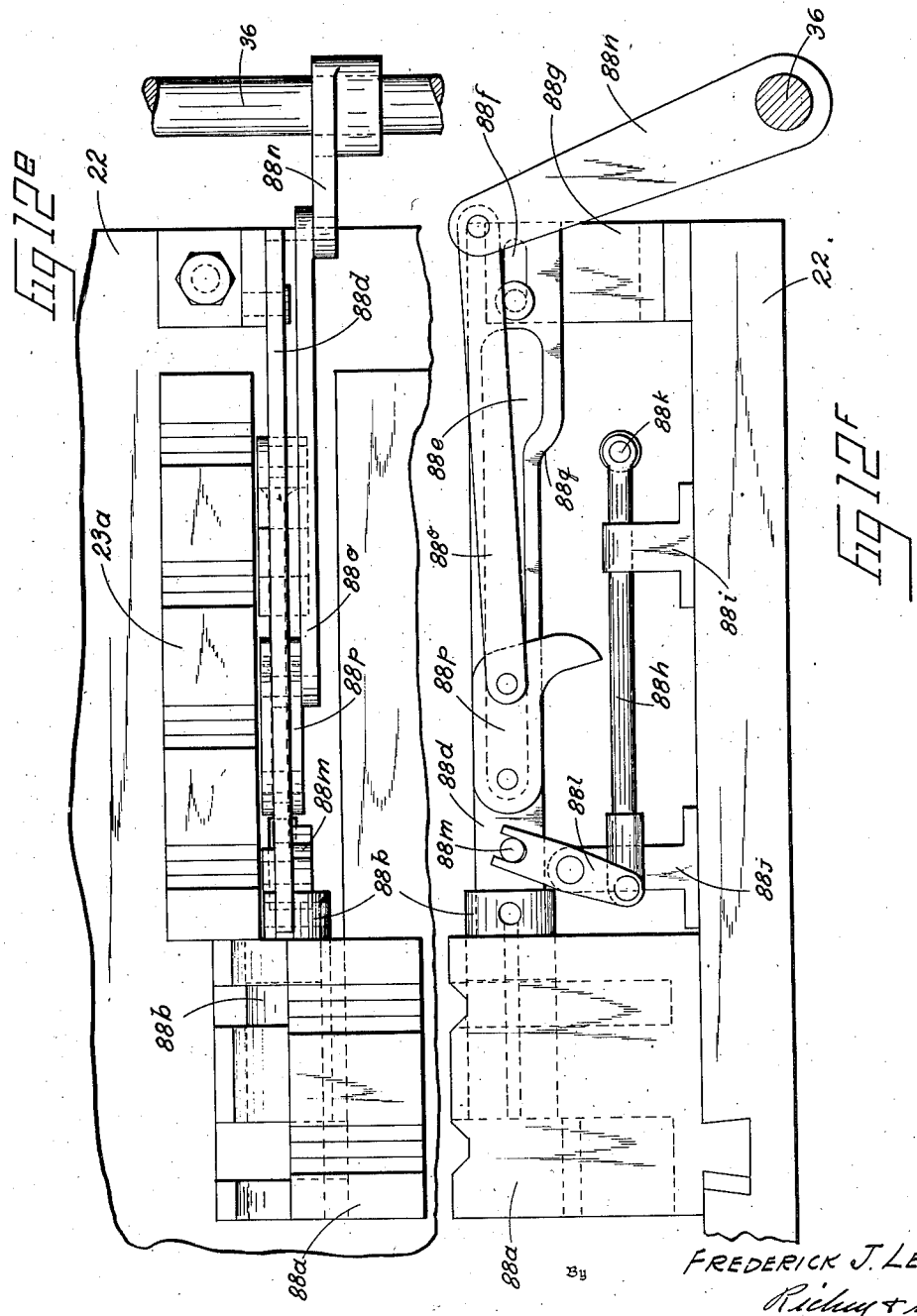
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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

Filed Aug. 17, 1934 14 Sheets-Sheet 13



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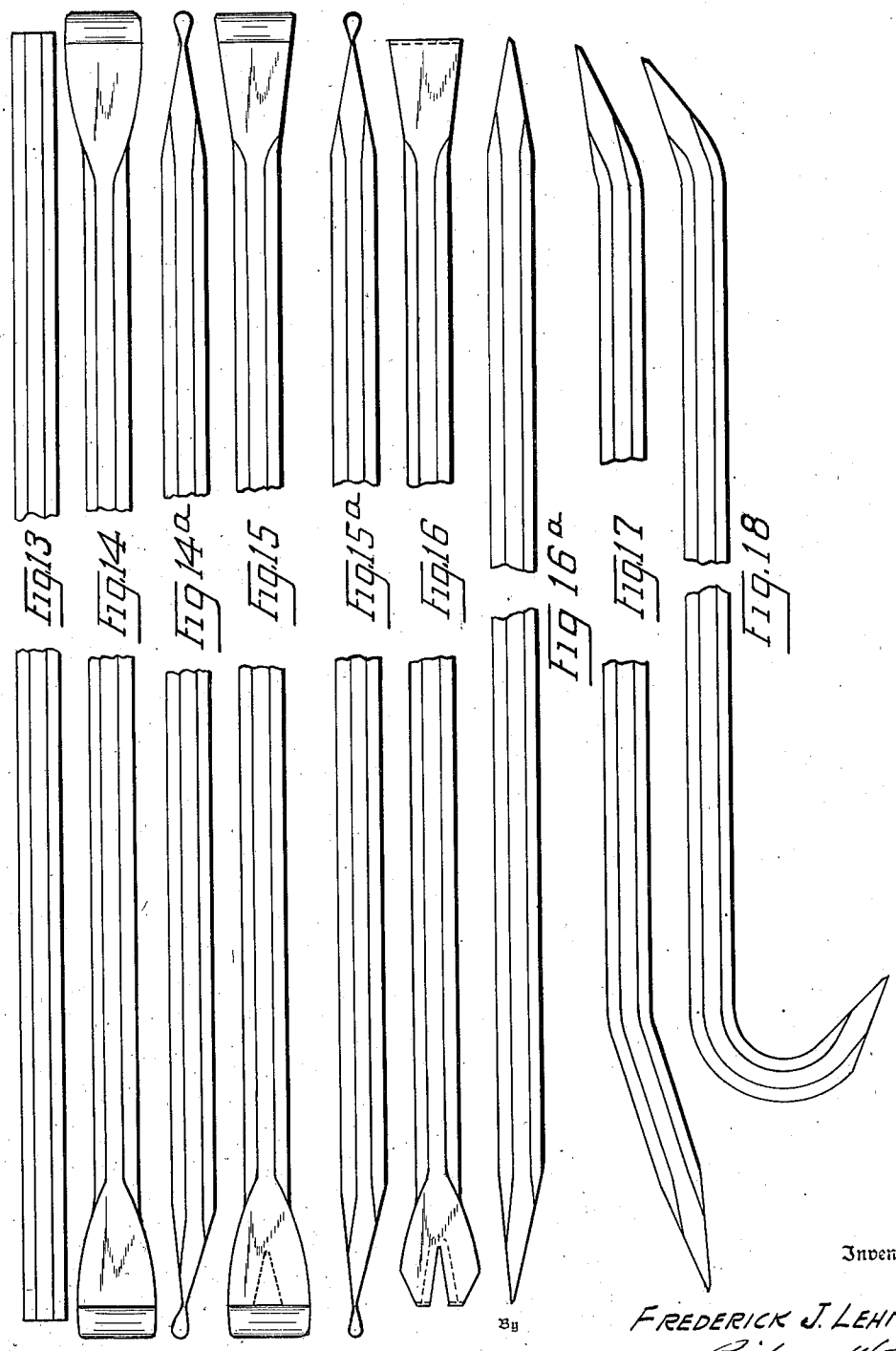
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METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

Filed Aug. 17, 1934 14 Sheets-Sheet 14



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Patented Oct. 27, 1936 2,058,698

UNITED STATES PATENT OFFICE

2,058,698

METHOD OF AND APPARATUS FOR FORGING AND SHAPING METAL ARTICLES

Frederick J. Lehman, Warren, Ohio, assignor to Warren Tool Corporation, Warren, Ohio, a corporation of Ohio

Application August 17, 1934, Serial No. 740,263

18 Claims. (Cl. 76—1)

This invention relates to a method of and apparatus for forging and shaping metal articles, and the primary object of the same is to provide means whereby certain types of tools and metal articles may be made on a low cost volume production basis entirely automatically and of uniform construction and high quality throughout.

A more specific object is to provide a method and a machine for carrying out the method whereby tools commonly known in the trade as "wrecking bars" may be made on a low cost production basis without sacrificing quality, and the description and drawings deal with such subject matter, it being understood that with certain modifications in parts, principally with respect to the dies and shaping units hereinafter described, the machine may be adapted to the manufacture of numerous types of metal articles, not herein enumerated, within the scope of the invention as defined by the claims.

The method, therefore, is concerned with the manufacture of wrecking bars and, generally stated, consists in heating to a working temperature the opposite extremities of bar stock of suitable length, rough-forging and finish forging the chisel and claw ends of the bar and trimming and shearing said ends while forming a nail head recess in the claw end, and progressively bending both the chisel and claw ends into the desired shape.

The method has been designed particularly to facilitate carrying out the rapid production of wrecking bars by relatively simple and compact mechanism.

The apparatus for carrying out the method is arranged so that it may be installed in the conventional forging machine or press, or other machine having the proper operating characteristics and power to carry out the various steps of the method.

In the drawings:

Figure 1 is a view in side elevation of a forging press having the apparatus for carrying out the present method operatively associated therewith;

Fig. 2 is a view in end elevation of Fig. 1;

Fig. 2*a* is a side elevational view, more or less diagrammatic, of a furnace adapted for heating the bar stock, together with a feeder and a conveyor operatively associated with the forging and shaping machine; and Fig. 2*b* is a section taken on the line 2*b*—2*b*, Fig. 2*a*;

Fig. 3 is a bottom plan view of an upper or head plate forming part of the apparatus, together with the forming dies and gripping members carried thereby;

Figs. 4 and 4*a* and Figs. 5 and 5*a* are views in side and end elevation, respectively, of the upper and lower chuck or blank-gripping assemblies;

Fig. 6 is a view in side elevation of the blank transfer mechanism;

Fig. 7 is a plan view of Fig. 6 together with the lower chucks or gripping jaws and forming dies showing the relative positions of the parts on the lower supporting plate;

Fig. 7*a* is a sectional view taken substantially on the line 7*a*—7*a*, Fig. 7;

Fig. 7*b* is an enlarged fragmentary detail view of the bar blank centering mechanism; and Fig. 7*c* is a similar view showing the parts in another position of operation;

Fig. 7*d* is a sectional view taken substantially on the line 7*d*—7*d*, Fig. 7;

Figs. 8 and 9 are views in side elevation of the upper and lower sets of forming dies and bending units for the claw end of the wrecking bar;

Figs. 10 and 11 are views in side elevation of the upper and lower dies and units for the chisel end of the wrecking bar;

Figs. 12, 12*a* and 12*b* are views in side elevation of bending units for the claw end of a wrecking bar showing the parts in varying positions of operation; and Figs. 12*c* and 12*d* are similar views of the bending units for the chisel end of a bar;

Figs. 12*e* and 12*f* are detail views in plan and side elevation of parts which cooperate with the lower claw-bending or anvil die to provide clearance for the claw after the bending operation;

Figs. 13 to 18, inclusive, are detail views illustrating the various steps of the method and showing a wrecking bar blank shaped in five successive operations into the form of a complete tool.

Referring to the drawings in detail, in Figs. 1 and 2 a forging press is shown having a base frame **5** on which are mounted pedestal brackets or uprights **6**, **6***a* and **6***b*. A crank shaft **7** is mounted for rotation in suitable bearings on the upper ends of said brackets, said crank shaft being provided with suitable connecting rods **8** which carry a head plate **9**. The shaft **7** may be driven through the medium of a drive shaft **10** which has bearing at opposite extremities in pedestal brackets **11** and **12**; a fly wheel **13** and a drive pinion **14** being mounted on said shaft **10**, the drive pinion meshing with a gear **15** secured on a stub shaft **16**. The shaft **16** may be connected to the crank shaft **7** through the medium of a clutch or other suitable coupling **17**. The head **9** reciprocates on guide rods or bolts **18** and **18***a*, said head being provided with outstanding lugs **18***b* which engage said rods. Below the head

9 is a bed plate 19, which forms a support for part of the assembly to be described. A drive pulley 20 is shown on the outer end of the drive shaft 10.

The operation of machines of this type is well understood by those having a knowledge of the art. The head 9 may be operated intermittently, if desired, through the medium of the clutch 17, or the machine may be operated continuously.

It will be understood that the particular construction of the forging press above briefly described forms no essential part of the present invention except to provide in combination therewith a complete operative machine; an important feature of the present invention being the adaptability of the mechanism for use with any conventional forging press or analogous machine having the required capacity to carry out the forging and shaping operations.

The machine proper for carrying out the present method may be said to comprise in general the following coordinated and coacting assemblies: bar-supporting and gripping mechanism, bar-transfer mechanism, and upper and lower forging dies and shaping units; these assemblies being carried by upper and lower plates 21 and 22 secured to the head plate 9 and bed plate 19, respectively, of the forging machine, the upper plate 21 being formed with guide holes 21*a* provided with bushings or bearings which engage the guide rods 18 and 18*a*, and the lower plate 22 having similar holes 22*a* which receive said rods to thereby hold the latter plate in vertically aligned position with respect to the head plate 9 and upper plate 21.

The bar-gripping and supporting assemblies are best shown in Figs. 3, 4, 5 and 7. There are preferably four of these assemblies, two supported in spaced relation on the plate 21 and two secured to the plate 22 in vertical alignment with those on the plate 19. Since these assemblies are substantially the same in each instance subject to certain minor variations to accommodate certain forging and shaping operations, like reference numerals have been applied to corresponding parts in each assembly, and a description of a part in one assembly which is substantially similar in the remaining assemblies will therefore suffice.

Each bar-supporting and gripping assembly comprises a jaw or chuck plate 23 (lower left) (23*a* lower right, 23*b* upper left, 23*c* upper right) which is resiliently mounted on springs 24 seated in annular recesses 25 and 25*a* formed in the plates 21 and 22. The compressive strength of these springs should be such as will permit limited depression or "give" of the jaw plates when the forming and shaping operations take place, as will hereinafter be more fully described. To hold the jaw plates against displacement by the tension normally exerted by the springs 24 thereon, pins 26, having stop heads 26*a* at one end thereof, are mounted in similarly shaped bores 26*b* formed in the plates 21 and 22 and have their opposite extremities projecting into a depending skirt or boss 23*d* formed on the base of each jaw plate 23, 23*a*, 23*b*, and 23*c*. Tapered cross pins 27 are passed through transverse clearance recesses 28 formed in a boss 29 formed on each of the plates 21 and 22, and are fixed to the outer extremity of each of the pins 26 and also to the skirt or boss 23*d*. Thus the jaw plates have a limited movement against the pressure of springs 24 when they move together with a bar blank therebetween, such movement being limited by the space between the boss 29 and each jaw plate, note particularly Figs. 4 and 5.

Each of the jaw plates 23, 23*a*, 23*b*, and 23*c* is formed with jaws or notches 30 which are shaped to conform to the contour of the bar.

The relative arrangement of the jaw plates 23, 23*a*, 23*b*, and 23*c* is clearly shown in Figs. 3 and 7, said plates being adapted to grip the opposite extremities of a bar short of its end portion and hold the latter in position when said end portions are operated on by the forging dies and shaping units.

The bar blanks are successively transferred from one notch to the other by the transfer mechanism, best shown in Figs. 6 and 7. This mechanism as here shown comprises a pair of spaced transfer members in the form of bars 31 and 31*a*, which are formed with a series of receiving and retaining notches 32 to accommodate the bar blanks being transferred thereby. At one end, each of the bars 31, 31*a* have pivotally connected thereto a connecting rod or link 33 which is formed with a clearance slot 34 in which the one end of arms 35 and 35*a* are slidably pivoted, the opposite ends of the said arms being splined to a shaft 36. The outer end of the shaft 36 has an arm 37 fixed thereon which is pivotally connected to an operating link or rod 38 extending upwardly and pivotally connecting with the reciprocating head 9 of the forging machine, note also Fig. 1.

A sliding bar 39, having an operative connection with the shaft 36 through the medium of link 39*a* and lever arm 39*b*, is mounted in a track or guideway 40 centrally arranged with respect to the transfer bars 31 and 31*a*, said bar having a cam slot 39*c* in which a crank pin roller 41 engages, the latter being rotatably mounted on crank arms of a crank shaft 42 which is mounted in bearings 43 disposed at opposite sides of the transfer mechanism on the plate 22. At opposite extremities thereof the crank shaft 42 is provided with crank arms 44 which carry rollers 45 and 45*a* adapted to contact the under surface of each of the bars 31 and 31*a* and raise the latter vertically when the crank shaft is actuated by the bar 39 and crank pin roller 41 moving in cam slot 39*c*.

To definitely limit the elevated position of the transfer bars 31 and 31*a*, a stop member or projection 46 is provided and is mounted for arcuate adjustment on a screw bolt or pin 47 secured in a frame member 60. This stop member 46 is adapted to be contacted by a lug 49 formed on a cam 50, which is secured to and rotates with shaft 42.

The crank shaft 42 connects with a rear shaft 54 through the medium of a link rod 55 and crank arms 56 and 57. The shaft 54 functions substantially in the same manner as the shaft 42, being provided with bracket arms 44*a* and rollers 45*b*, 45*c* which operate in the same manner as the parts 44 and 45 just described.

To accurately guide the transfer bars 31, 31*a* in their vertical movement so that the notches 32 will accurately align with the notches of the plates 23 and 23*a*, spring-pressed guide detents 58 and 58*a* are each mounted in housing blocks 59, 59*a* secured to frame members 60 and 60*a*. The inner end of each of the detents 58, 58*a* is adapted to engage in a vertical groove or recess 61 formed in the side of each of the bars 31, 31*a*.

The under portions of the bars 31, 31*a* are formed with arcuate recesses 62 adapted to drop

down over the rollers 45—45c when the bars reach the limit of the transfer position.

The operation of the transfer mechanism just described is substantially as follows:

When the shaft 36 is turned or oscillated in a counter-clockwise direction, the arm 39b connected to bar 39 drives the latter forwardly, causing the cam slot 39c to act on the cam roller 41 and turn the shaft 42 to the left or counter-clockwise as viewed in Fig. 6, thereby throwing the rollers 45, 45b upwardly, the latter contacting with the transfer bars 31, 31a and moving the latter vertically until the stop lugs 49 on cams 50 contact stops 46, at which point the bar-receiving recesses of the bars will have been raised above the recesses or jaw portions 30 of the lower jaw plates 23 and 23b and will have raised any bar blanks clear of said plates, the bars being guided accurately vertically and held against horizontal movement by the detent members or guide locks 58, 58a. When the transfer bars reach their uppermost point of vertical travel, the pivotal connections of the arms 35 will have reached the innermost extremity of each of the slots 34 formed in the links 33, whereupon the transfer bars 31, 31a are driven forwardly, carrying the bar blanks therewith, until the blanks reach the next adjacent jaw 30, whereupon the arcuate recesses 62 register with the rollers 45—45c, the bar 39 moves back and the transfer bars lower, depositing blanks that may be carried thereby onto the jaw plates or chucks 23 and 23a.

To ensure against displacement of the bar blanks from a true working position during the transfer operation, clamp or hold-down members in the form of oscillating hooks or fingers 63 are provided, note particularly Fig. 7a in conjunction with Fig. 7. These hooks 63 have angle-shaped shanks 63a which are pivotally mounted at an intermediate point on a horizontal slide 63b, which is provided with pins 63c engaging in slots 63d formed in a vertical slide 63e, the latter being mounted for limited vertical movement on anchor blocks 63f against the pull or tension of springs 63g. At their lower ends each of the hook shanks 63a is pivotally connected to a rod or link 63h which is connected to the one end of a link 63i the opposite end of the link being connected to arm 35a. Contact studs or pins 63j and 63k are secured to the slide 63b and project outwardly for contact with one of the hook shanks 63a. The horizontal slide 63b is frictionally engaged with the vertical slide by means of spring-pressed detents 63l when the slide 63b is is in its extreme forward position so as to ensure a pivotal movement of the hooks or fingers 63 prior to movement of the horizontal slide, when the connecting bar 63h is first moved forwardly by lever 35a.

The operation of the bar-clamping mechanism just described is as follows:

When the shaft 36 is rotated and lever 35a turns toward the left, as viewed in Fig. 7a, at the start of the transfer operation, the detents 63l hold the slide 63b against horizontal movement until the hooks or fingers 63 swing clockwise and clamp over the bar blanks B, whereupon both the slides 63b and 63e and the hooks 63 move vertically with the transfer bars 31, 31a until the latter start their transfer movement toward the left, at which time the pin 63j is contacted by one of the hook shanks 63a and the slide 63b moves toward the left with the hooks 63 and transfer bars 31, 31a, the detents 63l releasing the slide 63e. When the transfer operation is completed and the arms 35 and 35a turn back, the fingers or hooks 63 swing clear of the bar blanks. During the transfer movement the springs 63g determine the pressure of the hooks 63 on the bar blanks B. In Fig. 7a, the position of one of the hooks 63 when fully tripped is shown in dotted lines, the remaining parts being shown in the positions they assume when lowered, there being a slight clearance between the hooks and bar blanks. When the transfer bars 31, 31a move back to the right, the pin 63k is contacted by one of the hook shanks 63a and the fingers and slide 63b move back to loading position.

To hold the bar blanks firmly against movement during bending of the end portions thereof, gripping jaws 64 and 64a are provided and are rotatably mounted or journaled on a jack shaft 65 which is mounted in bearings 66 at the rear extremity of the transfer mechanism. A sliding cam 67 is provided and is operatively associated with the bar 39 through the medium of an abutment slide 67', the cam 67 being slidably mounted on the rear extremity of the guideway 40 and the bar 39 being slidingly mounted on the front extremity of the slide, note Fig. 7d. Cam 67 has formed thereon front and rear cam portions 67a and 67b adapted to engage coacting portions formed on the jaws 64 and 64a.

When cam 39 approaches the end of its forward travel or to the left in Fig. 7d, it abuts cam 67 and moves the latter such distance as will cause cam portions 67a and 67b to simultaneously act on gripping jaws 64 and 64a and close the latter on the central portion of a bar blank, gripping the blank and holding it firmly in the desired position. Just before the jaws close, the recesses 62 register with rollers 45—45c and the bars 31, 31a lower and deposit a bar blank between the jaws. When cam 39 approaches the end of its rearward travel or to the right in Fig. 7d, its bottom portion contacts a rear projection or boss 67'' on slide 67' and retracts cam 67, thereby permitting jaws 64 and 64a to drop open by gravity and release the bar held thereby. The chucks 23 and 23a preferably terminate or stop short of the jaws 64 and 64a.

Means are provided for centering the bar blanks when the latter are loaded onto the chuck plates 23, 23a, such means being shown in detail in Figs. 7b and 7c. The upper and lower plates 21 and 22 have connected thereto coacting pivotally mounted centering arms 68, 68a. The arm 68a is mounted to turn inwardly or depress against the tension of a spring 68b, while the arm 68 is normally urged inwardly by spring 68c. The contiguous ends of these arms are reversely turned or cammed while the arms 68a are each formed with a beveled centering face 68d.

Fig. 7b shows the positions of the parts as the upper and lower plates and the dies carried thereby move together to effect a forging and shaping operation, while Fig. 7c shows the positions the parts assume when the said parts have substantially reached a forging or shaping position, the arms 68 engaging the arms 68a and pressing the faces 68d of the latter against opposite ends of the bar blank B.

The forging dies and shaping or bending units are mounted on the plates 21 and 22 just beyond the rear extremities of the gripping members or chucks 23—23c, note the plan views in Figs. 3 and 7. Figs. 8 and 9 show in side elevation the relative arrangement of the upper and lower dies and units for forming the claw end of a wrecking bar, while Figs. 10 and 11 show the arrangement of the dies and units for forming the chisel end

of a bar. The dies and bending units are preferably separately and removably mounted on the plates 21 and 22 through the medium of dovetailed bosses or ribs 69 and wedges 69a which engage in like-shaped grooves formed in raised bosses 69b formed on said plates.

The first working of the bar is carried out by the coacting dies 70 and 71 at one end and coacting dies 72 and 73 at the other end.

The next shaping or forging operation is carried out by the coacting dies 74 and 75 at one end, and the coacting dies 76 and 77 at the other end.

The following operation is effected by coacting dies 78 and 79 at one end, and the coacting dies 80 and 81 at the other end.

The next operations are performed by chisel-end bending dies or units 82, 82', 83 and 84, and claw-end bending dies or units 85, 86, 87 and 88. The contour given to the bar by these latter dies is shown in Figs. 17 and 18, the chisel end of the bar being first bent at a slight angle by the die 82 and coacting die 83, and completely bent by the die 82' and coacting die 84; while at the claw end of the bar, the dies 85 and 86 first partially bend the said end at an angle and thereafter the bending units 87 and 88 complete the bending of said end into the form of a claw or hook.

The shape and general construction of the forging and trimming dies may be readily understood by referring to the drawings, and a detail description is not necessary. The bending units or dies are preferably constructed as shown more or less in detail in Figs. 12 to 12d, inclusive, and a brief description thereof follows:

Figs. 12c and 12d show the dies for bending the chisel end of the bar, the upper dies 82 and 82' preferably being constructed of a single piece or casting, the die 82 being contoured to give a preliminary bend to the end of a bar while 82' completes the bend. The lower dies 83, 84, which coact with 82 and 82', are also preferably made integral or in one die block which is seated in a bearing block 84a with bearing rollers 84b interposed therebetween. Thus as the bar bends, the die block rotates or turns through the arc of the bend, to thereby reduce friction and wear on the dies and the power required to effect bending.

The upper claw bending units, which are generally designated at 85 and 87, have cooperatively associated therewith what may be termed the upper half of an anvil block 85a which coacts with a lower anvil block 88a, these blocks being formed with die recesses to receive the bar blank, note also Figs. 3 and 7. The upper bending unit or die 85 is shown as having a tapered die face for preliminarily bending the claw, while the unit 87 comprises a roller 87a which is mounted in an arm or bracket 87b, the latter being provided with a thrust bearing 87c which permits limited inward turning movement of the arm. Figs. 12, 12a and 12b clearly illustrate the operation of the dies 87 and 88.

To provide clearance for the claw after it has been bent into shape on the anvil die 88a, the latter has operatively associated therewith a movable die member or block 88b, which is withdrawn and reinserted in timed relation to the bending operation by the mechanism illustrated in detail by Figs. 12e and 12f. The block 88b is mounted for lateral sliding movement in an arcuate recess formed in the nose portion of the die 88a and may be held against rotation by a spline key 88c, said block being suitably secured on the one end of a slide 88d, which is formed with a lost-motion slot 88e and a mounting slot 88f, which latter limits the reciprocatory movement of the slide. At its rear end, slide 88d is supported by a bracket or pedestal 88g mounted on bottom plate 22. A retracting slide 88h is mounted in supporting brackets 88i and 88j adjacent slide 88d and at its rear end is provided with a contact roller 88k and at its front end is pivoted to the lower end of a lever 88l, the latter being fulcrumed on bracket 88j and having a slot in its upper end in which a pin 88m, carried by slide 88d, engages. A lever 88n is secured on shaft 36 and has pivoted thereto a link 88o which in turn pivotally connects with a pawl 88p mounted to slide in slot 88e. A cam 88q is formed at the rear extremity of the slide 88d.

The die-reciprocating mechanism operates substantially as follows:

When shaft 36 is rotated toward the left to effect transfer of bar blanks, pawl 88p contacts roller 88k and turns lever 88l clockwise, thereby retracting slide 88d and the die block 88b carried on the end thereof, this action ensuing just prior to elevation of the transfer bars 31, 31a. When slide 88d reaches its retracted position, cam 88q causes pawl 88p to clear roller 88k and the said pawl travels idly in slot 88e until it abuts the forward end wall thereof, (during which time the bar blanks are being transferred from one die to another) whereupon the slide 88d is advanced, carrying die block 88d back into anvil die 88a.

It will be noted the dies 82, 82' and 83, 84 coact to bend the chisel end of the bar in one direction, while the dies 85, 86 and 87, 88 coact to bend the claw end of the bar in a reverse direction.

While any type of furnace or heating unit may be used for heating the bars preparatory to the forging operations, it is preferred to employ a furnace of the type more or less diagrammatically illustrated in Figs. 2a and 2b. This furnace, which is generally indicated at 90, has a heating chamber 91 which is designed to heat the opposite extremities only of the bars to a working heat. A conveyor 92 is mounted to traverse the chamber 90 and carries the bar blanks B with their opposite extremities projecting laterally into the chamber. Cleats or analogous members 93 may be employed to evenly space the bar blanks on the conveyor.

A hopper 94 is shown mounted at one extremity of the conveyor and may be provided with an automatic feed device in the form of upper and lower slides or fingers 95 and 96 which are mounted on spring-return levers 97. These slides project into the discharge extremity of the hopper from opposite sides thereof, the slides 96 moving out to the right as viewed in Fig. 2a to clear the end of the hopper and permit discharge of a bar blank while the slides 95 move in to close the hopper while a blank is dropping onto the conveyor. The arms 97 are arranged to be actuated by the opposite ends of the members 93.

The conveyor 92 is arranged to discharge the bar blanks onto the transfer bars 31 and 31a and its drive is therefore synchronized with the drive of the transfer mechanism.

The preferred method of forming the bar and the general operation of the machine is as follows:

Bar blanks of suitable length and having the conventional octagonal or analogous shape may be loaded into the hopper 94. As the conveyor moves under the hopper, the opposite extremities of the bar spacing and centering members 93

contact the arm 97 and throw the slides or fingers 96 forwardly clear of the discharge end of the hopper while the slides or fingers 95 move into and close said end, the space between the slides or fingers preferably being such as to accommodate only one bar.

The bar blanks on the conveyor have their opposite extremities projecting out into the furnace chamber 91 and are directly exposed to the flame and heat in said chamber so that they are brought to a working heat during the time they are passing through the furnace.

The bar blanks on the conveyor are loaded onto the first receiving recesses of the transfer members 31 and 31*a*. The members 31 and 31*a* reciprocate in a substantially rectangular path in performing the transfer operation. The first station therefor may be considered the loading station. At the next station, the opposite extremities of the bar blank are laid in the chuck jaws 30 which coact with the dies 70, 71 and 72, 73.

A bar blank ready for the working operation is shown in Fig. 13. In Figs. 14 and 14*a*, the blank is shown after the opposite extremities thereof have been subjected to the action of the forging dies 70, 71 and 72, 73, the chisel end of the bar being forged and the claw end of the bar being partially forged, a certain amount of flash *f* remaining on the ends of the bar.

It will be noted that at the time the bars are laid on the chuck plates 23 and 23*a* and the dies retracted, the said plates are slightly above the plane of the dies. However, when the jaw or chuck plates 23*b* and 23*c* move down into gripping relation with the plates 23 and 23*a*, both sets of plates are depressed to a point where they align horizontally with the adjacent dies, the ends of the bars contacting the dies, and simultaneously the upper die strikes the end of the bar and the forging and shaping operations result. The foregoing operation is illustrated more or less diagrammatically in Fig. 6, where the upper full line shows the position of the chuck plates 23 and 23*a* before the upper coacting chuck plates 23 and 23*c* move into engagement therewith, and the intermediate dotted line showing the working position reached by said plates when the blanks are being subjected to the forging or shaping operation.

At the next station, the blanks at the chisel end of the bar are subjected to the action of the dies 74 and 75, which dies trim the sides of the chisel; and at the opposite or claw end of the blank, the latter is subjected to the action of the dies 76 and 77, which dies finish-forge the said claw end and partially form or punch the claw recess, note the contour of the die 77 in Fig. 9 in conjunction with the bar shown in Figs. 15 and 15*a*.

At the next station, the chisel end of the bar is subjected to the action of the dies 78 and 79 which trim the flash from said end and also bevel or sharpen the end; while at the claw end of the bar the latter is subjected to the action of the dies 80 and 81, which completely punch out the claw slot and trim the sides and end of the blank, note the contour of the dies 80 and 81 in Figs. 8 and 9 in conjunction with the bar shown in Figs. 16 and 16*a*.

At the next station, the bar blank is subjected to the first bending operation, which at the chisel end of the bar is performed by the dies 82 and 83 and at the claw end of the blank by the dies 85 and 86, a blank after being subjected to these dies being shown in Fig. 17.

At the fifth or final station, the opposite ends of the bar are bent into final form as shown in Fig. 18, these bending operations being performed at the chisel end of the bar by the dies or units 82′ and 84, and at the claw end of the bar by the dies or bending units 87 and 88, the chisel and claw bending operations being clearly illustrated in Figs. 12 to 12*d*, inclusive, as heretofore noted.

When a full set of blanks have been passed through the machine, there will be five forging and shaping operations ensuing simultaneously at each end of the bar blanks. When the blanks reach the final or bending station, they are gripped firmly and positively by the jaws 64 and 64*a* to insure against any tendency towards displacement during the bending operations.

After passing through the machine, the bars may be deposited on a cooling table, a container, or other means where they may be cooled and boxed ready for shipping.

While the machine and coacting parts have in general been shown in the preferred form, yet it will be understood that certain changes in structure and mode of operation may be adopted within the scope of the invention as defined by the appended claims.

I claim:

1. A machine for forging and shaping elongated metal articles from lengths of bar stock comprising a bed plate and a reciprocating head plate, upper and lower forging dies and shaping units associated with said plates, upper and lower resiliently mounted gripping chucks disposed adjacent said dies and units and having jaw recesses adapted to receive and support bar blanks, means for automatically transferring the blanks from one of said recesses to the other, and means for reciprocating said upper head plate to move the chucks and dies into operating relation, said chuck plates upon moving together being depressed to a position where said recesses are in working alignment with said dies.

2. A machine for forging and shaping elongated metal articles from lengths of bar stock comprising a bed plate and a reciprocating head plate, upper and lower forging dies and shaping units associated with said plates, upper and lower resiliently mounted chuck plates disposed adjacent said dies and having jaw recesses adapted to receive and support the opposite extremities of bar blanks, transfer mechanism disposed between the lower dies and units and their corresponding chucks and including one or more transfer members having recesses arranged to align with said jaw recesses, means for reciprocating said transfer members to transfer the bar blanks from one jaw recess to the other, and means for reciprocating said upper head plate to move the chucks and dies into operating relation, said chuck plates upon moving together being depressed to a position where said jaw recesses align with said dies.

3. A machine for forging and shaping elongated metal articles from lengths of bar stock, comprising a bed plate and a reciprocating head plate, upper and lower forging dies and shaping units associated with said plates, upper and lower resiliently mounted gripping chucks disposed adjacent said dies and having jaw recesses adapted to receive and support bar blanks, means for transferring the blanks from one of said recesses to the other, means for holding the blanks

against angular displacement during the transfer operation, and means for reciprocating said upper head plate to move the chucks and dies into operating relation, said chuck plates upon moving together being depressed to a position where said recesses align with said dies.

4. A machine for forging and shaping elongated metal articles from bar stock comprising a bed plate and a reciprocating head plate, upper and lower forging dies and shaping units associated with said plates, upper and lower resiliently mounted chuck plates disposed adjacent said dies and units and having jaw recesses adapted to receive and support bar blanks, one or more reciprocable elongated transfer members mounted adjacent said chuck plates and having transverse recesses arranged to align with the jaw recesses of said chuck plates, means for reciprocating said transfer members in a substantially rectangular path to transfer the blanks from one jaw recess to the other, and means for positively gripping said bars and holding them in place in the recesses of said transfer members during the transfer operation.

5. Means for forging and shaping elongated metal articles from lengths of bar stock comprising a bed plate and a reciprocating head plate, upper and lower forging dies and bending units associated with said plates and arranged to successively forge and bend the opposite extremities of a bar blank, upper and lower chuck members disposed adjacent said dies for holding the blanks against displacement when being operated upon by the dies, means for transferring bar blanks from one die and unit to the other, and means for positively gripping and holding a bar against displacement while being subjected to the action of the bending units.

6. Means for forging and shaping elongated metal articles from lengths of bar stock comprising a bed plate and a reciprocating head plate, upper and lower forging dies and bending units associated with said plates and arranged to successively forge and bend the opposite extremities of a bar blank, upper and lower chuck members disposed adjacent said dies for holding the blanks against displacement when being operated upon by the dies, means for transferring bar blanks from one die and unit to the other, and cam actuated jaws for positively gripping and holding the blanks against displacement while being operated upon by said bending units.

7. Means for forging and shaping elongated metal articles from lengths of bar stock comprising in combination with a forging machine, upper and lower sets of forging dies and shaping units arranged to perform successive forging and shaping operations on the articles, means for transferring bar blanks from one of said dies or units to the other, and a plurality of chuck plates each located parallel with said dies and units and having jaw recesses adapted to align therewith during the forging operation, said plates normally lying in a horizontal plane beyond that of the shaping dies and units and being resiliently mounted so that they will be depressed into a position substantially in horizontal alignment with said dies when gripping the articles.

8. Apparatus for forging and shaping elongated metal articles from lengths of bar stock comprising a horizontally disposed heating furnace, a conveyor in said furnace, means for feeding bar stock to said conveyor, a forging machine, a plurality of aligned forging dies associated with said machine for progressively shaping opposite ends of the stock, gripping chucks operatively mounted with respect to said dies, transfer members mounted adjacent said gripping chucks and arranged to receive bar blanks from the conveyor, and means for reciprocating said transfer members to transfer the blanks from one die to the other.

9. Apparatus for forging and shaping elongated metal articles from lengths of bar stock comprising, in combination, a heating furnace, a conveyor arranged to traverse said furnace, means at one end of said furnace for feeding bar blanks to one end of said conveyor, a forging machine located at the opposite end of said conveyor, said forging machine having a reciprocating head plate and a lower bed plate, a plurality of aligned forging dies supported by said plates and arranged to perform successive forging operations on opposite extremities of the blanks, a plurality of resiliently-mounted upper and lower gripping chucks disposed adjacent said dies and having jaw recesses adapted to align therewith, elongated reciprocable transfer members mounted adjacent said lower chucks and having recesses arranged to align with the jaw recesses of the chucks, said transfer members being arranged to successively receive lengths of bar stock from the conveyor, means for reciprocating said transfer members in a substantially rectangular path to transfer the bar blanks from one jaw recess to the other of the lower chucks to bring the blanks in an operative position with respect to said dies, and means for reciprocating said head plate to cause the dies to deliver successive forging blows to opposite ends of said blanks.

10. Means for making wrecking bars from bar stock comprising in combination with a forging machine having upper and lower supporting members, a plurality of aligned dies and bending units secured to said members, chucks operatively associated with said dies and units and having a plurality of jaw recesses arranged to align therewith, means for transferring bar blanks from one of said dies and units to the other, said bending units including a bending die which is rotatably mounted to permit it to turn in an arc conforming with the bend of the bar.

11. Means for making wrecking bars from bar stock comprising in combination with a forging machine having upper and lower supporting members, a plurality of aligned dies and bending units secured to said members, chucks operatively associated with said dies and units and having a pluralty of jaw recesses arranged to align therewith, means for transferring bar blanks from one of said dies and units to the other, said bending units including a die block, a support therefor, and bearings interposed between the die block and its support to permit the said die block to turn in an arc conforming with the bend of the bar.

12. Means for making wrecking bars from bar stock comprising in combination with a forging machine having upper and lower supporting members, a plurality of aligned forging dies and bending units supported by said members, chucks mounted adjacent said dies and units and having jaw recesses adapted to align therewith, transfer members operatively mounted adjacent said chucks and having recesses adapted to receive bar blanks, means for reciprocating said transfer members in a substantially rectangular path to transfer blanks from one die and unit to the other, said forging dies being arranged to progressively forge the opposite ends of the bar to the desired shape and said bending units including an anvil

die and a roller arranged to engage the end of a bar blank after it has been subjected to the action of the forging dies and bend it around said anvil die.

13. Means for making wrecking bars from bar stock comprising in combination with a forging machine having upper and lower supporting members, a plurality of aligned forging dies and bending units supported by said members, chucks mounted adjacent said dies and having jaw recesses adapted to align therewith, transfer members operatively mounted adjacent said chucks and having recesses adapted to receive bar blanks, means for reciprocating said transfer members in a substantially rectangular path to transfer blanks from one die and unit to the other, said forging dies being arranged to progressively forge the opposite ends of the bar to the desired shape and said bending units including an anvil die and a coacting roller arranged to engage the claw end of a bar after it has been subjected to the action of the forging dies and bend it around said anvil die, and a rotatably mounted bending die and a die coacting therewith arranged to reversely bend the chisel end of a bar.

14. Apparatus for making wrecking bars from bar stock comprising a horizontally disposed furnace arranged to heat the opposite extremities of a bar blank, a conveyor arranged to traverse said furnace, means for feeding bar blanks to one end of the conveyor, a forging machine mounted adjacent the opposite end of the conveyor, said forging machine including upper and lower supporting members, a plurality of aligned forging dies and bending units secured to said members in aligned relation to perform successive forging and bending operations on a blank, resiliently mounted chuck plates disposed adjacent said dies and having jaw recesses therein adapted to align with the dies and units, and transfer mechanism disposed on said lower supporting member between the chucks carried thereby and having one or more reciprocable elongated transfer members formed with a plurality of recesses arranged to align with said jaw recesses, and means for reciprocating said transfer members in a substantially rectangular path to transfer bar blanks from one jaw recess to another.

15. The method of making wrecking bars which consists in heating the opposite extremities of bar stock to a working temperature and thereafter subjecting said stock to the action of forging dies and bending units arranged to first rough forge the chisel and claw ends of a bar blank, then trim the sides of the chisel end of the blank and rough form a claw slot in the claw end of the blank and finish forge the point of the blank, then trim and bevel the chisel end of the blank and punch the metal from the claw slot at the claw end of the blank and trim the sides of said claw end, then preliminarily bend the claw and chisel ends of the blank and finally completely bend said ends.

16. In a machine for forging and shaping elongated metal articles, upper and lower supporting plates, a plurality of aligned dies supported by said plates, and means for transferring bar blanks successively from one die to the other, said means comprising spaced elongated transfer members having transverse recesses therein for receiving bar blanks, a crank shaft disposed beneath said members and having cam rollers at opposite extremities thereof, a cam roller mounted on said shaft, a sliding cam having its forward extremity arranged to engage said roller, means for actuating said sliding cam to rotate said shaft to thereby cause said cam rollers to raise said transfer members, said transfer members being formed with under-cut recesses adapted to register with said rollers and permit the members to drop at the termination of the forward stroke thereof.

17. In a machine for forging and shaping elongated metal articles from lengths of bar stock, upper and lower forging dies and bending units arranged to perform successive forging and bending operations upon the stock, said bending units including an anvil die and a movable die block associated with said anvil die, means for transferring bar stock from one of said dies and units to the other, and means for removing and replacing said movable die block in timed relation to the operation of said transferring means.

18. In a machine for making wrecking bars from bar stock, a plurality of aligned dies arranged to perform successive forging and bending operations, means for transferring bar blanks from one of said dies to the other, said bending units including an anvil die for bending the claw end of the wrecking bar and a movable die block associated with said anvil die, said die block being retractable to provide clearance for the claw after the latter is bent to permit transfer of the blanks, and means for removing and replacing said die block in timed relation to the operation of said transferring means.

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