Dec. 1, 1970 V. A. IANNUCCI 3,544,284

CASTING AND FORGING APPARATUS

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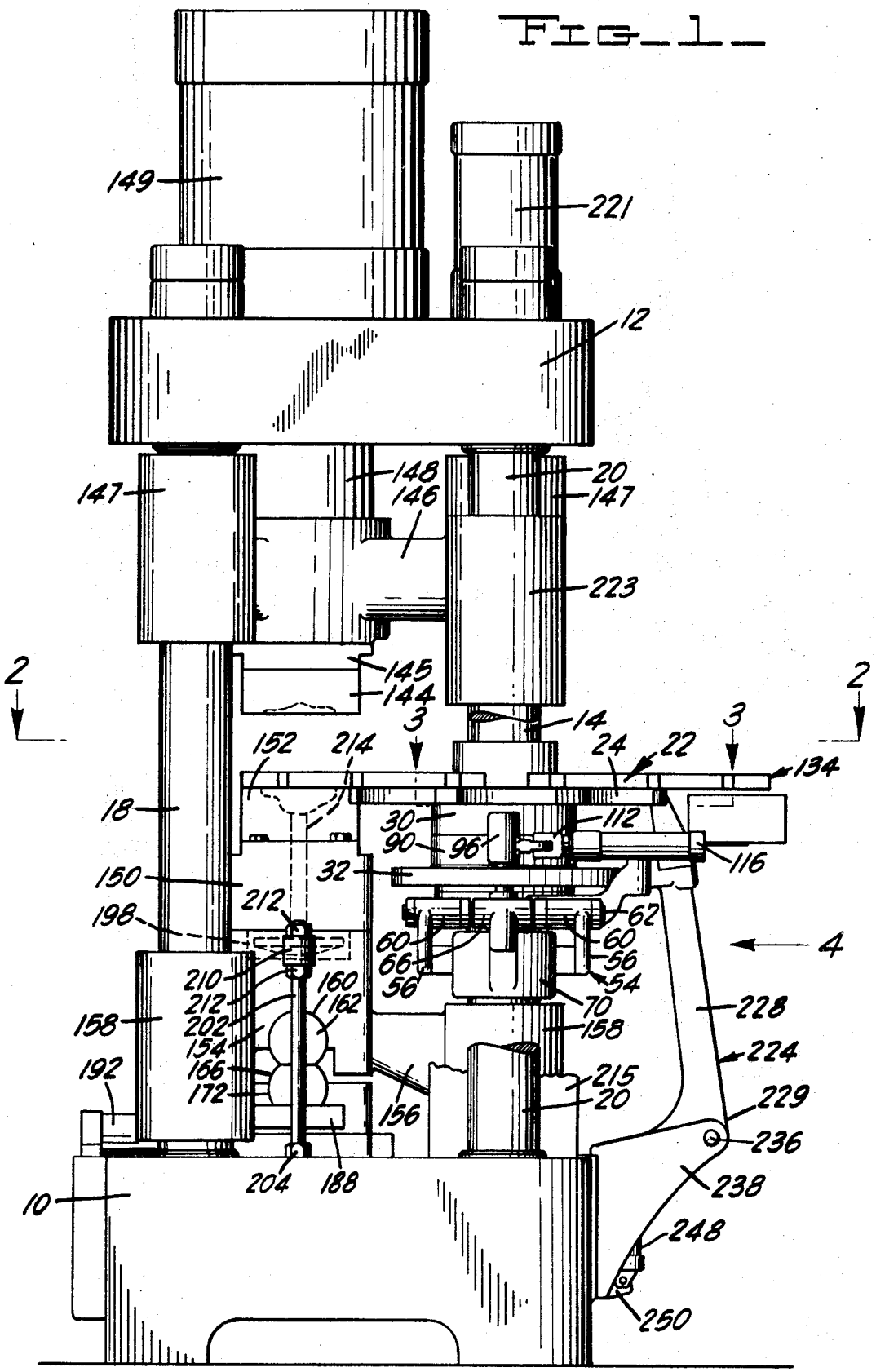
Fig. 1



CASTING AND FORGING APPARATUS

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FIG. 2

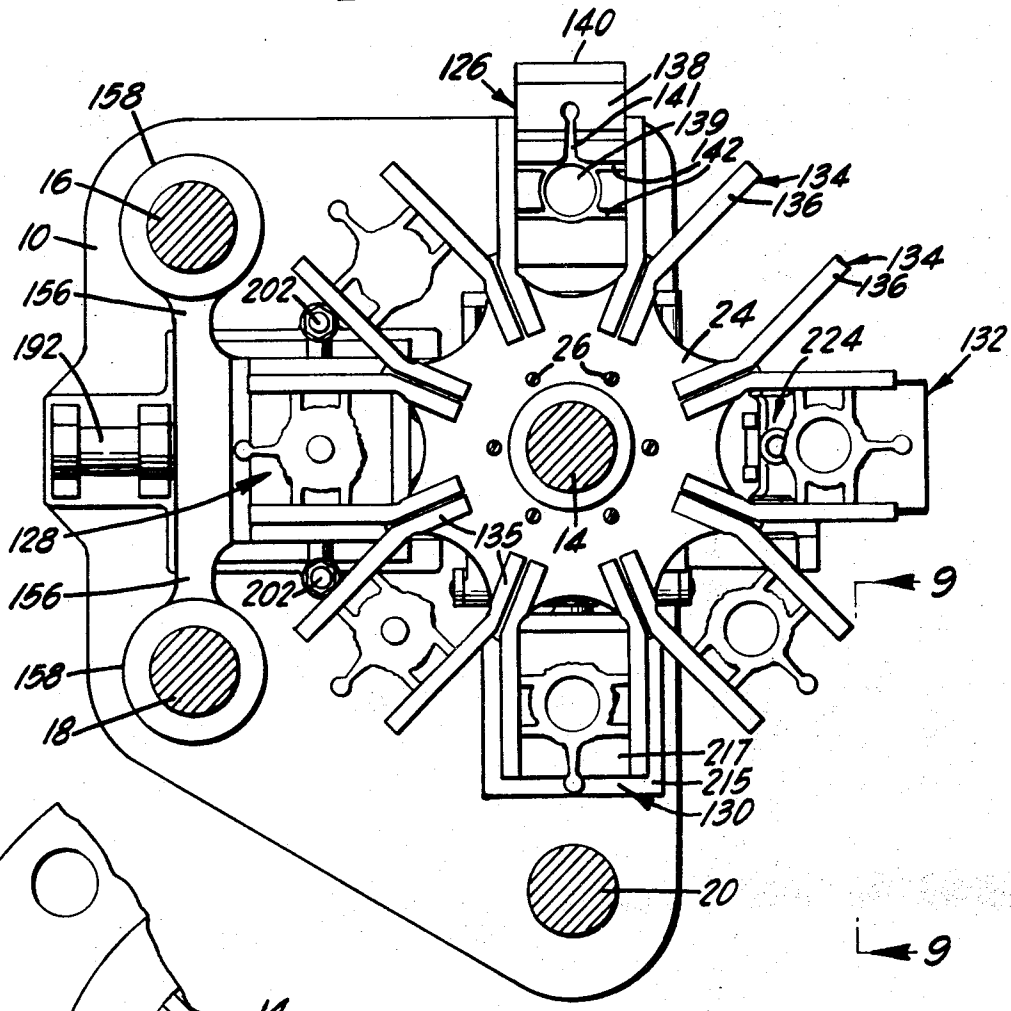
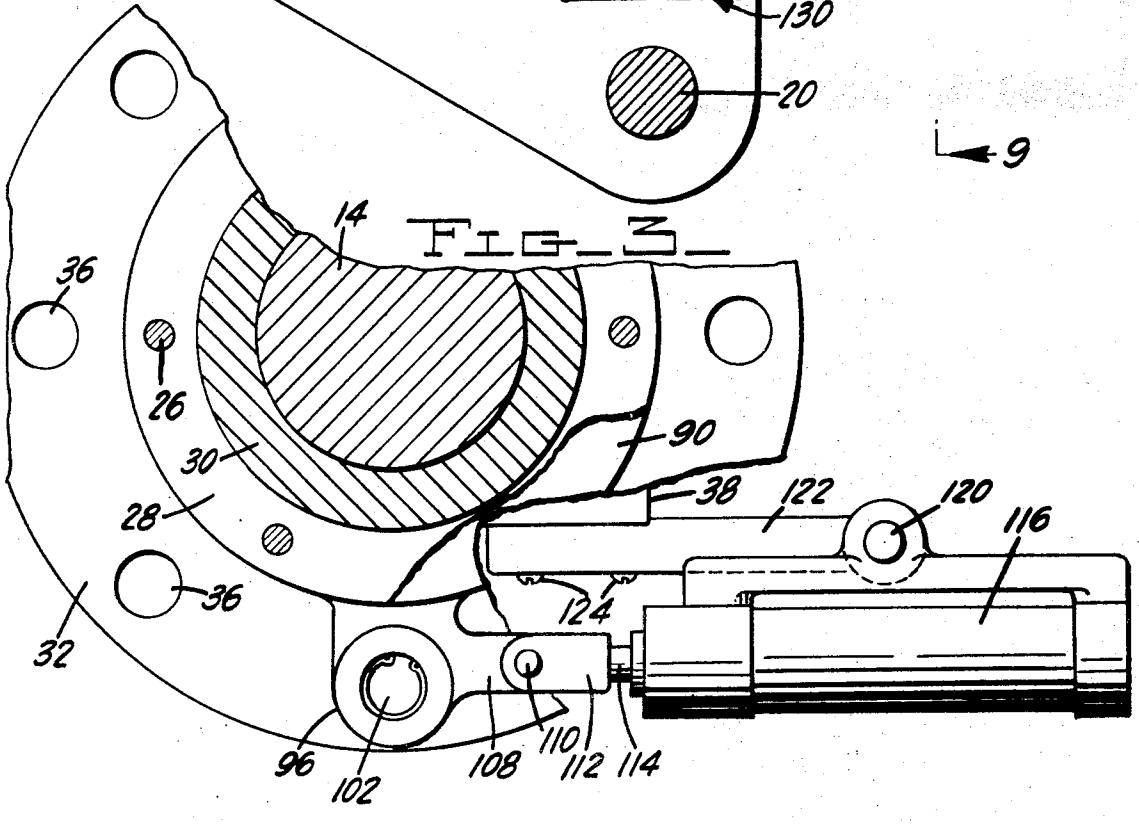


FIG. 3



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CASTING AND FORGING APPARATUS

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FIG. 4

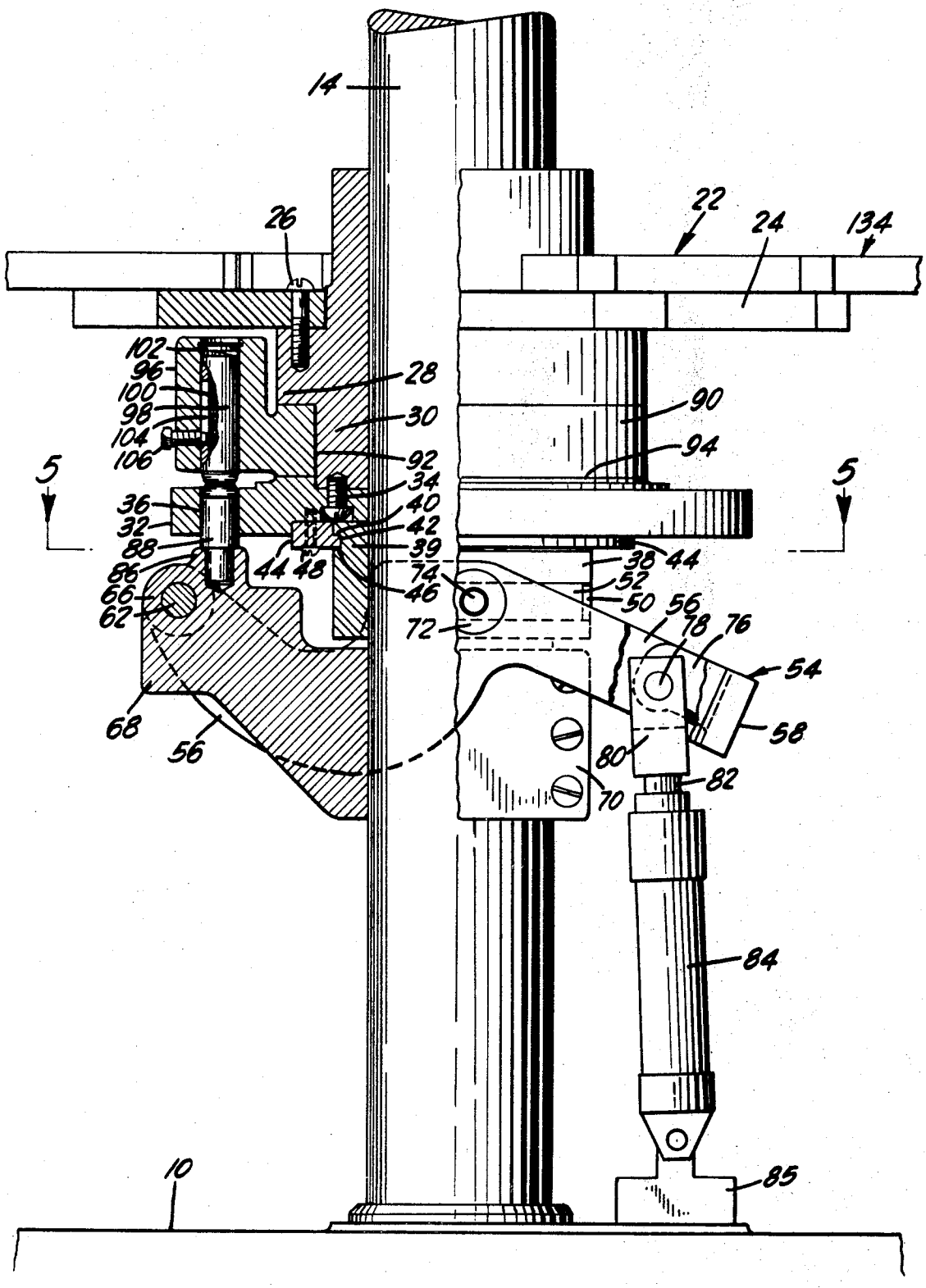

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Fig. 5

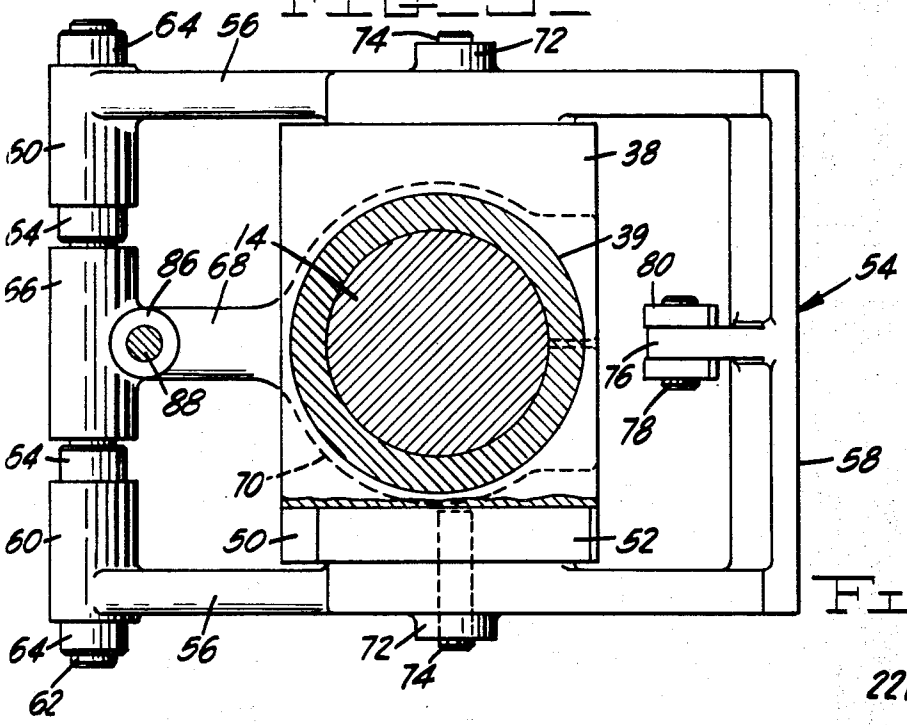


Fig. 8

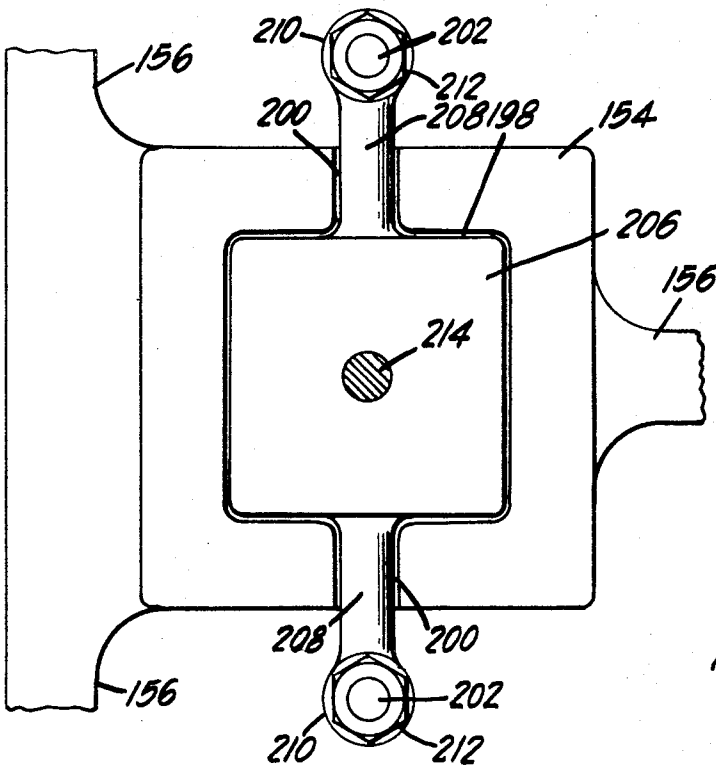
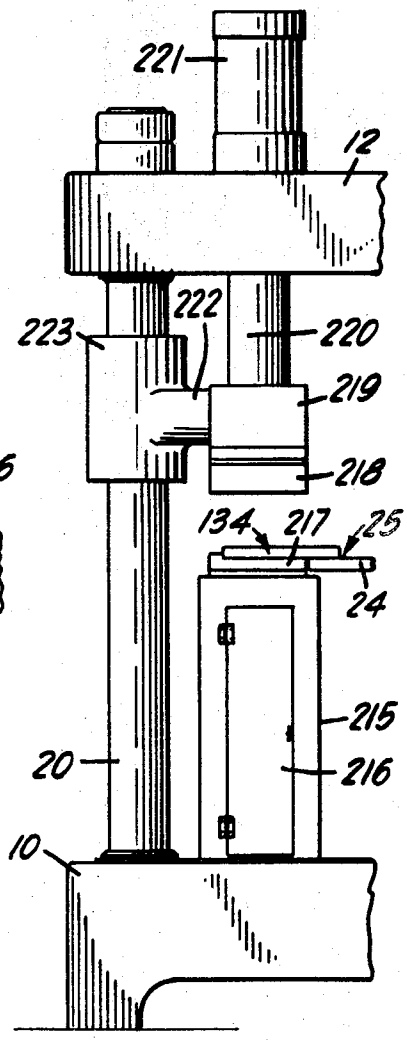


Fig. 9



CASTING AND FORGING APPARATUS

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Fig. 6

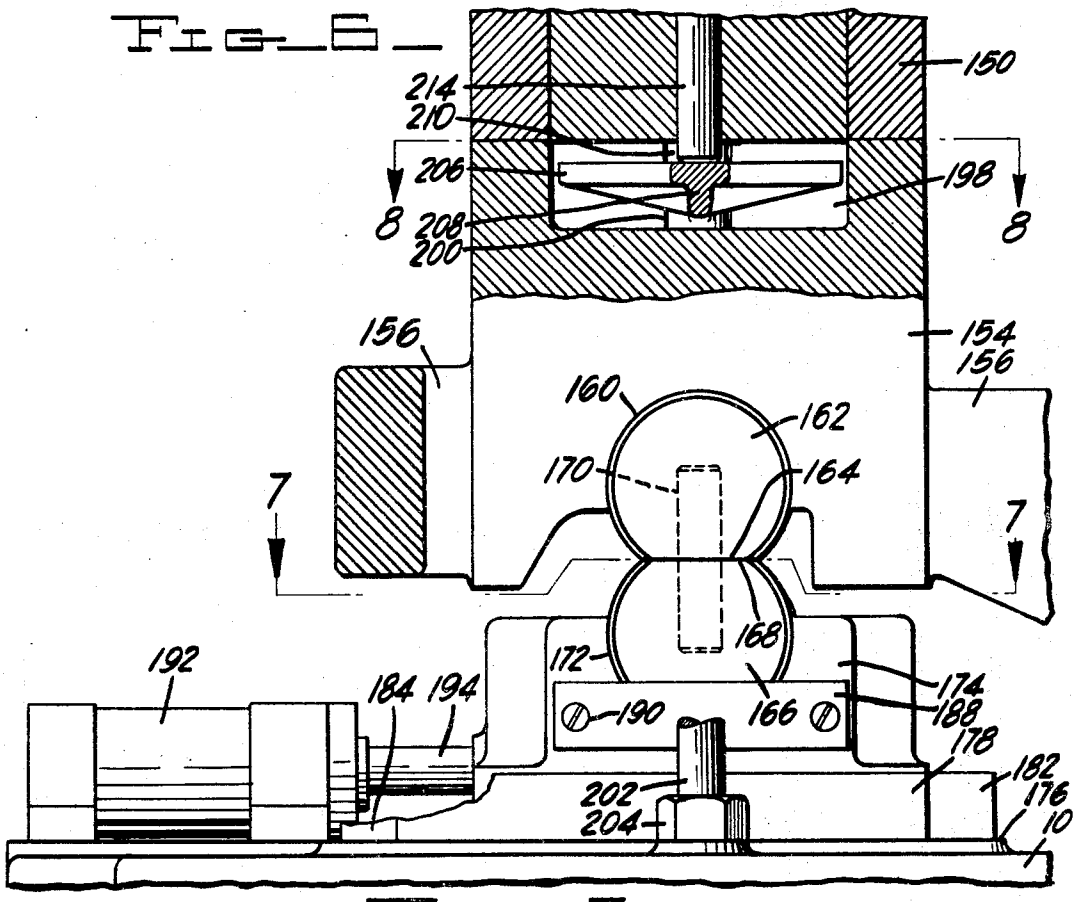

Fig. 7

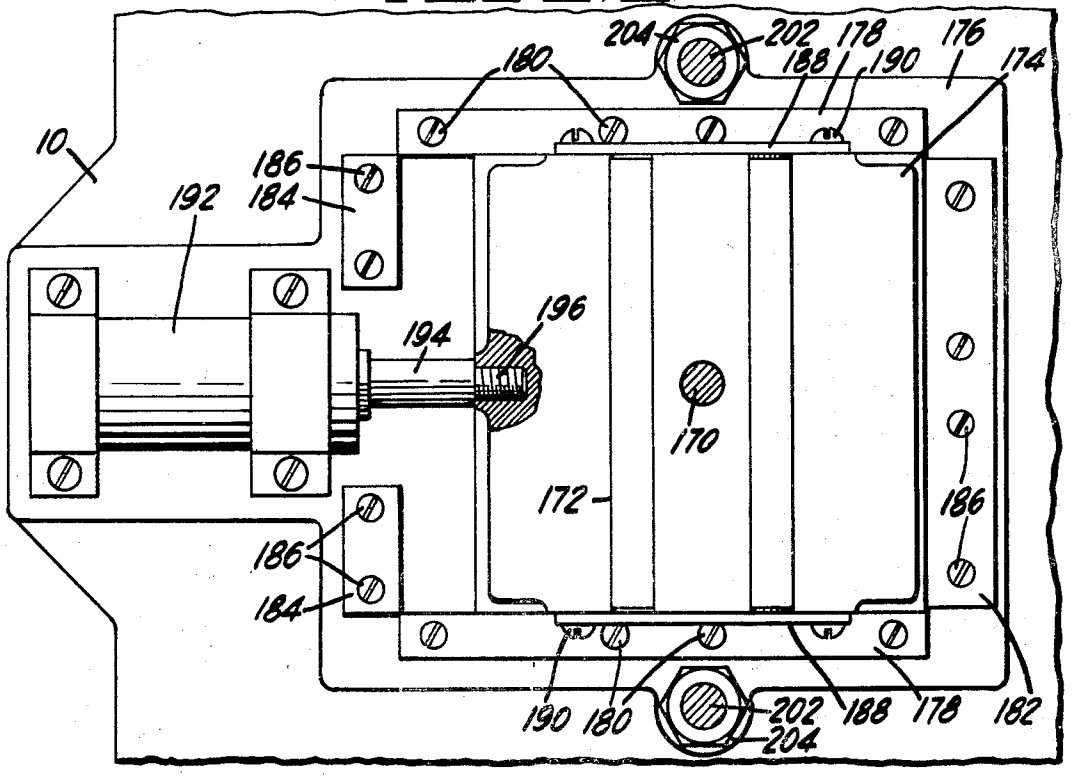

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Fig. 10

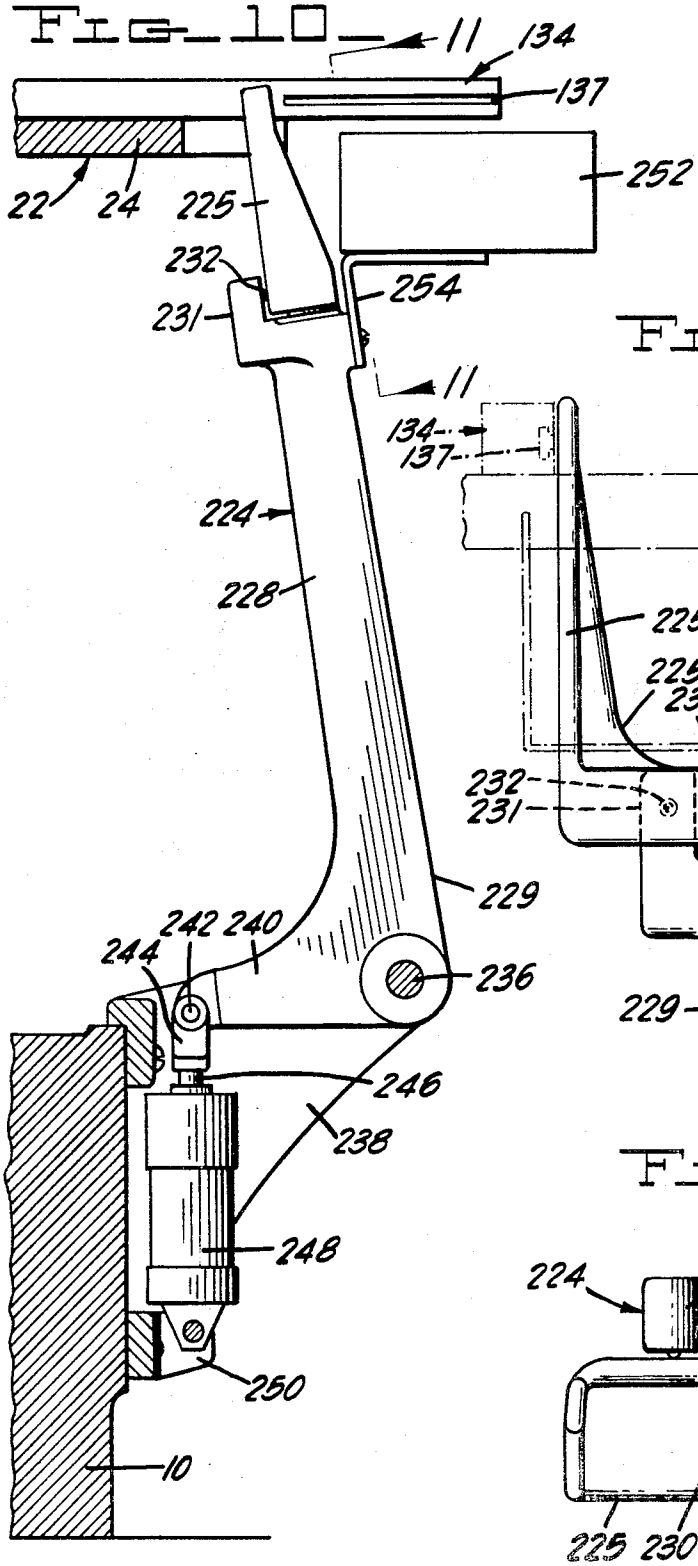


Fig. 11

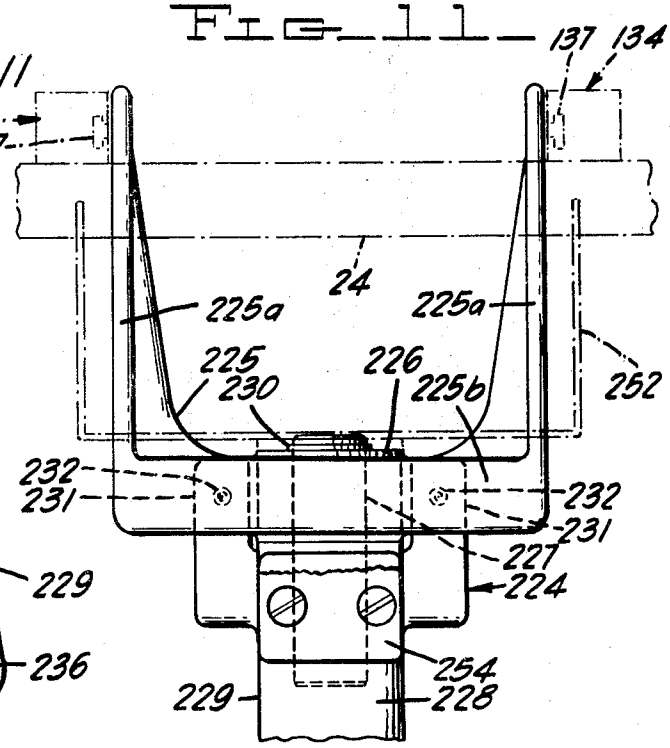
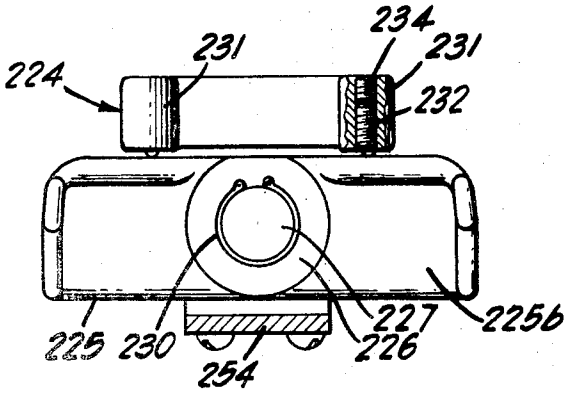


Fig. 12



United States Patent Office 3,544,284 Patented Dec. 1, 1970

3,544,284

CASTING AND FORGING APPARATUS

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Filed Apr. 26, 1968, Ser. No. 724,367
Int. Cl. B23p 23/04
U.S. Cl. 29—33 12 Claims

ABSTRACT OF THE DISCLOSURE

A machine for simultaneously casting one or more metal work pieces at a first station, forging said previously cast pieces at a second station, trimming and releasing previously forged pieces for collection at a third station and ejecting the scrap trim of previously trimmed pieces at a fourth station, the machine including an indexable and vertically movable turntable having means to convey the work pieces through the several operations by integrally cast portions thereof. Following each set of operations the turntable is elevated from a locked stationary position to release the lock and lift the newly cast work piece from the casting die and to similarly lift the work pieces at the forging and trimming stations, and the turntable is then indexed while in its elevated position.

BACKGROUND OF THE INVENTION

Conventionally in forming forged parts from metals such as brass, aluminum or ferrous materials the metal is first cast into the form of an ingot, the ingot is then converted into rod form by rolling or extruding and thereafter the rod is heated to a forging temperature for the forging operaiton. More recently equipment has been developed which provides for the casting of the metal in a die, to form a work piece roughly the shape of the desired forging, and for the forging of the work piece as a continuous process, the forging operation being performed before the work piece has cooled below the desired forging temperature. The instant invention is concerned with improvements in such equipment particularly in the direction of simplification, higher efficiency and greater capacity.

The prior equipment referred to is exemplified by that disclosed in patent to Harrison et al. No. 3,445,904, issued May 27, 1969 and assigned to the assignee of the instant application. The machine disclosed in said patent includes a casting station where the metal is poured into a main cavity portion of a mold or casting die and permitted to flow therefrom into cavities formed in arms projecting from a turntable to provide support runners for the work piece cast in the main cavity. The machine further includes forging, trimming and scrap ejecting stations. Following the casting operation and after a time delay sufficient to alow the cast work piece to cool to a self-sustaining condition the casting die is lowered from the work piece and the turntable is rotated whereby the newly cast work piece is delivered to the forging station, a previously forged piece at the forging station is delivered to the trimming station and the scrap resulting from the trimming of a previously forged piece is delivered to the ejecting station.

SUMMARY OF THE INVENTION

The machine of the instant invention performs the several steps of the machine of said Pat. No. 3,445,904 and similarly employs a rotatable or indexable turntable for moving a succession of casting, supported by integrally cast support runners, from the casting station through the forging, trimming and scrap ejection stations. However in

accordance with the instant invention the indexable turntable and its operating means are so constructed that the turntable is elevated from a locked working position following the completion of the operation at each of the several stations to raise the work pieces to a level at which they will clear the stationary mechanisms thereat. The turntable is then rotated or indexed to advance the work pieces to the next station and thereafter lowered to its original level and gain locked in position. The forging station includes mechanism to, following the forging operation and before the turntable can be elevated, immediately lower the bottom forging die to separate it from the work piece for the prevention of overheating of the die. This mechanism is combined with means for separating the work piece from the bottom forging die to ready it for transport upon elevation and indexing of the turntable. The ejection station includes an ejecting arm movable to its operative position while the turntable is elevated and including self-adjusting fingers for contacting the support runner elements of the scrap.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a machine incorporating the concepts of the instant invention;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1 looking in the direction of the arrows;

FIG. 3 is a sectional view on an enlarged scale taken on the line 3—3 of FIG. 1 looking in the direction of the arrows;

FIG. 4 is a view partially in section and partially in elevation looking in the direction of the arrow 4 of FIG. 1 and with parts omitted;

FIG. 5 is a sectional view taken on the line 5—5 of FIG. 4 looking in the direction of the arrows;

FIG. 6 is a detailed view on an enlarged scale of a portion of the apparatus illustrated in FIG. 1;

FIG. 7 is a sectional view taken on the line 7—7 of FIG. 6 looking in the direction of the arrows;

FIG. 8 is a sectional view taken on the line 8—8 of FIG. 6 looking in the direction of the arrows;

FIG. 9 is an elevational view of a portion of the machine looking in the direction of the arrows 9—9 of FIG. 2;

FIG. 10 is an elevational view on an enlarged scale of a portion of the apparatus ilustrated in FIG. 1 with parts omitted;

FIG. 11 is a sectional view on an enlarged scale taken on the line 11—11 of FIG. 10 looking in the direction of the arrows; and

FIG. 12 is a plan view of the apparatus illustrated in FIG. 11 with parts in section.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and particularly to FIGS. 1 and 2 the machine in accordance with the instant invention, and which is adapted to perform the functions of the apparatus disclosed in said Pat. No. 3,445,904 but in a more facile manner, comprises a base 10 and a head 12 supported from the base by a plurality of cylindrical columns 14, 16, 18 and 20. Mounted on column 14 for rotative and longitudinal movements thereon is a turntable or turret 22 comprising a plate member 24 having eight scallops in its periphery the plate being secured as by studs 26 (see FIGS. 2 and 4) to a flange 28 of an annular hub 30 having an inner wall defining a bearing surface for the rotational and vertical movement of the turntable. An annular plate 32 is secured to the lower end of hub 30 as by studs 34 the annular plate having an annular series of eight equally spaced perforations 36 (see FIGS. 3 and 4).

A block 38 (see FIGS. 4 and 5) of rectangular configura-

tion, except for an annular extension **39**, has a central bore receiving column **14** for vertical movement of the block thereon. Annular extension **39** is undercut to define an annular flange **40** overlying an annular recess **42**. A split ring **44** having a flange **46** fitting within recess **42**, with sufficient clearance to permit relative rotational movements of ring **44** and block **38**, is secured as by studs **48** to plate **32** whereby the several parts of the turret proper will move with block **38** upon longitudinal adjustment of the latter on the column.

Two opposed lateral sides of block **38** are grooved as indicated at **50** to receive longitudinally extending sliders **52**. A turret elevating and lowering yolk, indicated generally at **54**, comprises a pair of arms **56** projecting on opposite sides of block **38** from a connecting base or bar **58**. The free or outer ends of the arms carry suitably integrally formed sleeves **60** (see FIG. 1) mounted for rocking movement on a shaft **62** between collars **64** fixed to the shaft. Shaft **62** is supported by a sleeve **66** carried by an arm **68** projecting from a collar **70** secured against both rotational and longitudinal movements on column **14**. Arms **56** at points intermediate their ends, said points being substantially diametrically opposite each other with respect to column **14**, are provided with hubs **72** rotatably receiving pins **74** projecting outwardly from and fixed in sliders **52** preferably midway of the lengths of the sliders. A lug **76** projecting inwardly from bar **58** preferably centrally thereof is connected by a pin **78** to a forked element **80** of a piston rod **82** forming part of a piston-cylinder hydraulic motive unit **84** of conventional type pivotally mounted on a bracket **85** fixed to base **10**. Pin **78** is rotatably mounted in one of the elements **76**, **80** and fixedly connected to the other of said elements.

When the piston of motive unit **84** is in its fully retracted position the turret is in its lowered position, hereinafter referred to as its "working position" as illustrated in FIG. 4. Upon admission of fluid under pressure to the right of the piston the piston advances within the cylinder rocking yolk **54** upwardly on shaft **62** and through the intermediary of pins **74** and sliders **52** raising the turret to an elevated position determined by the furthest travel of the piston, said elevated position being hereinafter referred to as the "indexing position" of the turret.

A boss **86** is formed integrally with sleeve **66** the boss fixedly supporting an upwardly directed locking pin **88** positioned and dimensioned to enter an overlyong perforation **36** of the annular series of such perforations when the plate member **32** is rotated to position the perforation on the same radial line as the pin and the turret is lowered to its working position. The dimensions of pin **88** are such that the pin accurately locates the rotated position of turret **22** while at the same time ready entry into and withdrawal of the pin from the perforation is permitted. Further the pin is of a length to, in the working position of the turret, extend slightly above the level of plate member **32**. Suitably the upper end of the pin is rounded to promote its entry into the perforations.

Referring particularly to FIGS. 1, 3 and 4 means are disclosed for indexing or rotating the turret through steps equal to the distance between perforations **36**. The indexing means comprises a ring **90** mounted for rotational movement relatively to the turret proper but for vertical movement therewith in an annular slot defined by a recess **92** in hub **30** and an annular surface **94** of plate member **32**. Ring **90** is provided with a projecting boss **96** having a bore receiving an indexing pin **98** positioned from the center of column **14** a distance equal to that of perforations **36**. Pin **98** has a rounded lower end and is dimensioned to be readily received within perforations **36**. In its preferred embodiment it includes a hollow central section in which is mounted a compression spring **100** the spring bearing against a lower solid section of the pin and a stop **102** forming an end closure for the bore. Suitably the wall of the pin is slotted as at **104** and a

limit screw **106**, received in a threaded perforation of the wall of boss **96**, projects into the slot. As will be understood the extent of vertical travel of indexing pin **98** in either direction is determined through contact of screw **106** with an end of the slot. Referring particularly to FIG. 3 an arm **108** projects from boss **96** and is pivotally connected by a pin **110** with a connecting element **112** carried by the outer end of the piston rod **114** of a hydraulic piston-cylinder motive unit **116** of conventional type. The motive unit is rockably mounted on a pin **120** carried by an arm **122**, the latter being secured to block **38** as by screws **124**.

In preparation for the indexing of turret **22**, the preparatory step taking place while the turret is in its lowered or working position as illustrated in FIG. 4, unit **116** is energized to rotate ring **90** and hence pin **98** in a clockwise direction as viewed in FIG. 3 the extent of such movement, as determined by the stroke of the piston of the motive unit, being such as to position pin **98** in overlying relationship to a perforation **36** once removed in a clockwise direction from the perforation accommodating locking pin **88**. Indexing pin **98** when so positioned enters the underlying perforation **36** under the influence of its spring **100** the mechanism then being set for indexing. Upon elevation of the turret by energization of unit **84** plate member **36** moves upwardly with the turret whereby locking pin **88** is withdrawn from the perforation **36** in which it was engaged and the turret is thus freed to be rotated or indexed. Unit **116** is then operated to cause its piston to return to its position of FIG. 3 whereby, due to the engagement of pin **98** in the perforation **36** the turret is rotated or indexed one step bringing indexing pin **98** and the perforation in which it is engaged in overlying engagement with locking pin **88**. Upon lowering of the turret to its working position locking pin **88** enters the perforation occupied by indexing pin **98** and forces the latter out of the perforation into the position illustrated in FIG. 4. The indexing means can then be reset for a further indexing operation.

Similarly as in said Pat. No. 3,445,904 the turntable is employed to convey work pieces from a first station at which they are cast through forging, trimming and scrap ejecting stations such stations being indicated in the instant application at **126**, **128**, **130** and **132**, respectively (see FIG. 2). In the instant arrangement eight indexes of the turntable are employed for a complete revolution thereof, as will be understood from the prior description of the indexing mechanism. The purpose is to provide additional time for the desired temperature reduction of a cast piece between its casting at the casting station and its arrival at the forging station. This feature per se forms no part of the present invention.

For the purpose of transporting the work pieces the turntable is provided with means of the same general type as is shown in said Pat. No. 3,445,904 said means comprising pairs of fingers **134** each having a portion **135** affixed to plate member **24** between adjacent scallops and a portion **136** projecting from the table the projecting portions of each pair lying parallel to each other and to a median radial line. As will be noted eight pairs of the fingers **134** are provided so that at each index of the turntable a pair will be at each operating station and a pair will lie between each station. The perforation **36** and locking pin **88** are so placed that when the locking pin occupies a perforation the work pieces carried by the pairs of fingers at the several stations are properly positioned for the work to be performed thereon. The opposed sides of the projecting portions **136** of the arms of each pair of fingers are provided with inwardly opening longitudinal slots **137** (see FIG. 10) which are of T shape or dovetail cross section for receiving casting metal therein to form work piece supporting runners integrally joined with the main casting all as fully described in said Pat. No. 3,445,904.

The mechanisms at each of the several stations **126** to

132 will now be described. Referring first to casting station 126 a lower casting mold member 138 is supported in fixed position as by a block 140 (see FIG. 2) supported from base 10. The mold member 138 includes a main mold cavity 139 of a contour determined by the piece or combination of pieces to be cast, an entry runner 141 and four open-ended runners 142. The vertical position and dimensions of the mold is such that when the turntable is at its working level the runners 142 are in communication with the opposed slots 137 in fingers 134 whereby the cast metal not only fills the main mold cavity and runners 142 but flows into and fills the slots as previously mentioned. Upon solidification of the metal in the slots the cast work piece is supportable from the fingers. An upper mold member cooperating with mold member 138 may be employed if desired as illustrated in said prior Pat. No. 3,445,904 but inasmuch as the employment of such mold member forms no part of the instant invention it is not disclosed herein. However it will be recognized that if an upper mold member is to be used it must be mounted for movement which will permit it to clear the turntable when the latter is at its elevated or indexing level.

Referring now particularly to FIGS. 1, 6 and 7 the forging station 128 includes an upper forging die 144 carried by an upper platen 145 having three arms 146 terminating in sleeves 147 each sleeev being received for sliding movement on one of the columns 14, 16 and 18. The platen is mounted for movement with a piston rod 148 of a hydraulic piston-cylinder motive unit 149 of conventional type mounted on head 12. The stroke of the piston of motive unit 149 is such as to move die 144 between a position to perform a forging operation on a work piece supported by the turntable when the latter is at its operative level and a position in which it will clear the work piece and turntable when the latter is at its upper or indexing level.

The forging station also includes a bolster 150 supporting a lower forging die 152, of the desired configuration for the work piece being forged. The bolster 150 is mounted on a lower platen 154 the latter having arms 156 each terminating in a sleeve 158 receiving one of the columns 14, 16 and 18 for sliding movement thereon similarly as platen 145. Referring particularly to FIGS. 6 and 7 the lower side of platen 154 is provided with a longitudinally extending groove 160 of semicylindrical cross section. A block 162 of substantially cylindrical cross section but having a lower flattened side 164 fills groove 160 and projects therefrom. Block 162 is associated with a second block 166 of the same configuration as block 162 and having its flattened side 168 lying in contiguous relationship with the flattened side of block 162. The two blocks are secured together by a pin 170 received in similarly located bores extending radially inwardly of the blocks from their flattened sides. The pin serves as a pivot to permit relative adjustment of the blocks while at the same time maintaining the blocks in assembled relationship.

Lower block 166 is received in a seat 172 of semicylindrical cross section in a rectangular table 174 mounted for sliding movement on a raised portion 176 of base 10 between rails 178 secured to the base as by studs 180. The limits of the sliding movement of table 174 are determined by stops 182 and 184 secured as by studs 186 to the base. Lower block 166, and hence also the upper block 162, is restrained against endwise sliding movement by plates 188 partially overlapping the opposite ends of block 166 and secured to table 174 as by studs 190. The sliding movement is imparted to table 174 by an hydraulic piston-cylinder motive unit 192 mounted on base 10 and having a piston rod 194 with a threaded end 196 received in a correspondingly threaded recess of the block.

As will be understood from the foregoing description of the supporting structure for the lower platen the latter, together with the bolster and forging die carried thereby, is adapted to be adjusted between an upper working position as shown in FIG. 6 where a line connecting the centers of the blocks 162 and 166 lies in a vertical plane, to a somewhat lowered position, about one-half inch below the working position in actual practice, in which such line lies at an angle to the vertical, the adjustment being accomplished by sliding table 174 between the position of FIG. 6 and a position to the left thereof, as viewed in said figure, under the influence of motive unit 192.

Referring particularly to FIGS. 1, 6 and 8 the upper side of platen 154 is provided with an internal recess 198 communicating with the exterior of the platen through slots or passageways 200 suitably of the same depth as the recess. A pair of vertically extending rods 202 having their lower ends threaded in sockets in base 10 and secured therein by lock nuts 204 are positioned on opposite sides of the platen each being opposite one of the slots or passageways 200. A plate 206 is positioned within recess 198 the plate having ears 208 projecting through passageways 200 and terminating in sleeves 210 mounted for sliding movement on rods 202 to permit vertical adjustment thereof and secured in adjusted position by lock nuts 212. As will be understood the adjusted position of plate 206 will, in any event, be such that it will not interfere with the lowering of the platen and the overlying bolster 150 to the non-working position previously described.

Plate 206 supports an ejecting pin 214 received within a bore in bolster 150 and die 152, the adjusted position of plate 206 being such that the pin terminates at and lies in the plane of a portion of the upper surface of the die when the parts are in the working position of FIGS. 1 and 6. While but a single centrally located ejecting pin has been shown it will be understood that a plurality of pins similarly penetrating bores in the block may be employed in any suitable arrangement as required by the characteristics of the work piece being forged.

The trimming station is best illustrated in FIGS. 2 and 9 and comprises a table 215 mounted on base 10 and supporting a lower stationary female trimming die 217 at a level and in a position to underlie and be in contact with a work piece carried by the turntable fingers 134 at that station when the turntable is at its working level. A vertically movable male trimming die 218 is supported by a platen 219 in a position to overlie die 217. Platen 219 is carried by the piston rod 220 of an hydraulic piston-cylinder motive unit 221 of conventional type mounted on head 12. Platen 219 has a laterally extending arm 222 terminating in a sleeve 223 mounted for vertical sliding movement on column 20. As will be understood dies 217 and 218 are of the configuration required to shear the forged part or parts from the work piece carried by fingers 134 the metal remaining, although still supported by the fingers, being scrap. Suitably the interior of table 215 is hollow and serves as a receptacle to receive the forged parts and for this purpose an aperture is provided in its upper wall underlying the die piece 217 whereby the released forged parts are permitted to drop into the receptacle. An access door 216 is suitably provided in the front wall of the receptacle. As in the case of the forging station the stroke of piston rod 220 is such that when the piston is in its elevated position die 218 will be clear of a work piece carried by fingers 134 when the turntable is at its elevated or indexing level.

Referring now particularly to FIGS. 1, 2 and 9 to 11 inclusive the scrap ejecting station 132 is provided with scrap ejecting means indicated generally at 224 and comprising a U- or fork-shaped member 225 including tines 25*a* projecting from a base 225*b*. The base includes a hub 226 mounted for partial rotation on a pin 227 received within a bore or well in the end of an upwardly extending arm 228 of a two-armed lever 229. Member 225 is retained in position on the pin and against the end of arm 228 by a snap ring 230 fitting in an annular groove adjacent the upper end of the pin 227. Arm 228 has upwardly projecting lugs 231 lying behind base 225*b* of member

225 on opposite sides of pin 227. Each of the lugs is bored to receive a spring pressed plunger 232 secured in the bore by a plug 234 the plungers being adapted to contact the base of the U-shaped member and to yieldably maintain it in the position illustrated in FIG. 12.

Lever 229 is mounted for rocking movement on a pivot pin 236 projecting from a bracket 238 which in turn is mounted on base 10. A second arm 240 of lever 229 is pivotally secured as at 242 to a connecting element 244 of the piston rod 246 of an hydraulic piston-cylinder motive unit 248 of conventional type mounted for pivotal movement on a bracket 250 projecting from base 10. The parts of the above described mechanism are so constructed and proportioned that when the turntable is at its lower or working level and the piston of motive unit 248 is fully retracted each of the upwardly extending tines 225*a* projects to the height of and lies adjacent one of the fingers 134 and behind the scrap remainder of the work piece. Also the motive unit 248 is so constructed that upon movement of the piston to its forward position arm 228 is swung to cause the tines 225*a* to contact the scrap and then strip the portions thereof lying within the slots of fingers 134 from the slots whereby the scrap is released. The pivotal mounting of member 225 permits the same to automatically adjust, within the limits permitted by lugs 231, for equal contact of the tines with the work piece. An open-ended trough 252 supported from lever arm 229 by a bracket 254 is positioned to initially receive the ejected scrap. Upon the completion of the swinging movement of the arm during the ejecting operation the scrap slides from the trough and falls into a suitable collecting bin (not shown).

While the operation of the turret and of the mechanisms at the several stations have been described above the operation of the machine as a whole will be briefly reviewed.

It will be assumed that the machine has been in operation and that the turntable has been indexed and then lowered to its working level, that a pair of the fingers 134 embrace the casting die at the casting station, a pair of the fingers support the cast work piece in contact with the lower forging die at the forging station, a pair of the fingers support a forged work piece in contact with the lower or female trimming die at the trimming station, and a pair of the fingers support the trimmed scrap at the scrap ejection station with the tines 225*a* of lever arm 228 positioned behind the scrap. In addition there will be a pair of the fingers between each station supporting, except with respect to the fingers between the scrap ejecting and casting stations, a work piece at an intermediate stage.

The operator now pours molten metal such as brass, aluminum or a ferrous metal, depending on the product being produced, into the casting runner 141 of the casting mold, the metal flowing into the main mold cavity 139 and from thence into runners 142 and finally into slots 137 in the same manner as described in said Pat. No. 3,445,904 to fill the main cavity and to form the support runners. An upper die member or core movable into operative position may be employed if desired. As the metal cools it will shrink placing the metal of the runners 142 under tension whereby the metal in the slots 137 is brought into tight frictional engagement with the fingers 134, the T or dovetail shape of the slots preventing the withdrawal of the metal from the slots. After an interval sufficient to permit the metal in the casting die to solidify the operator through suitable control means (not shown) initiates the elevation of the upper mold member, if one is employed, and energization of motive unit 84 to elevate the turntable to its indexing position.

It will be understood that during the casting operation the forging dies have been operated at the forging station to forge the work piece carried by the fingers 134 thereat. Preferably simultaneously with the withdrawal of the upper forging die and in any event immediately following the forging operation motive unit 192 is actuated to withdraw table 174 to the left as viewed in FIGS. 6 and 7 whereby blocks 162 and 166, which in effect form a single lever arm, are tilted allowing platen 154 and the bolster to descend and thereby separate the lower forging die from the forged piece to prevent the overheating of the lower die as could otherwise occur due to the time delay before the elevation of the turntable and the lifting of the forged piece. While the bolster and die block descend the ejecting pin or pins 214 remain stationary insuring that the forged work piece is separated from the lower forging die.

Also the period that the metal is being poured to form the casting motive unit 221 is energized to cause its piston rod 220 and platen 219 to descend to bring the male trimming die 218 into cooperative relationship with the female trimming die 217 to separate the forged pieces from the trim scrap as previously pointed out, the male die being then again raised to its elevated position. At the scrap ejection station motive unit 248 is energized to cause lever arm 229 to swing to the right as viewed in FIG. 10 and eject the scrap including the support runners from the fingers 134 the scrap first falling into trough 252 and upon further swinging movement of the arms sliding from the trough into a collecting bin or receptacle.

Following the completion of the casting operation and the elevation of the turntable previously described motive unit 116 is energized to rotate or index the turntable through one step. Motive unit 84 is then again energized but in an opposite stroke to lower the turntable to its working level locking pin 88 entering the overlying perforation 36 to accurately position the turntable and at the same time eject indexing pin 98. The indexing means is then again operated by energization of the motive unit 116 but in an opposite stroke to reset the indexing pin for a further indexing movement. The operations performed at the several stations and described previously are then repeated.

It will be understood that while the sequence of operation of the seevral motive units may be under manual control preferably a control system involving electrically operated valves in the hydraulic lines (not shown) to the several motive units, such as described in said Pat. No. 3,445,904 or of any other suitable type, may be employed, such control system however not being illustrated herein as it forms no part of the instant invention.

Having thus described the invention in rather complete detail it will be understood that these details need not be strictly adhered to, and that various changes and modifications may be made all falling within the scope of the invention as defined by the following claims.

I claim:

1. In a machine for producing metal forgings and including a casting station, a forging station, and a turntable for transporting work pieces cast at the casting station to the forging station said turntable having means for supporting said work pieces during said transport by integrally cast portions thereof the improvement comprising; means for locking said turntable against rotation at a first level for said casting and forging operations, means for elevating said turntable to a second level and simultaneously releasing said locking means, means for indexing said table while at said second level to transport a newly cast work piece from said casting station, a forged piece from said forging station and a previously cast work piece to said forging station, means to lower said turntable to said first level and lock the same against rotation, and means for presetting said indexing means in preparation for an indexing movement of said turntable while said turntable is at said first level.

2. In a machine as defined in claim 1 wherein there is a supporting post and said turntable is mounted on said post for rotative and sliding movements relative thereto.

3. In a machine for producing metal forgings and in-

cluding a casting station, and a turntable for transporting work pieces cast at the casting station to the forging station said turntable having means for supporting said work piece during said transport by integrally cast portions thereof the improvement comprising; means for locking said turntable against rotation at a first level for said casting and forging operations, means for elevating said turntable to a second level and simultaneously releasing said locking means, means for indexing said table while at said second level to transport a newly cast work piece from said casting station, a forged piece from said forging station and a previously cast work piece to said forging station, and means to lower said turntable to said first level and lock the same against rotation, and wherein said turntable includes an annular portion having a continuous annular series of equally spaced perforations, said indexing means includes a device mounted for rotative movement with and relatively to said annular portion, said device mounted for rotative movement comprises means engageable with successive perforations of said spaced perforations, and there is means to, upon disengagement of said engageable means with a perforation, rotate said device relatively to said annular portion and following engagement with one of said spaced perforations to cause conjoint rotation of said indexing device and said annular portion.

4. In a machine as defined in claim 3 wherein said locking means comprises a fixed support, and a locking element carried by said support in position to engage an overlying perforation of said series of perforations when said turntable is at said first level and to disengage said perforation when said said turntable is at said second level.

5. In a machine as defined in claim 4 wherein said means engageable with said perforations and said locking element are so positioned that upon lowering of said turntable to said first level and engagement of said locking element with one of said spaced perforations said locking element ejects said means engageable with said perforations from said one perforation.

6. In a machine as defined in claim 1 in which said forging station includes upper and lower forging dies and there is means for moving said upper die between a lower forging position at said first level and an upper position clearing a work piece positioned therebeneath when said turntable is at said second level, and there is means to move said bottom die between a forging position at said first level and a lower level spaced from but adjacent to said first level.

7. In a machine as defined in claim 6 wherein said means to move said bottom die comprises a vertically movable support therefor, a slide, lever means extending between said slide and said support and adapted upon movement of said slide to adjust between an inclined and a substantially upright position, and there is means for moving said slide.

8. In a machine as defined in claim 7 wherein said lever means comprises a pair of primarily cylindrical members having flattened contiguous surfaces, there is a recess in said support receiving a circumferential portion of one of said members and there is a recess in said slide receiving a circumferential portion of the other of said members, and there is means for securing said members against separation while permitting relative adjustment therebetween.

9. In a machine as defined in claim 6 wherein there is forged part ejecting means penetrating said bottom die and there is means so supporting said ejecting means and said ejecting means is so constructed that a portion thereof lies in the plane of an area of the upper surface of said bottom die when said bottom die is at said first level and projects above said plane when said bottom die is at said second level.

10. In a machine as defined in claim 9 wherein said ejecting means comprises a vertically extending member received within an opening in said die and said means supporting said ejecting means includes means for maintaining said member against movement with said bottom die.

11. In a machine as defined in claim 1 wherein said turntable includes a base portion, said means for supporting said work pieces by integrally cast portions thereof comprises parallel members projecting substantially radially from said base portion and having longitudinally extending recesses to receive the metal comprising said integrally cast portions, and wherein said machine includes a trimming station whereat a forging is separated from said integrally cast portions, and said machine further includes an ejecting station whereat said integrally cast portions are ejected from said parallel members, the further improvement comprising an ejecting means at said ejecting station comprising an arm having means to contact work pieces carried by said parallel member said arm being constructed to project between said parallel members when said turntable is at its first level and to lie below said parallel members when said turntable is at said second level, said arm being pivotally mounted for movement between a rearward position between said parallel members and adjacent said base and a forward position beyond said parallel members, means to move said arm from said forward position to said rearward position when said turntable is at said second level and means to move said arm from said rearward position to said forward position when said turntable is at said first level to eject said integrally cast portions from said parallel members.

12. In a machine as defined in claim 11 wherein said means to contact said work pieces comprises a pair of tines each tine of said pair being adapted to lie adjacent one of said parallel members when said turntable is at said first level and said arm is in its rearward position and means mounting said pair of tines on said arm for limited rotational movement.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,544,284 Dated December 1, 1970

Inventor(s) Vincent A. Iannucci

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 70, change "casting" to --castings--.

Column 3, line 47, change "overlyong" to --overlying--.

Column 5, line 17, cancel "prior".

Column 5, line 27, change "sleeev" to --sleeve--.

Column 6, line 68, change "25a" to --225a--.

Column 8, line 13, after "Also" add --during--.

Column 8, line 41, change "seevral" to --several--.

Signed and sealed this 30th day of March 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents