Oct. 19, 1948. D. BROWN ET AL 2,451,713

SEWER PIPE OFF-BEARING AND FINISHING MACHINE

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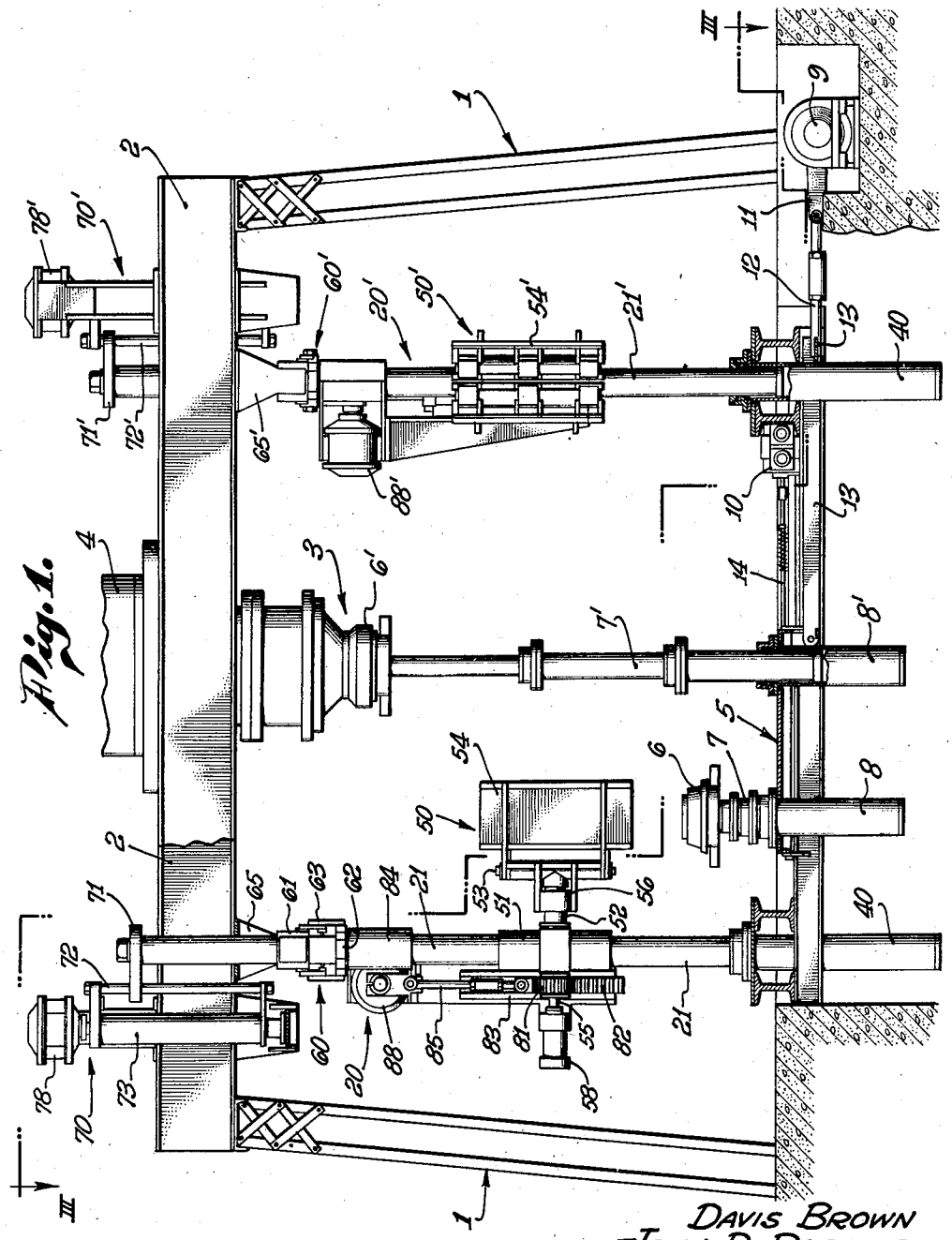


Fig. 1.

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SEWER PIPE OFF-BEARING AND FINISHING MACHINE

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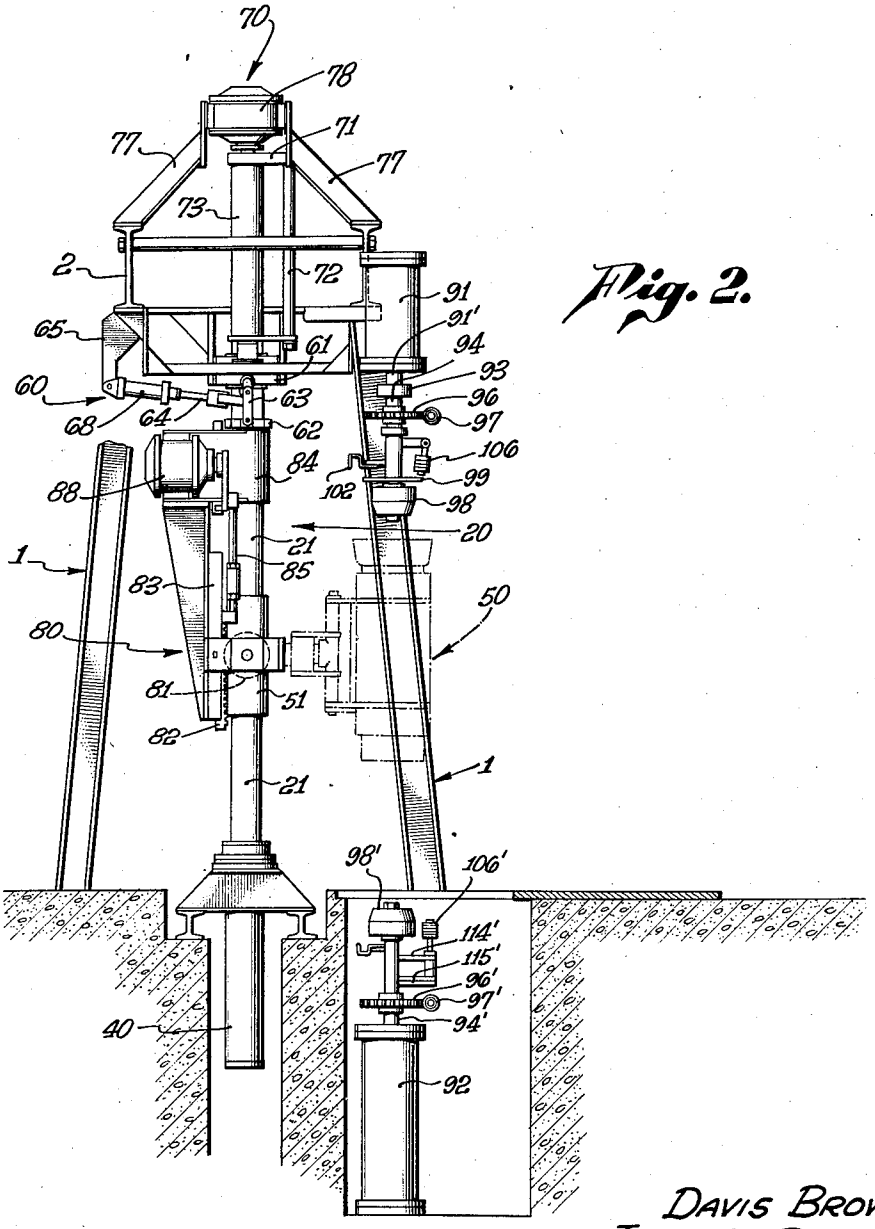


Fig. 2.

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SEWER PIPE OFF-BEARING AND FINISHING MACHINE

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Fig. 3.

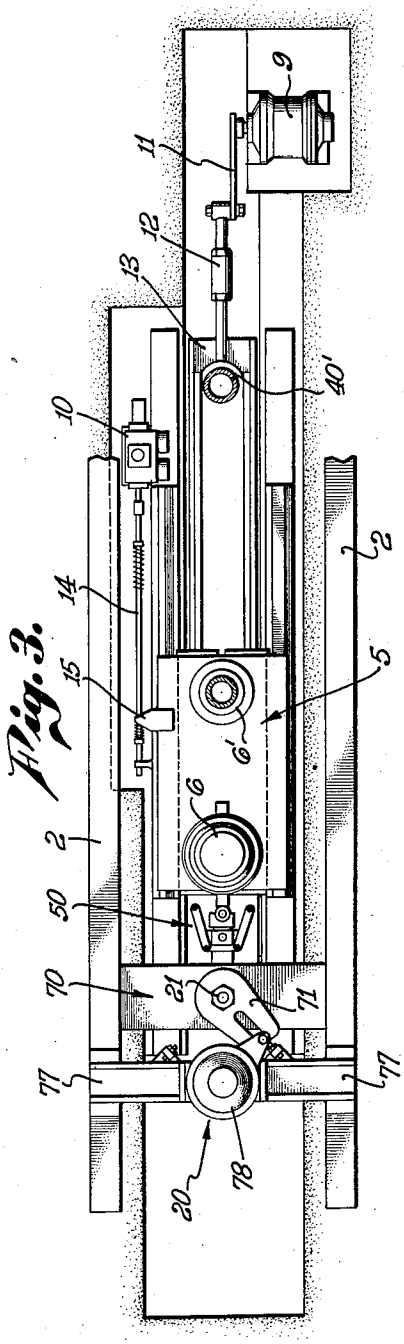
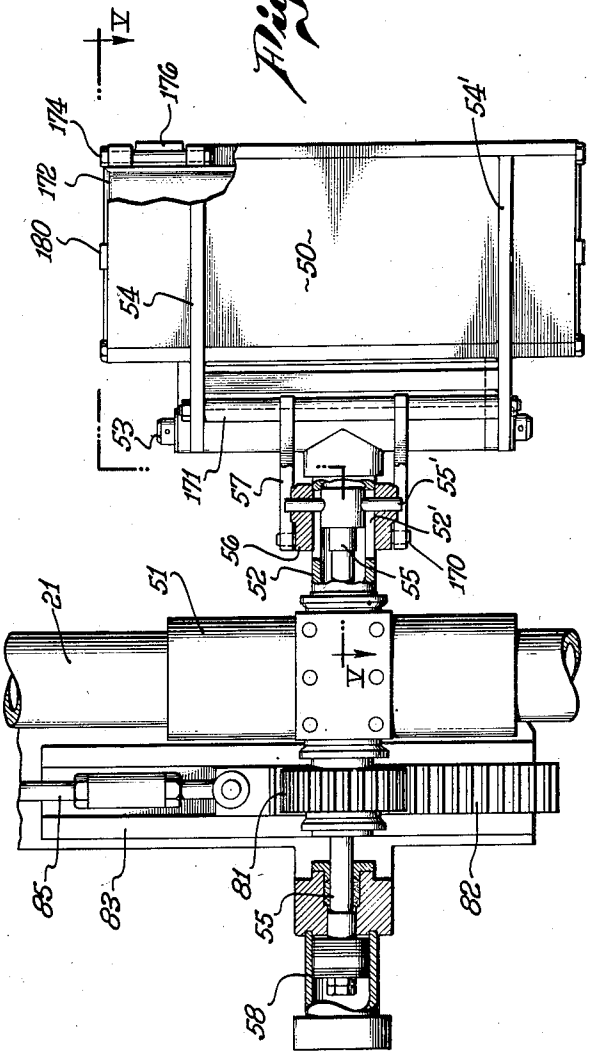


Fig. 4.



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Fig. 5.

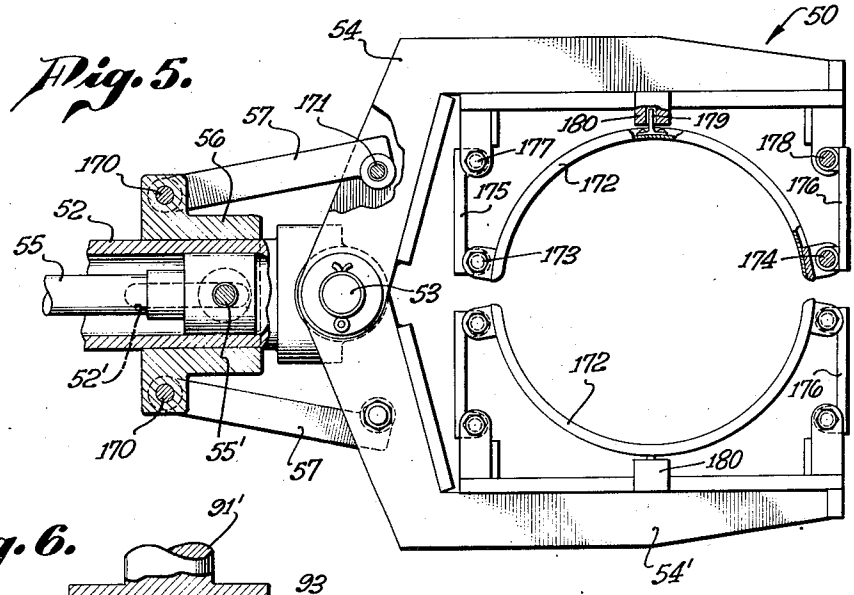


Fig. 6.

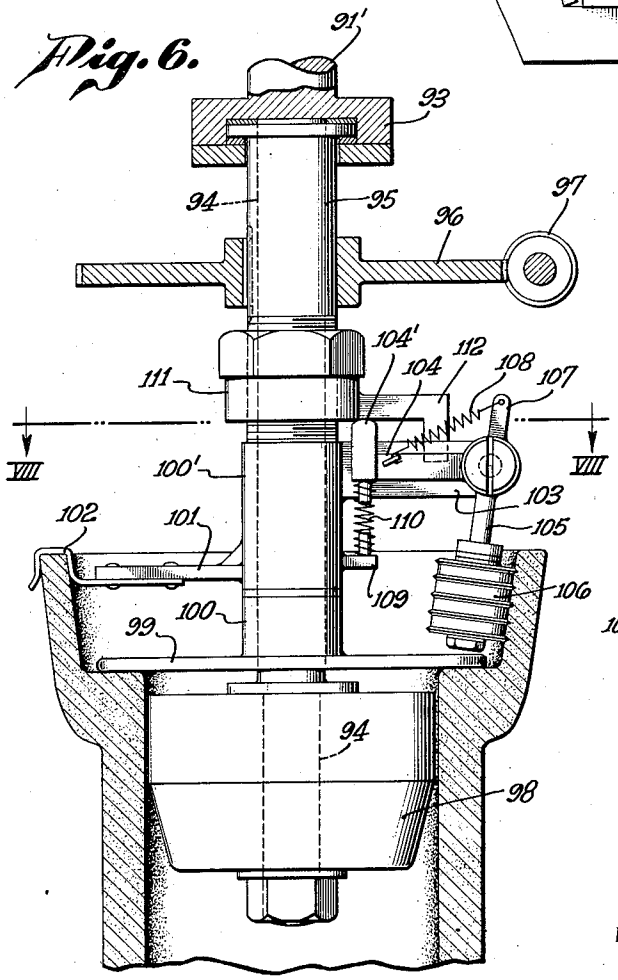
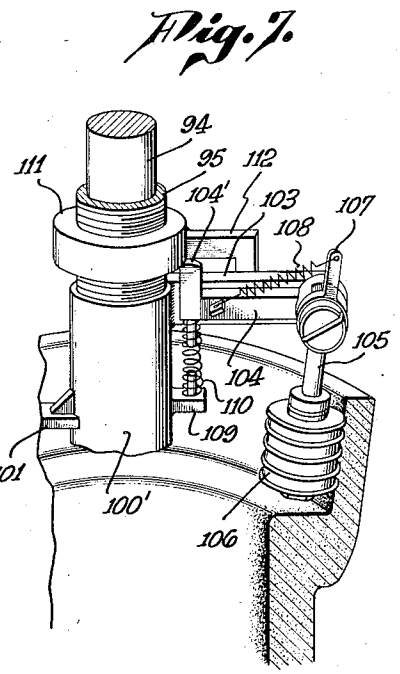


Fig. 7.



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SEWER PIPE OFF-BEARING AND FINISHING MACHINE

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Fig. 8.

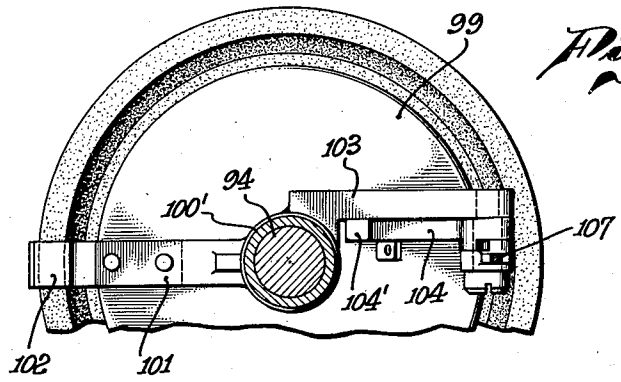


Fig. 9.

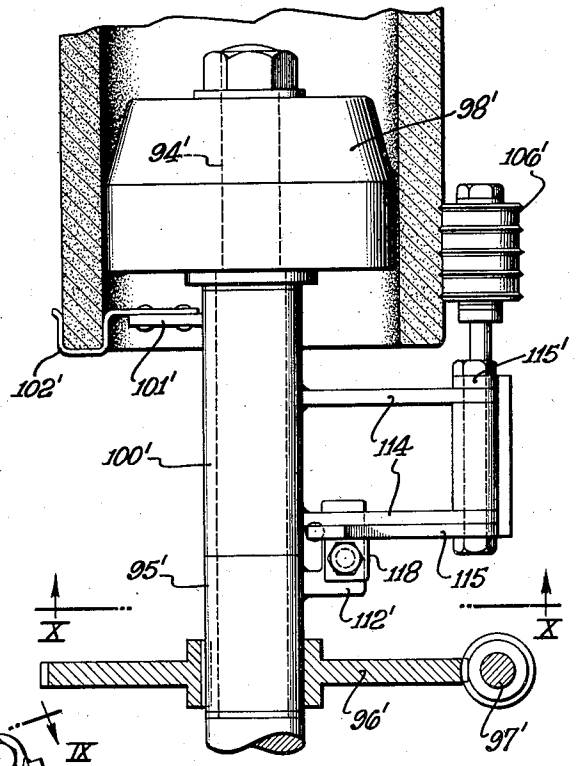


Fig. 11.

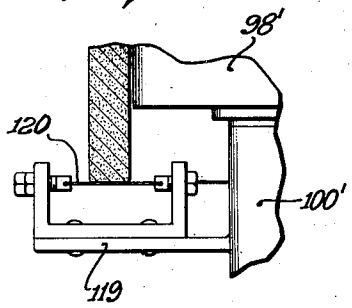
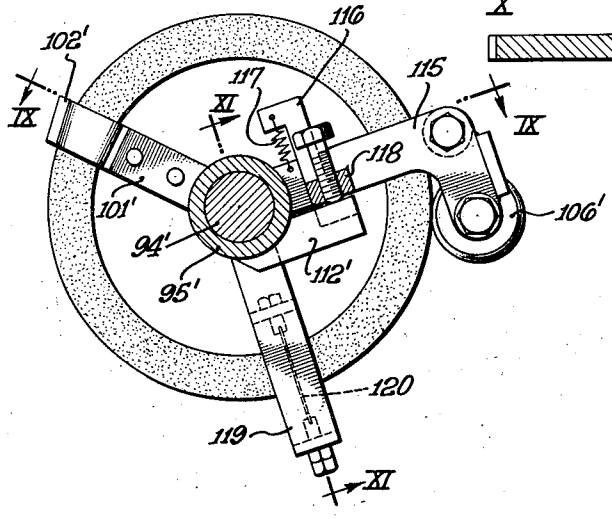


Fig. 10.



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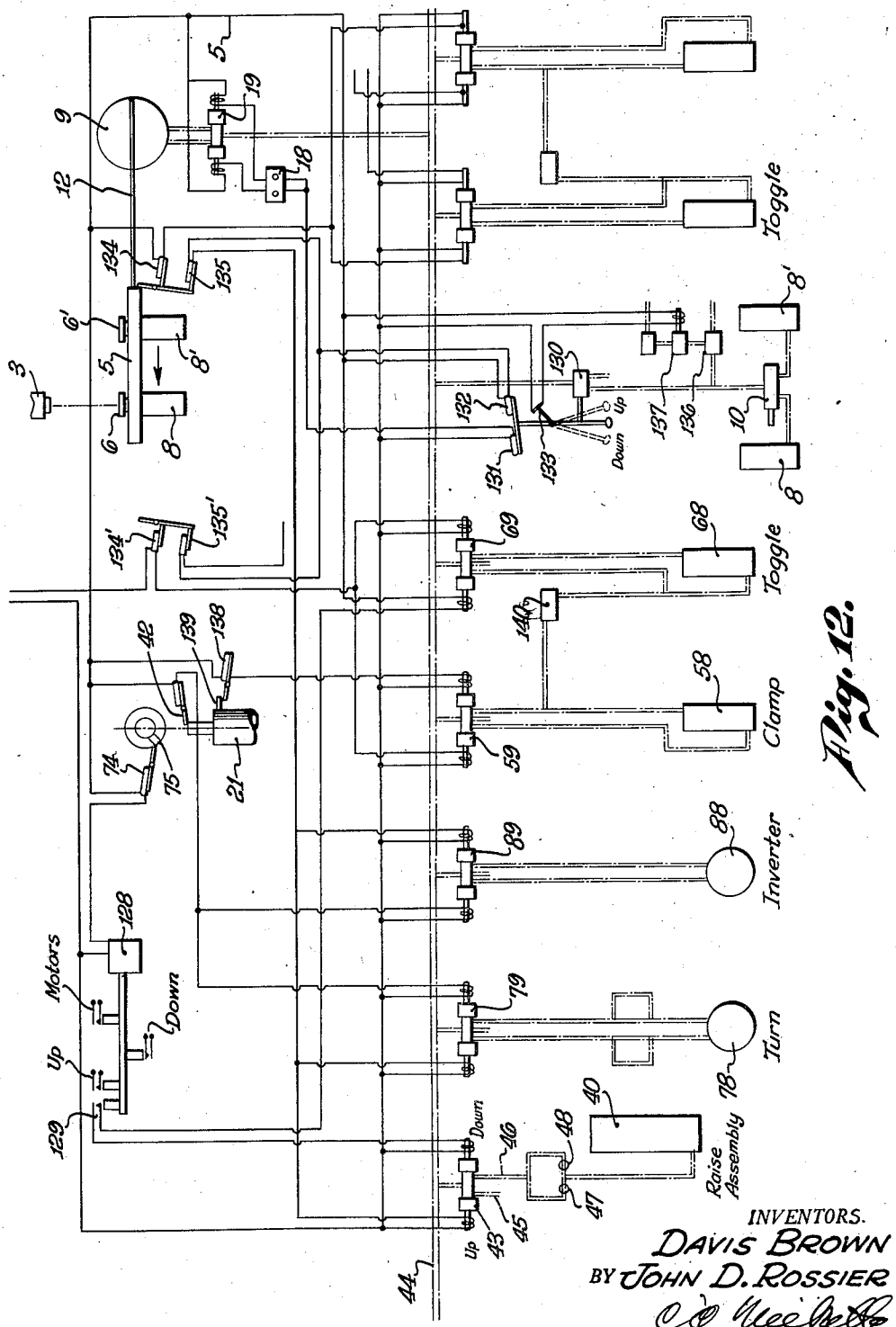


Fig. 12.

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Fig. 13.

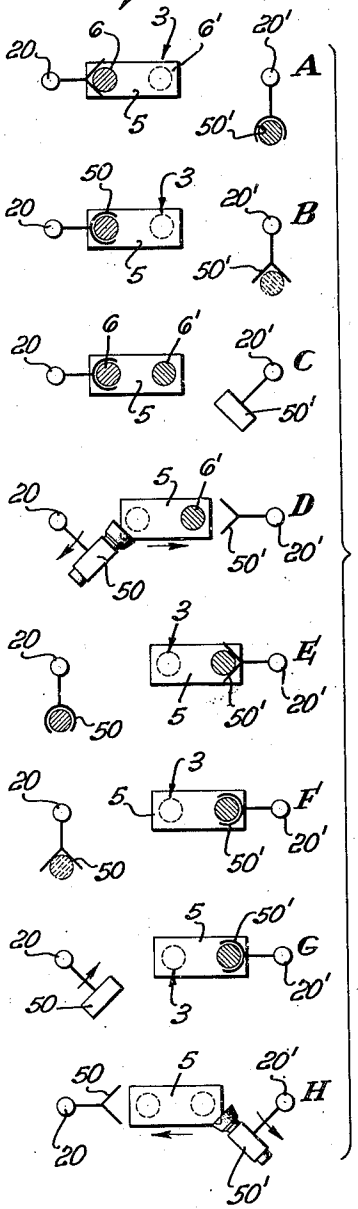


Fig. 14a.

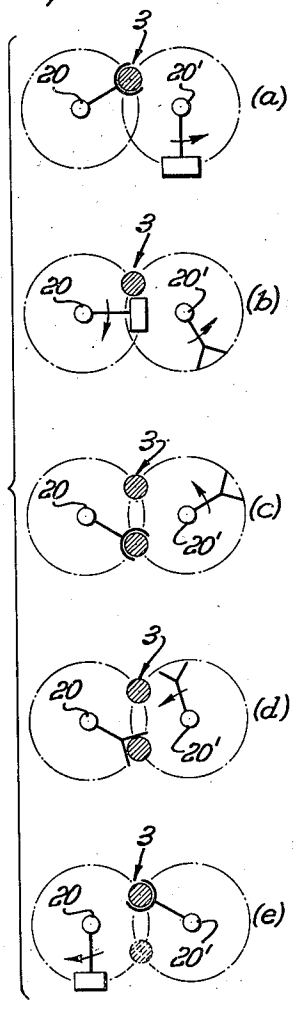
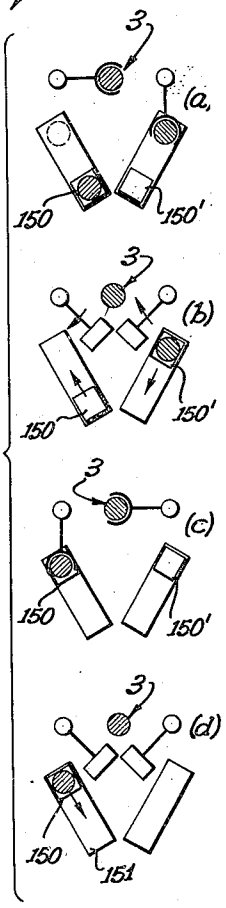


Fig. 14b.



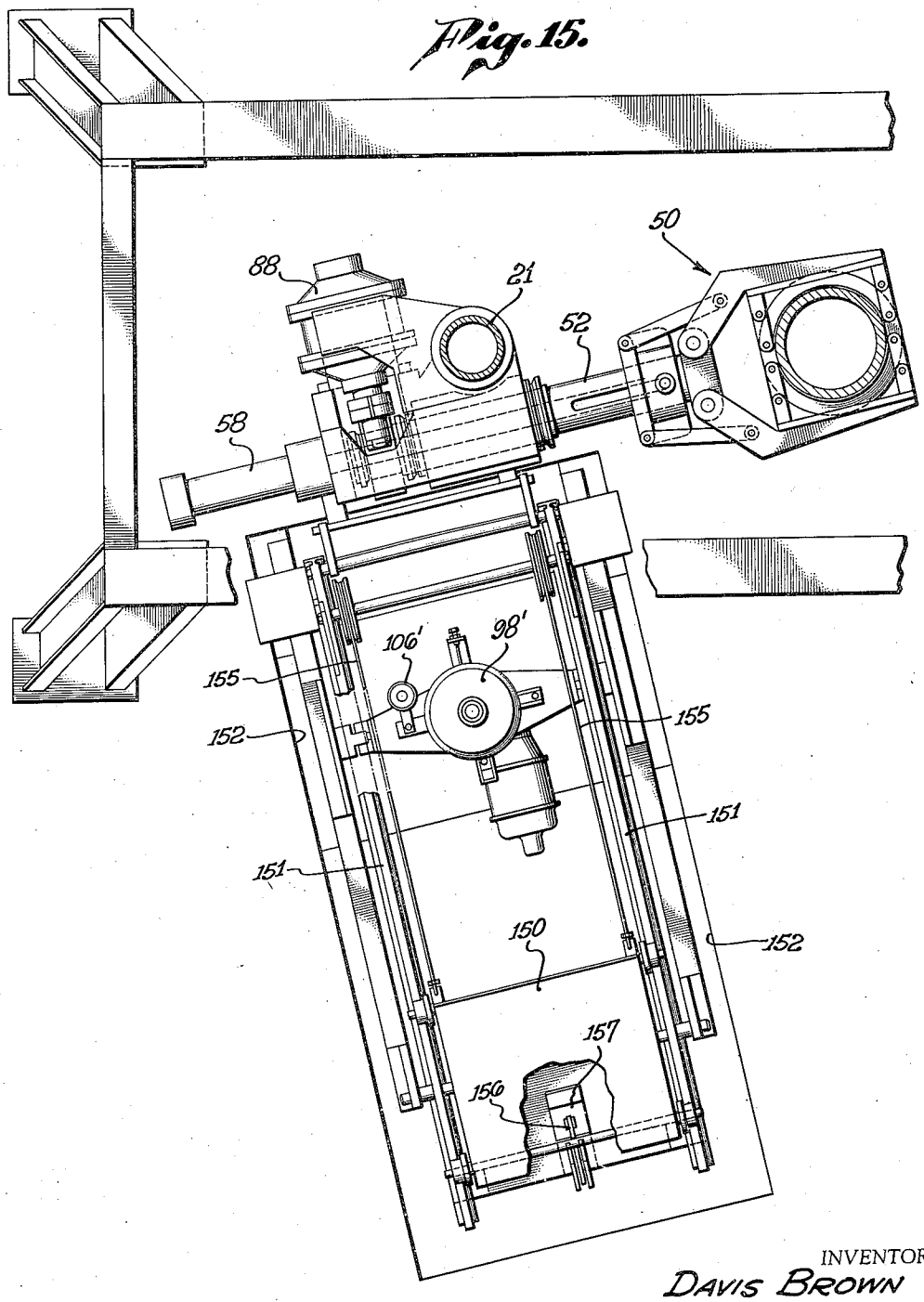
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SEWER PIPE OFF-BEARING AND FINISHING MACHINE

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Fig. 15.



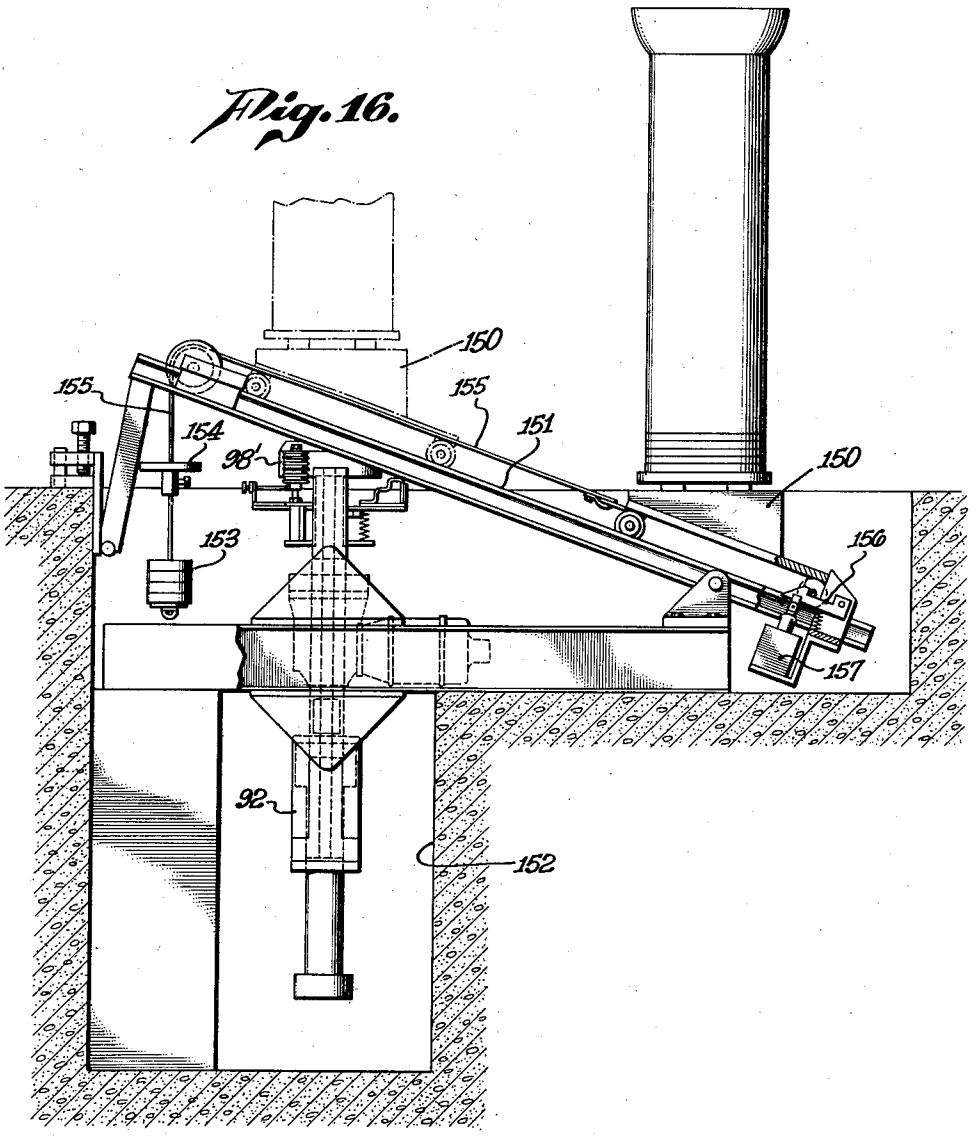
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SEWER PIPE OFF-BEARING AND FINISHING MACHINE

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Fig. 16.



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2,451,713

UNITED STATES PATENT OFFICE

2,451,713

SEWER PIPE OFF-BEARING AND FINISHING MACHINE

Davis Brown, Los Angeles, and John D. Rossier, Compton, Calif.; said Rossier assignor to said Brown

Application November 5, 1945, Serial No. 626,752

22 Claims. (Cl. 25—40)

1

This invention relates to a machine for moving relatively large objects from one point to another and is particularly directed to a machine for handling extruded clay composition pipe whereby such pipe may be removed from a die and transported to a predetermined discharge point. In a more complete machine, the molded pipe is automatically removed from the die, turned or inverted, brought into operative relation with a finishing mechanism and then placed upon a suitable carrier or pallet so that it may be removed from the vicinity of the die and subjected to various other operations such as drying, burning, glazing, etc. Although the machine is capable of being used in handling various objects, the subsequent description will be specifically directed to the adaptation of the machine to the sewer pipe industry.

The clay industry, and particularly the clay pipe industry, has depended largely upon manual labor in the handling of its products during manufacture. Although sewer pipe originally was of small diameter and of relatively short length and could be readily handled manually, more recent developments have involved the manufacture of clay composition pipe of large diameter and of appreciable length. Clay pipe having a diameter of sixteen or eighteen inches and a length of four feet is not unusual and such pipe is of considerable weight and imposes a tremendous burden upon labor. The machine of the present invention facilitates the operations in that a single extrusion machine may be operated effectively and rapidly by a minimum of operators, the burdensome work of handling the extruded pipe being performed mechanically and automatically by the machine of this invention.

Generally stated, the machine of the present invention is used in combination with an extrusion die and a cooperating former. In the manufacture of bell end pipe, the former cooperates with the outlet of the die so as to form the bell end of the pipe. The former moves away from the die as the clay pipe is extruded therefrom. After a proper length has been extruded, the pipe is cut off. The machine of the present invention then grasps the extruded pipe, lifts it from the former and carries the pipe away to a point of discharge. During such movement, the pipe is preferably inverted, end for end, and brought into cooperative relation with a finishing mechanism which finishes the ends of the pipe, trimming the pipe to a precise length and rolling or annealing the ends so as to strengthen them. Thereupon, the machine automatically

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deposits the pipe in its inverted position upon a suitable carrier, pallet, or the like, on which the pipe is carted away to the driers. It may be noted that since the clay composition is relatively plastic, the pipe is preferably not permitted to stand upon its bell end, since such bell may be readily deformed in its attempt to support the weight of the pipe. Upon inversion, the pipe may stand upon its so-called spigot or plane end, the thrust being direct and the chance of causing deformation of such end being practically negligible.

The invention, moreover, contemplates the provision of pressure fluid and electro-responsive means whereby the various operations are timed and automatically performed in proper sequence. Safety features are included so that the pipe or other object being handled is not dropped or moved unless other conditions permitting safe movement of the object have been fulfilled.

An object of the invention, therefore, is to provide a new and improved machine for carrying and handling various objects, particularly clay pipe.

A further object is to provide a bearing-off mechanism capable of handling relatively fragile, molded objects such as freshly extruded pipe.

A still further object is to provide an automatic mechanism for removing extruded pipe from a die and depositing such pipe at a point removed from the die without the necessity of employing excessive amounts of manual labor.

Again an object of the invention is to provide automatic means for removing freshly formed, relatively fragile clay composition objects from a die, automatically performing finishing operations on such objects and depositing the objects at a discharge point removed from the primary source of such objects.

These and various other objects will become apparent to those skilled in the art from a contemplation of the exemplary forms of the invention more fully described hereafter. In such description, reference will be had to the appended drawings, in which:

Fig. 1 is a front elevation of one complete pipe forming and handling assembly embodying the invention hereof.

Fig. 2 is an end view of the arrangement shown in Fig. 1.

Fig. 3 is a horizontal sectin and plan taken approximately along the plane III—III of Fig. 1.

Fig. 4 is an enlarged, partially broken away view of the pipe clamping means.

Fig. 5 is a horizontal section and plan view taken along the plane V—V in Fig. 4.

Fig. 6 is an enlarged side elevation, partly in section, of a finishing device adapted to cooperate with an upper end of a pipe.

Fig. 7 is a perspective view of a portion of the device illustrated in Fig. 6.

Fig. 8 is a transverse section taken along the plane VIII—VIII of Fig. 6.

Fig. 9 is an enlarged side elevation, partly in section, of a finishing device adapted to cooperate with a lower end of a pipe.

Fig. 10 is a transverse section taken along the plane X—X through Fig. 9.

Fig. 11 is a vertical section taken along the plane XI—XI of Fig. 10.

Fig. 12 is a combined wiring diagram and schematic representation of various elements used in the assembly shown in Fig. 1.

Fig. 13 is a schematic representation of a sequence of steps carried out during the operation of the device.

Figs. 14*a* and 14*b* are schematic representations of alternative methods of operation.

Fig. 15 is a plan view of a modified arrangement adapted to perform the operations illustrated in Fig. 14*b*.

Fig. 16 is a side elevation of the modification shown in Fig. 15.

The machine illustrated in the drawings preferably includes a framework having the uprights 1 and the horizontal upper platform 2 which may either support or be closely associated with a customary clay extrusion machine. A machine provided with a vertically directed die 3 is illustrated in the drawings, the main pressure chamber of the machine being partially indicated at 4. In the form of machine illustrated in Figs. 1, 2, and 3, a shuttle 5 is provided, this shuttle being movable beneath the die 3. The shuttle is provided with two formers 6 and 6′ mounted for vertical movement, as for example, by means of telescopic rods 7 and 7′ actuated by hydraulic cylinders 8 and 8′, these cylinders being carried by the shuttle. Means are also provided for moving the shuttle horizontally so as to place the formers 6 and 6′ alternately in alignment with the vertical axis of the die 3. The shuttle motor is indicated at 9. The shuttle also operates a selector valve indicated at 10.

The machine includes a bearing-off mechanism or assembly generally indicated at 20 adjacent the die 3. In the form illustrated in Figs. 1 and 2, two such bearing-off mechanism are positioned adjacent the die 3, the other mechanism being indicated at 20′. Since both assemblies are substantially identical, the description will be particularly directed to but one such assembly.

Generally stated, each assembly is provided with means for imparting vertical motion thereto, such as for example, the hydraulic cylinder 40. Each assembly carries an object grasping or clamping device indicated at 50. Means are provided for preventing undesired vertical motion of the assembly until other conditions are met, and such releasable blocking means are generally indicated at 60 (see Fig. 2). Means are also provided for turning the entire assembly about a vertical axis and such turning means are generally indicated at 70. The device may also include means for inverting the clamp so as to upend the object held by the clamp; such inverting means are generally indicated at 80. The machine in its ultimate form is also provided with a finisher 90 adapted to cooperate with the object

held by the clamp at or near the discharge position thereof so as to perform finishing operations upon the pipe held by the clamp just before such pipe is discharged.

Before going into the details of the mechanism, the various operations of the machine will become apparent from an examination of Fig. 13. As there shown in plan, the shuttle 5 is at the left end of its stroke, the former 6 carrying a completed pipe, whereas a new pipe is being formed or extruded through the die 3 on to the former 6′. The assembly 20 is in position to receive a freshly extruded pipe, whereas the assembly 20′ is releasing the finished pipe. In step B, assembly 20 is grasping the pipe, whereas assembly 20′ has opened its clamping means 50′ to discharge a finished pipe. In step C the assembly 20 is lifting the clamped pipe off the former, whereas assembly 20′ is returning to its original position and simultaneously inverting the clamp 50′. During steps A, B, and C a pipe is being extruded through the die 3 on to the former 6′.

In step D assembly 20 is shown inverting the pipe and simultaneously turning into a discharge position. The shuttle 5 is moving toward the right and assembly 20′ with its clamp in open position is ready to receive the freshly extruded pipe carried by the former 6′. In step E assembly 20 is shown turned into its discharge position and at this stage the ends of the pipe held by the clamp 50 may be subjected to a finishing operation. In the meantime, assembly 20′ may be getting ready to grasp the pipe on former 6′. In step F assembly 20 is shown lowering and releasing the finished pipe while assembly 20′ is clamping and lifting the pipe from former 6′. Step G includes the return of assembly 20 and the reinversion of the clamp carried thereby, whereas assembly 20′ is lifting the pipe from former 6′ and initiating its travel to its discharge position. In step H assembly 20 is shown in position to receive another pipe which was extruded through the die during steps E, F, and G while assembly 20′ is turning and inverting the pipe from former 6′.

It will be evident from the schematic description of the sequence of operations illustrated on Fig. 13 that the die is kept active and pipe may be rapidly manufactured and automatically carried away from the die.

By referring to Figs. 1 and 2, it will be noted that the shuttle 5 is positioned over a pit and is moved along suitable guides. The motor 9 is preferably of the hydraulic type and is provided with a crank arm 11 and linkage 12 connected to a yoke 13 which, in turn, is connected to the shuttle 5. The yoke is slotted so as to receive the hydraulic cylinder 40′ of assembly 20′. The selector valve 10 is provided with an actuating rod 14, such actuating rod being moved by means of an arm 15 extending from the shuttle 5, the rod 14 being provided with suitable stops capable of cooperating with the arm 15 when the shuttle is at the end of each stroke. The valve 10 is therefore moved at the end of each stroke of the shuttle 5 and such valve preselects and determines which of the two former rod cylinders 8 or 8′ will be capable of being raised or lowered by the operator, as will be more fully described hereafter.

The assembly 20 consists of a vertically movable member 21 capable of being rotated about its axis. Vertical motion is imparted to this member 21 by means of the hydraulic cylinder 40. The upper end of the member 21 or any appropriate por-

tion thereof is adapted to contact a switch 42 (see Fig. 12) when the assembly is at the top of its stroke. The vertical motion of the assembly is under the control of a suitable valve 43 which is preferably of the 4-way, closed center, detent, solenoid-operated type. As shown in Fig. 12, such valve (as well as the other valves) may be supplied from a main hydraulic pressure manifold or source 44, outlet 45 being a return to the sump associated with the hydraulic system, whereas line 46 leads to the bottom of the hydraulic cylinder 40 through a split line including regulatable orifice valves 47 and 48 and oppositely directed check valves in the two branches of the line 46.

The main assembly carries a clamp generally indicated at 50. Such clamp may be carried by an external sleeve 51 attached to the main column of the assembly, the sleeve being provided with a bracket through which a rotatable, hollow quill 52 extends. The end of this quill carries a transverse bearing post 53 upon which L-shaped clamp frames 54 and 54' are pivotally mounted.

The grasping and releasing of the clamp is under the control of a hydraulic motor 58 which in turn is regulated by a 4-way, closed center, detent, solenoid-operated valve 59 (shown in Fig. 12). The motor 58 controls the reciprocation of a piston rod 55 mounted within the quill 52, such piston rod having transversely extending pins 55' extending through slots 52' in the quill 52 and engaging a collar assembly 56 slidable on such quill. The collar assembly is connected by means of links 57 to the clamp frames 54 and thereby causes such clamp frames to close upon or release the pipe.

In order to prevent vertical motion of the assembly 20 and column 21 thereof before the clamp 50 has operated, and in order to properly time the various operations, a blocking mechanism 60 is provided. This blocking mechanism comprises a stationary collar 61 suitably supported from the upper frame or platform of the machine and surrounding the vertical assembly. The vertically movable element 21 is provided with a collar 62 attached thereto. The stationary collar 61 and the collar 62, which is movable with the main vertical element 21, are linked together by means of toggles 63, such toggles being movable by means of a hydraulic motor 68 connected to the linkage 63 by an arm or piston rod 64. In the event the motor 68 is of the hydraulic cylinder type, the end of such motor may be pivotally connected to a bracket 65 extending from the upper platform 2 of the machine. The motor or hydraulic cylinder 68 is under the control of a 4-way, closed center, detent, solenoid-operated valve 69.

It will be understood that the vertical movement of the assembly is limited by the stationary stop 61. Whenever the toggle 63 is broken by the hydraulic cylinder 68, the assembly 20 may move upwardly until the stop collar 62 comes in contact with the stationary stop 61.

Means are also provided for turning the entire assembly about its vertical axis so as to move the clamp 50 from a position immediately above a former to a discharge position. Such means may comprise a slotted arm 71 mounted upon the upper end of the vertical assembly, the slot in such arm slidably receiving a turning pin 72 carried by arms extending from a rotatable jack shaft 73 suitably journaled in the upper framework of the machine. Partial rotation through

a suitable angle is imparted to the jack shaft 73 by means of motor 78 which is controlled by means of a 4-way, closed center, detent, solenoid-operated valve 79. The motor 78 and the upper journal for the jack shaft 73 may be supported by a superstructure or bracing 77. It will be readily understood that partial rotation of the jack shaft 73 together with its driving pin 72 will cause rotation of the slotted arm 71 and the vertical assembly 20 about the vertical axis of such assembly.

Means may be provided for the purpose of insuring operation of a finishing mechanism 90 when the assembly 20, together with its clamp 50, has been rotated into operative relation with the finisher. Such means may comprise an arm 75 extending from the slotted arm 71 (or any other portion of the rotatable assembly) such arm being adapted to close a switch 74 (illustrated in Fig. 12).

During turning of the assembly from a pipe receiving position to a finishing and discharge position, it may be desirable to invert the clamp 50. The inverting means is generally referred to at 80 and may comprise a pinion 81 mounted on the sleeve or quill 52 which supports the clamp 50. The pinion 81 cooperates with a rack gear 82 slidably mounted in a supporting structure 83 extending from the sleeve 51. The supporting structure may, at its upper end, be provided with another collar and bracket 84, the bracket portion of such collar supporting a pressure fluid motor 88 suitably connected to the rack gear 82 as by means of a linkage 85. The motor 88 is under the control of another 4-way, closed center, detent, solenoid-operated valve 89 (see Fig. 12).

It will be evident from the description given that when the hydraulic motor 88 is energized, the rack gear 82 will be moved vertically in a direction parallel to the axis of the vertical assembly 20 and will cause rotation of the sleeve 52 by reason of the pinion 81. Rotation of the sleeve 52 will be translated into rotation of the clamp carriage so as to cause the entire clamp to rotate about a horizontal axis coincidental with the axis of the piston 55.

Adjacent the vertical assembly 20, but at a point removed from the die 3, is the finishing mechanism 90 by means of which both ends of the pipe may be trimmed and finished by rolling and annealing the ends so as to make them more resistant to breakage and facilitate the development of a tough body during burning. In some instances, the finisher may only operate on one end of the pipe and in other instances or installations, the finisher may be dispensed with entirely. The form of device illustrated in the drawings, however, is capable of acting upon both ends of a pipe. The finishing mechanism in its ultimate form includes a device for operating on the upper or bell end of the pipe and a device for operating on the lower or spigot end of the pipe. These two mechanisms are moved toward each other by means of hydraulic cylinders (or other suitable means) such as 91 and 92, the operation of these cylinders, together with the driving motor for operating the finisher proper, being controlled by switch 74 previously noted. The rod 91' of the hydraulic cylinder 91 is provided with a swivel joint 93 to which the main shaft 94 is connected. Such main shaft 94 is provided with a rotatable sleeve 95 on which there is mounted a pinion 96 in engagement with a worm 97 driven by a small motor, not shown.

The lower end of the central shaft 94 is provided

with a conical head 98 capable of entering the upper end of the pipe held by the clamp. Immediately above the head 98 is a disc or foot 99 carried by the lower end of a sleeve section 100 slidable upon the shaft 94. The upper portion of the sleeve section 100' carries a radially extending arm 101 provided with a finishing and rounding blade 102 adapted to cooperate with the end of the bell of the pipe. Such sleeve section 100' is also provided with a radial arm 103 carrying a pin on which there is pivoted a control arm 104 and a separately pivotable shaft 105 carrying the roller 106, an upper extension of such shaft 107 being connected by means of a spring 108 to the arm 104. Around the pivot pin the arms 104 and 105 are provided with an interlocking engagement which permits the arm 104 to move downwardly while the arm 105 remains stationary and does not move in a pivotal manner around the pivot pin. The sleeve section 100' is also provided with a lug 109 carrying a spring 110 bearing against the inner end of arm 104 tending to raise such arm. In such raised position the arms 105—107 are pivoted upon the pivot pin so as to cause the roller 106 to approach the sleeve section 100'.

The driven sleeve 95 carries a suitable nut or collar 111 provided with a pusher arm 112, this arm contacting the supporting bracket 103 and causing the supporting bracket, sleeve section 100' and finishing mechanism carried thereby to be rotated. The pusher collar 111 is sufficiently large so that when the plate 99 has been brought into contact with the inner shoulder of a bell end pipe and the centrally disposed shaft 94, together with its conical head 98, has descended into the bell end pipe, the sleeve section 100 will raise sleeve section 100'. The lug 104' carried by the inner end of the arm 104 will contact the driven push collar 111. Since the driven sleeve 95 and push collar 111 are fastened to the central shaft 94 and will descend therewith, relative axial motion is attained between sleeve section 100' and push collar 111, thereby causing the arm 104 to pivot about its pin, spring 110 being overcome. Such pivotal, downward movement of arm 104 permits the roller 106 to be swung against the inner side of the bell, undue pressure against such bell being prevented by reason of the broken interlock around the pivot pin, only the pressure of spring 108 forcing the roller 106 against the bell.

The lower finisher adapted to contact the plane or spigot end of the pipe is raised and lowered by means of the hydraulic cylinder 92 and in a similar manner, raises shaft 94' carrying a conical head 98' which enters the pipe. A sleeve 100' is journaled upon the shaft 94', such sleeve carrying a pair of arms 114 which support a bell crank lever 115 interlocked with an upper arm 115', these two arms 115 and 115' supporting the upstanding pin on which there is rotatably mounted the roller 106'.

The inner end of bell crank lever 115 is provided with an extension 116 and a spring 117 connected to such extension and to one of the arms 114 normally urges the bell crank lever around its pivot pins so as to place the roller 106' away from the outer surface of a pipe.

The shaft 94' also carries a driven sleeve 95' (driven by sprocket 96' and worm and motor 97'). This driven sleeve 95' carries a radially extending pusher arm 112' which bears against a downwardly extending lug 118 carried by the bell crank 115. The pusher thereby overcomes the spring 117 and pivots the bell crank so as to bring the roller 106' into rolling contact with the outer surface of the pipe. Simultaneously rotation is imparted to the sleeve 100' and such sleeve carries a radial arm 101' carrying a finisher 102' and also a radial arm 119 provided with a trimming or cutting blade, knife or wire 120.

By suitably adjusting the hydraulic cylinders 91 and 92 and the various sleeves carried by the shafts 94 and 94', the finishing device may be caused to enter the pipe, finish both ends and produce a pipe of precise, predetermined length.

The valves for admitting pressure fluid to the hydraulic cylinder 91 and 92 and the switches for the control of the motor driving worms 97 and 97' may be under automatic control established by a commutator drum driven by a separate motor 128 (see Fig. 12). At the conclusion of a cycle of operations, this motor-driven control commutator 128 may momentarily close switch 129 as indicated in the wiring diagram so as to signal the completion of a finishing operation and permit the assembly to discharge the now finished pipe.

As best shown in Fig. 2, the lower hydraulic cylinder 92 is positioned within a pit adjacent the assembly 20 so that at the completion of a finishing operation, the entire lower finisher withdraws into the pit permitting an operator (or some automatic mechanism) to place a pallet, dolly, or other device immediately beneath the now finished pipe.

At the completion of the finishing operation the assembly 20 is lowered and after being lowered the clamp 50 is opened, thereby depositing the pipe upon the pallet or dolly for removal to a drying kiln or the like.

The clamp 50 is preferably arranged so as to firmly and uniformly clasp pipe which may vary somewhat in diameter. The L-shaped clamp frame members 54 pivot on the king pin 53 (which is firmly mounted on the end of rotatable sleeve 52) and are preferably connected by actuating links 57 to the movable piston 55 by means of collar assembly 56 and radially extending pins 55'. The ends of links 57 are pivotally connected to sleeve 56 as at 170 and the other ends of links 57 may be attached directly to the clamp frames 54, or upper and lower clamp frames on one side of the clamp may be connected one to the other by means of a member 171 and the links 57 pivotally connected to such member 171.

In order to insure firm, yielding contact with pipe of varying diameter (within limits) and with pipe which may be slightly out of round, each of the clamp frames carries a semicircular, resilient clamping face 172 which is pivotally connected at its ends 173 and 174 to links 175 and 176 pivotally connected to the clamp frame as at 177 and 178. The semicircular, resilient member 172 may carry a rearwardly extending fin 179 slidably cooperating with a longitudinally extending guide 180 carried by the clamp frames 54. In this manner the clamping elements 172 are maintained in suitable relation to each other so that each semicircular member 172 cooperates with the same center in space when the clamp is closed. Spring means may be provided around the pivot points 177 and 178 so as to prevent undue spreading of the ends of each clamp face 172. The rearwardly extending fin 179 may, moreover, be provided with a transversely extending lip cooperating with a corresponding slot in the longitudinal guide 180 for the purpose of

limiting inward motion of the radial portion of the edge of clamp faces 172.

In order to permit these various operations to be carried out in an automatic manner, electroresponsive means are provided so that an operator may run the entire machine from a single vantage point, initiating the various operations and permitting the mechanism to carry out a complete sequence without further personal manual control. Fig. 12 schematically illustrates certain elements of the apparatus and discloses an electrical circuit which permits these operations to be carried out automatically by means of the various devices described hereinbefore.

In Fig. 12 the shuttle 5 is at its righthand position so that the former 6 is in axial alignment with the die 3. Attention is called to the fact that the hydraulic cylinders 8 and 8' are shown on the shuttle and also appear at the bottom of Fig. 12 where they are shown connected by suitable conduits to the shuttle-operated valve 10 previously referred to. The shuttle-operated valve 10 or selector valve is associated by a suitable conduit with a hand controlled valve 130, this valve being a 4-way, closed center, spring centering type of lever-operated valve. The lever of said valve is capable of closing and opening switches 131 and 132 and is also capable of closing the switch 133 when it is in center position only.

It will also be noted that the movement of the shuttle 5 actuates switches positioned at the ends of the stroke of the shuttle. In its righthand position (illustrated) the shuttle is shown as having closed switches 134 and 135. The lefthand switches 134' and 135' are shown in open position.

The shuttle motor 9 is controlled by means of the solenoid operated, 4-way, reversing valve 19 capable of being placed in operation by means of push buttons illustrated at 18.

In order to simplify the composite hydraulic and electrical diagram (Fig. 12) the hydraulic lines have been indicated in dash lines. Incoming electrical power appears at the top of the figure.

Operation of the mechanism

In the position illustrated in Fig. 12, with the shuttle at the right, it may be assumed that a complete pipe is resting upon the former 6' which is in lowered position. The lefthand former 6 can be raised by operation of the lever-operated valve 130 by moving the lever to its up position, whereupon hydraulic fluid will be permitted to pass from the supply manifold through the valve 130 to the selector valve 10. The selector valve 10 has been actuated by the shuttle so that pressure fluid may flow into hydraulic cylinder 8. After the former 6 has been raised to contact with the die 3, the valve 130 is brought to the center position. As clay is being extruded through the die 3, the former 6 will move downwardly under a controllable back pressure, the back pressure being established by an adjustable orifice or throttle valve 136 which is opened by the pilot valve 137, such valve opening whenever switch 133 is closed (by placement of the lever-operated valve 130 in center position). Pressure fluid from cylinder 8 will therefore bleed through the throttle valve 136, imparting only the desired amount of resistance to the downwardly extruded pipe from the die 3. It is also to be noted that when the former 6' has been completely lowered (by moving the valve 130 to its down position) the switch 132 had been closed at the same time that switch 135 was closed. While the shuttle is in the righthand position, therefore, the up side of valve 43 controlling the raising of the assembly was energized through the closing of switches 135 and 132 and simultaneously the block side of toggle-actuating valve 69 was closed so that upward movement of the assembly is prevented even though pressure fluid is being admitted to assembly cylinder 40. Inasmuch as the main assembly and vertically movable post 21 thereof are in the down position, switch 138 is closed, this switch being actuated by an arm 139 carried by the assembly. The closure of switch 135 had energized the unclamped side of valve 59 which controls the clamping cylinder 58.

From the above it will be noted, therefore, that means have been provided, controlled by the position of the shuttle, for selectively limiting the control of valve 130 to one only of the former raising and lowering cylinders 8 and 8', such means including the shuttle-operated valve 10.

Means are also provided for moving the shuttle (push buttons 18, electroresponsive valve 19, and hydro motor 9) but means have been provided for rendering the shuttle moving means inoperative unless both former rods 6 and 6' are in lowered position. From the circuit it will be evident that push buttons 18 are inoperative unless the master control 130 is in down position, since such down position is necessary in order to close switch 131.

After the bearing-off mechanism 20' has removed the pipe from former 6' and a pipe has been extruded on to former 6, such pipe being cut off from the die by a normal cutting-off mechanism (generally operated by hand), and after the former 6 has been completely lowered, the shuttle 5 may be moved to the left by operating the left push button 18. The hydro motor 9 is preferably of the vane type so that the shuttle accelerates and decelerates slowly. As the shuttle reaches its lefthand position it closes switches 134' and 135' and also changes the position of selector valve 10. The switch 135' is associated with the assembly raising cylinder 40' and its associated valve 43', the turning control 79' and inverting control 89' associated with the assembly 20'. The switch 134' energizes clamp side of control valve 59 and also energizes the unblock side of control valve 69.

Means are provided for causing the clamp 50 to grasp the pipe on the former 6 before the assembly is raised and turned so as to make certain that the bell end of the pipe is raised off the former and is clear of the protuberances thereon before the assembly is turned. Although switch 134' energizes the clamp side of 59 and unblock side of 69 simultaneously, the fluid pressure actuates the clamp first and then passes through sequence valve 140 into the unblock motor 68 which unblocks the toggle. Sequence valve 140 is a pressure type of valve which is adjustable for any desired pressure and will not open until a predetermined pressure has been built up by the operation of the clamp so that the toggle is not released until the pipe has been firmly grasped. Although sequence means are here shown for actuating the clamping means before the unblocking means are actuated, other means for producing this sequence of operations may be used.

As soon as the toggle is released, pressure cylinder 40 raises the assembly. The pipe held by

the clamp 50 is therefore raised from the former. It is to be recalled that the up side of valve 43 was last energized through 135 and 132.

As the assembly 20 moves up with the pipe held by the clamp 50, the assembly closes switch 42. The closing of this switch energizes one side of control valve 79 (marked clockwise in Fig. 12), thereby supplying pressure fluid to motor 78 so as to turn or partially rotate the entire assembly in a clockwise direction or toward discharge position. Simultaneously switch 42 energizes the circuit to one side of valve 89 (also marked clockwise in Fig. 12) causing pressure fluid to be supplied to the hydraulic motor 88 and thereby invert the pipe clamp and pipe held therein. In this manner the assembly in its elevated position turns from a pipe receiving position to a pipe discharge position and simultaneously inverts the pipe.

As the assembly reaches its discharge position, arm 75 closes switch 74, which energizes the finisher or finisher motor 128 which controls the operations of the finisher. When the finisher completes its operation, control motor 128 momentarily closes switch 129. The closing of this switch energizes the down side of valve 43 and the block side of toggle controlling valve 69. These two operations permit the entire assembly to be lowered. As the assembly reaches a desired low elevation with a finished pipe now held by the clamp, the arm 139 closes switch 138 which in turn energizes the unclamp side of valve 59 thereby causing the clamping motor 58 to open the clamps and release the finished pipe. The clamp 50 remains in an open position throughout the return stroke.

Assembly 20 will not return to its original position, however, unless the shuttle 5 is still at the righthand end of its travel. Switch 135 must be closed and switch 132 must be closed in order to energize the return side of valve 79 and the reinverting or return side of valve 89.

By means of the apparatus described hereinabove a single extrusion machine may be operated in a practically continuous manner and large numbers of sewer pipe efficiently handled with the minimum amount of labor. It is to be remembered that an extruded clay pipe twelve inches in diameter and four feet long may weigh between one hundred and one hundred forty pounds, and because of the rather low strength of a freshly extruded pipe, great care must be exercised in handling such pipe. The machine of the present invention, by reason of the yieldable character of the clamps and the precise, automatic manner of its operation, handles these large, bulky, heavy objects without breakage and without manual labor. It may be noted in passing that the diameter of extruded pipe varies somewhat, depending upon the characteristics of the clay composition being used, its moisture content, etc. The clamps 50 adapt themselves to such minor variations in diameter by reason of the yieldable character of the clamping faces.

Modified form of apparatus

It will be evident to those skilled in the art that the bearing-off devices or assemblies 20 and 20' may be arranged to cooperate with an extrusion die in a variety of different ways. Figs. 14*a* and 14*b* illustrate schematical, alternative arrangements which may be employed. In Fig. 14*a* the two assemblies or bearing-off devices 20 and 20' cooperate with a single die 3 and deposit finished pipe at a single discharge point. It will be noted that in this arrangement the assemblies 20 and 20' rotate from a pipe grasping position to a pipe finishing and discharge position and then continue their swing to return to a pipe receiving position. In Fig. 14*b* two pipe bearing-off devices operate from a single die but deposit their pipe upon two separate carriers or dollies which in turn move the pipe to a desired point from which they may be transported to the drier or kiln.

The latter modification shown in Fig. 14*b* is also shown in greater detail in Figs. 15 and 16. The vertical assembly 20 used in this modification may be constructed in substantially the same manner as that previously described and may include means for imparting vertical motion to the assembly, a clamp 50, a blocking and releasing mechanism to permit vertical motion, means for turning the entire assembly, means for inverting the clamp, and a finisher. The modified form of device distinguishes from the apparatus originally described hereinabove in that a single, vertically reciprocable former is employed, such former being always in direct alignment with the axis of the die. Moreover, instead of depositing the finished pipe upon pallets, dollies, or the like, the pipe is deposited upon a carriage 150 mounted upon inclined guide rails 151, such guide rails straddling the pit 152 in which the finishing mechanism for the bottom end of the pipe is positioned. The carriage 150 may be counterbalanced as at 153 and damping means may be included for causing the carriage to slow down as it reaches the bottom of the incline. Such dampers may be in the form of dash pots cooperating with the carriage as it reaches the lower end of its travel or an additional weight 154 may be slidably mounted upon the counterbalancing cable 155 on suitable supports, such added weight being picked up by the main counterweight 153 as the carriage 150 nears the bottom of the incline.

When the carriage reaches the lower end of the incline, it is temporarily retained there by a latch 156 so as to permit the finished pipe to be removed from the carriage by means of a dolly or the like. The latch is releasable by means of a solenoid 157, such solenoid being energized by the return of the finisher to a position below the incline and out of the way of the carriage.

Those skilled in the art of hydraulic controls and electroresponsive controls will be readily capable of correlating the various operations of this modified form of device so as to carry out the purpose of the invention, in view of the detailed description given heretofore in connection with the original form of the device. Moreover, the invention is not limited to the specific form or design of the finishers herein shown, since numerous modifications and changes may be made in the construction and arrangement of the various elements for trimming, rolling and finishing the ends of the pipe. Obviously, structural details as to the supporting structures, framework, bracing, and the like are within the scope of those skilled in the art. Mercury-type switches have been illustrated in Fig. 10, but obviously contact-type switches may be substituted instead. Certain types of electrically actuated control valves have been disclosed in connection with the hydraulic system; other types of valves and other types of controls may be used. All changes coming within the scope of the appended claims are embraced thereby.

We claim:

1. In a machine for handling unburned clay

pipe, the combination of: a vertically movable assembly adapted to remove pipe from a forming device, said assembly including a clamp arranged to virtually encircle and grasp the pipe; means for raising and lowering the assembly; a releasable block for preventing premature upward movement of the assembly; an inverter for the clamp adapted to rotate about a horizontal axis; a turning mechanism for alternately moving the assembly about a vertical axis from one to another of two predetermined positions; means for releasing the block and means actuating the releasing means when the clamp is actuated; an actuating mechanism for operating the turning mechanism and the inverter when the assmbly is raised; and means actuated by turning of the assembly to a discharge position for sequentially lowering the assembly and opening the clamp.

2. In a machine for handling freshly formed clay pipe: a vertically movable assembly provided with a pipe; hydraulic means for raising and lowering the assembly; means for opening and closing the clamp; hydraulic means for turning the assembly about its vertical axis; a releasable block for preventing premature elevation of the assembly; and means for releasing the block and rendering the assembly-raising means operative after the clamp has closed.

3. In a machine for handling freshly formed clay pipe: a vertically movable assembly provided with a rotatable pipe clamp; means for rotating the clamp to invert pipe held thereby; means for turning the assembly about its vertical axis; and electromagnetic means controlled by the elevation of the assembly for energizing the assembly-turning means and clamp-rotating means.

4. A machine for handling freshly formed clay pipe comprising: a bearing-off mechanism including a vertically movable assembly carrying a rotatable pipe clamp; means for closing and opening the clamp; means for raising and lowering the assembly; means for rotating the clamp to invert the same and a pipe held thereby; and means for turning the assembly about its vertical axis between a pipe-grasping position and a discharge position.

5. A machine for handling freshly extruded clay pipe comprising: a bearing-off mechanism including a vertically movable assembly carrying a rotatable pipe clamp; means for closing and opening the clamp; means for raising and lowering the assembly; means for rotating the clamp to invert the same and a pipe held thereby; blocking means for preventing premature raising of the assembly; means for releasing the blocking means and energizing the assembly-raising means after the clamp has closed; and means for turning the assembly about its vertical axis between a pipe-grasping position and a discharge position.

6. A machine for handling freshly extruded clay pipe comprising: a bearing-off mechanism including a vertically movable assembly carrying a rotatable clay pipe clamp; means for closing and opening the clamp; means for raising and lowering the assembly; means for rotating the clamp to invert the same and a clay pipe held thereby; means for turning the assembly about its vertical axis between a pipe-grasping position and a discharge position; and electroresponsive means controlled by the elevation of the assembly for energizing the assembly-turning means and clamp-rotating means.

7. A machine for handling freshly extruded clay pipe comprising: a bearing-off mechanism

including a vertically movable assembly carrying a rotatable clay pipe clamp; means for closing and opening the clamp; means for raising and lowering the assembly; means for rotating the clamp to invert the same and a clay pipe held thereby; means for turning the assembly about its vertical axis between a pipe-grasping position and a discharge position; blocking means for preventing premature raising of the assembly; means for releasing the blocking means and energizing the assembly-raising means after the clamp has closed; and electroresponsive means controlled by the elevation of the assembly for energizing the assembly-turning means and clamp-rotating means.

8. In an apparatus of the character stated in claim 7, the provision of: electroresponsive means controlled by the lowering of the assembly for energizing the clamp-opening means.

9. In an apparatus of the character stated a shuttle mounted for horizontal reciprocation beneath a vertical extrusion die; a pair of vertically movable formers and separate raising and lowering means therefor carried by the shuttle; means for reciprocating the shuttle to place each former alternately in alignment with the die while the former is in a bearing-off position; and a bearing-off mechanism adjacent each extreme position of the shuttle.

10. In an apparatus of the character stated a shuttle mounted for horizontal reciprocation beneath an extrusion die; a pair of vertically movable formers and separate raising and lowering means therefor carried by the shuttle; means for reciprocating the shuttle to place each former alternately in alignment with the die while the former is in a bearing-off position; a bearing-off mechanism adjacent each extreme position of the shuttle; a control lever for energizing the former raising and lowering means; selector means operated by the shuttle determining which former-raising means may be energized by the control lever; and electroresponsive means cooperating with the control lever for rendering the shuttle-moving means inoperative when the formers are in raised position.

11. In a machine of the character stated in claim 10, the provision of: electroresponsive means operated by movement of the shuttle into bearing-off position for initiating operation of the adjacent bearing-off mechanism.

12. In combination with a vertical extrusion die: a reciprocating, horizontal shuttle carrying a pressure fluid ram; a former on the ram extendable to a position adjacent the die; a reversible motor connected to said shuttle; a control valve having a fluid line to raid ram and a stem having an engagement with the reciprocal shuttle at a point in its movement in each direction adapted to alternatively connect and disconnect said ram in a pressure fluid circuit; and disconnect means for removing a pipe from the former comprising a vertically movable assembly including a motor-operated clamp for clasping the pipe and motor-operated device for lifting the assembly; and electric controls for said clamp and said device actuable upon movement of the shuttle to one of two extreme positions to initiate operation of the clamp and assembly.

13. In a pressure-fluid operated system for transferring molded objects, the combination of: a rotatable, vertically reciprocable assembly including a releasable block for alternately blocking and unblocking movement of the assembly; a clamp for the object and an inverter for the

clamp; valve controlled, reversible, pressure-fluid motors adapted to operate said block, said clamp, said inverter, and impart vertical and turning motion to the assembly; a common pressure-fluid supply for one side of the clamp and the block motors respectively, including a sequence valve adapted to delay flow of pressure-fluid to the motor for the block until completion of operation of the clamp; an electric circuit including actuators for both forward and reverse operation of valves for the motors; and automatically operated, electric switches in portions of the circuit operated in sequence by movement of selected elements following manual initiation of operation of said system wherein successive clamping and unblocking is followed in sequence by inverting and turning, and then reversal of said inverting and returning of said assembly to initial position.

14. In a pressure-fluid operated system for transferring pipe from a die to a finishing position and for finishing said pipe, the combination of: a shuttle having an electrically initiated, pressure-fluid drive and bearing a pair of pressure-fluid operated, extensible formers connected to a pressure-fluid circuit through opposite sides of a two-way valve, said shuttle being movable to place said formers alternately in operative relation to a die; a manually controlled valve between said two-way valve and a source of fluid pressure adapted to raise and lower one or the other of said formers depending on the position of the two-way valve; a bearing-off assembly movable upwardly and downwardly having a pressure-fluid ram in said circuit normally being urged toward a raised position; a pressure-fluid operated clamp on the assembly for holding and releasing a pipe; a pressure-fluid operated block normally restraining upward movement of the assembly adapted when released to permit upward movement of the assembly, said clamp and said block being in a common auxiliary fluid circuit and said auxiliary circuit having a sequence valve therein adapted to delay operation of the block until completion of operation of the clamp; electric-actuated valves for said clamp and said block having electric actuators for forward operation thereof and electric switch means operable by said shuttle in pipe-discharging position thereof for operating said actuators in a forward direction; a pressure-fluid operated inverter for the clamp and a rotator for the assembly respectively including electric-actuated valves having switches operable by upward movement of the assembly for simultaneously inverting and rotating the clamp; an electric-actuated element respectively for the downwardly moving side of said assembly valve and the release side of the clamp valve operable on the lowering of the assembly; and a circuit interrupter in circuit with the switches controlling initial operation of the inverter and rotator and adapted to be closed whenever the former is moved downwardly, said inverter and said rotator each having a reverse operating electric connection in circuit with a switch actuated by return movement of the shuttle to position beneath a die.

15. A pipe-handling machine in operative relation to a vertical, pipe extrusion die, comprising: a shuttle mounted for horizontal movement beneath the extrusion die; a pair of vertically movable formers and separate raising and lowering means therefor carried by the shuttle; means for moving the shuttle to place each former alternately in alignment with the die to receive a pipe while the other former is in a bearing-off position; and a bearing-off mechanism in operative relation to the former in its bearing-off position, said mechanism including a vertically movable assembly carrying a pipe clamp adapted to virtually encircle and grasp pipe upon the former, means for closing and opening the pipe clamp, means for raising and lowering the assembly, means for closing the pipe clamp before the assembly is raised, and means for turning the assembly about a vertical axis between a pipe-receiving position and a discharge position.

16. A pipe-handling machine in operative relation to a vertical, pipe extrusion die, comprising: a shuttle mounted for horizontal movement beneath the extrusion die; a pair of vertically movable formers and separate raising and lowering means therefor carried by the shuttle; means for moving the shuttle to place each former alternately in alignment with the die to receive a pipe while the other former is in a bearing-off position; and a bearing-off mechanism in operative relation to the former in its bearing-off position, said mechanism including a vertically movable assembly carrying a pipe clamp adapted to grasp and hold a pipe carried by the former, means for closing and opening the pipe clamp, means for raising and lowering the assembly, means for rendering the assembly-raising means operative after the clamp is closed, and means for turning the assembly about a vertical axis between a pipe-receiving position and a discharge position.

17. A pipe-handling mechanism for use with a vertical pipe extrusion die and a vertically reciprocable former in alignment with said die, comprising: a rotatable, vertically reciprocable assembly including a releasable block for alternately blocking and unblocking movement of the assembly, said assembly being positioned adjacent the die and former and carrying a pipe clamp arranged to grasp a pipe while it is on the former; means for raising and lowering the assembly; means for turning the assembly from a pipe-grasping position to a discharge position; means for inverting the clamp about a horizontal axis while the assembly is turning; and means for releasing the blocking means and energizing the assembly-raising means after the clamp has grasped a pipe.

18. A mechanism of the character stated in claim 17, wherein said assembly-turning means includes a slotted arm mounted upon the vertical assembly, a rotatable jack shaft provided with a turning pin slidably positioned in the slot of said arm, and a motor for driving the jack shaft.

19. A mechanism of the character stated in claim 17, wherein the pipe clamp is carried by a horizontally disposed, rotatable sleeve, a pinion carried by the sleeve, a rack gear in engagement with the pinion, and controllable means for moving the rack gear.

20. A mechanism of the character stated in claim 17, wherein the pipe clamp is carried by a horizontally disposed, rotatable sleeve, a pinion carried by the sleeve, a rack gear in engagement with the pinion, controllable means for moving the rack gear, and clamp and opening means including a piston rod slidable within the sleeve and connected to the clamp and hydraulic means for actuating the piston rod.

21. In an apparatus of the character stated: a shuttle mounted for horizontal reciprocation beneath an extrusion die of a pipe press; a pair of vertically movable formers carried by the shut-

tle; means for reciprocating the shuttle to place each former alternately in alignment with an extrusion die of a pipe press; means for raising and lowering each of said formers; and a bearing-off mechanism adjacent each extreme position of the shuttle, said bearing-off mechanism being arranged to grasp pipe carried by the former.

22. In an apparatus of the character stated in claim 21, the provision of means actuated by movement of the shuttle into extreme position for initiating the pipe-grasping operation of the adjacent bearing-off mechanism.

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