July 12, 1955 J. O. EVERHART ET AL 2,712,679

MEANS FOR FORMING ARGILLACEOUS PIPE

Filed Aug. 29, 1951

5 Sheets-Sheet 1

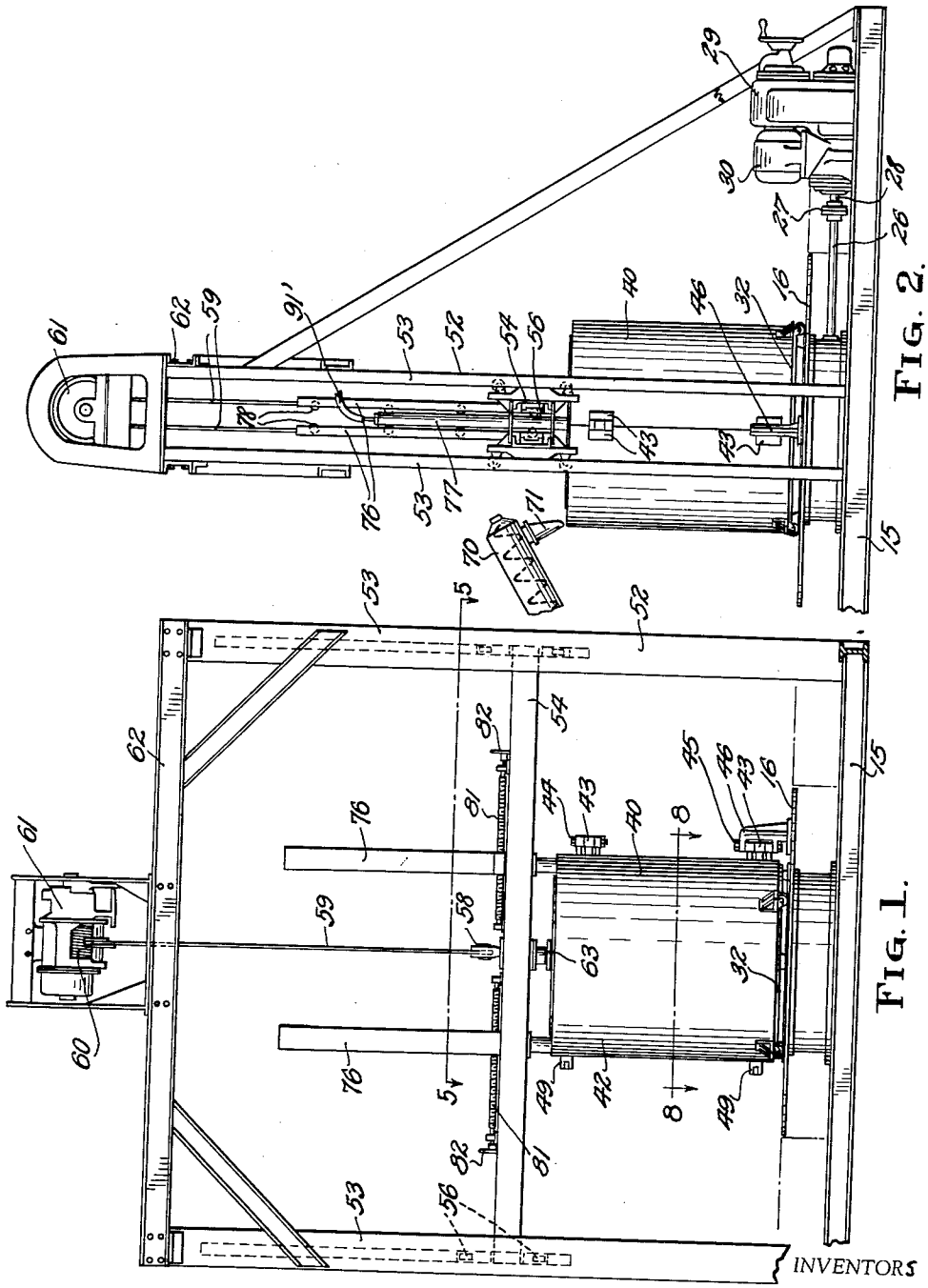


FIG. 2.

FIG. 1.

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5 Sheets-Sheet 2

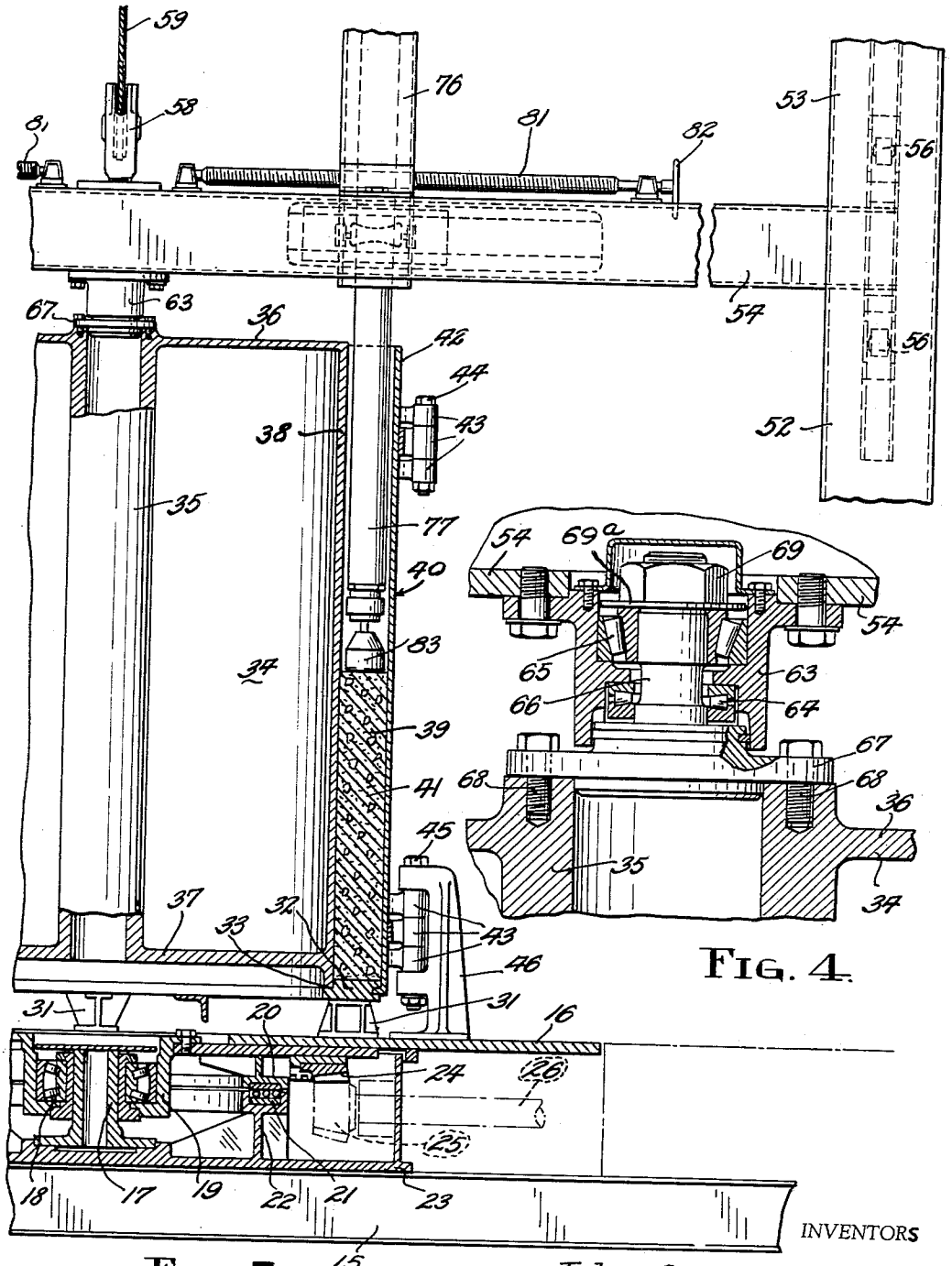


FIG. 3.

FIG. 4.

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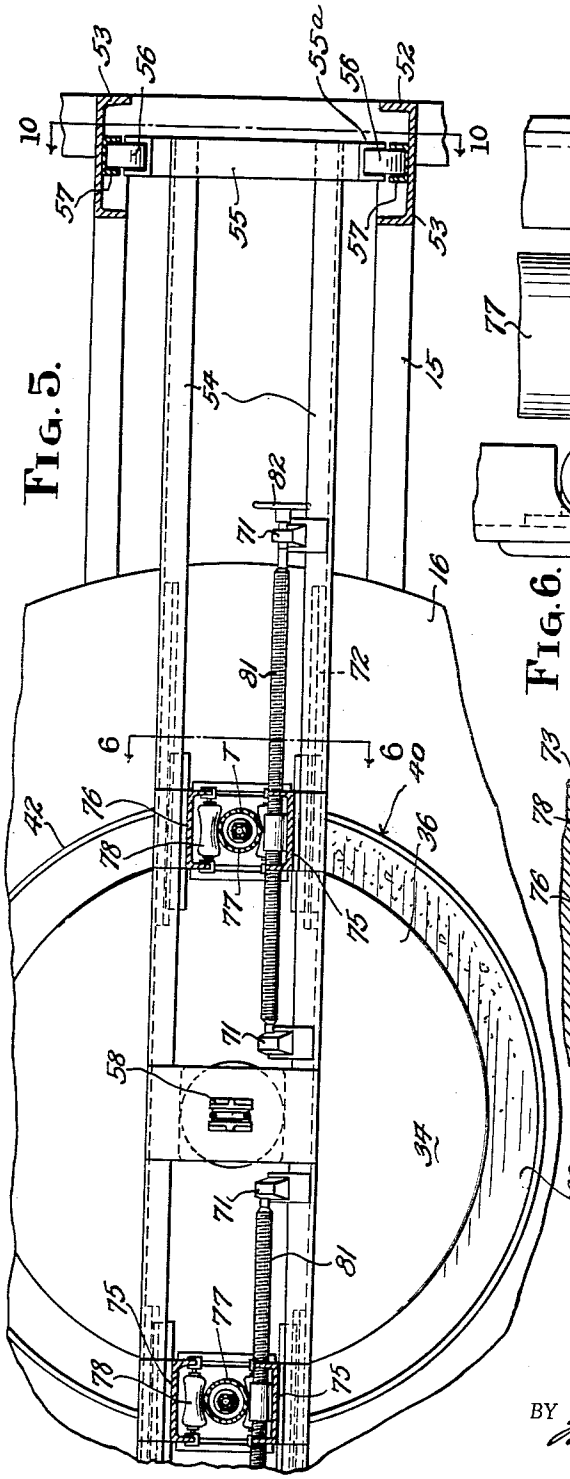


FIG. 5.

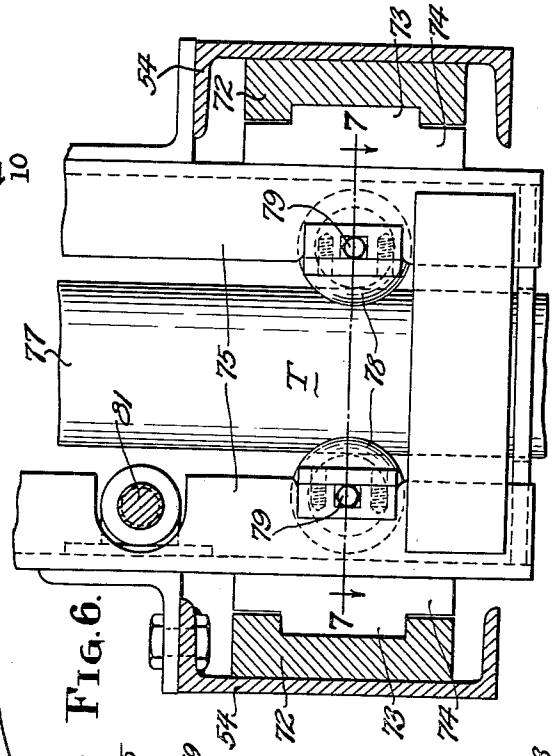


FIG. 6.

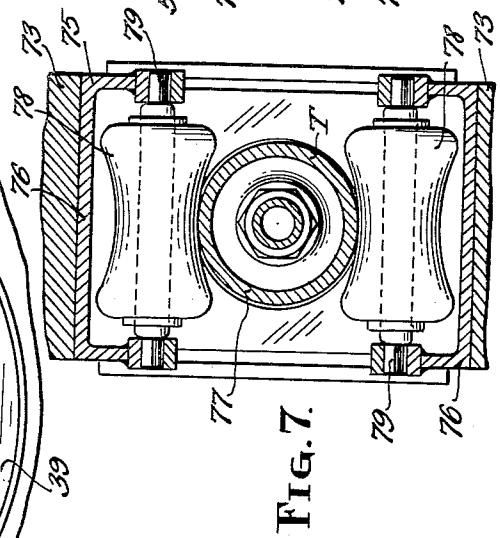


FIG. 7.

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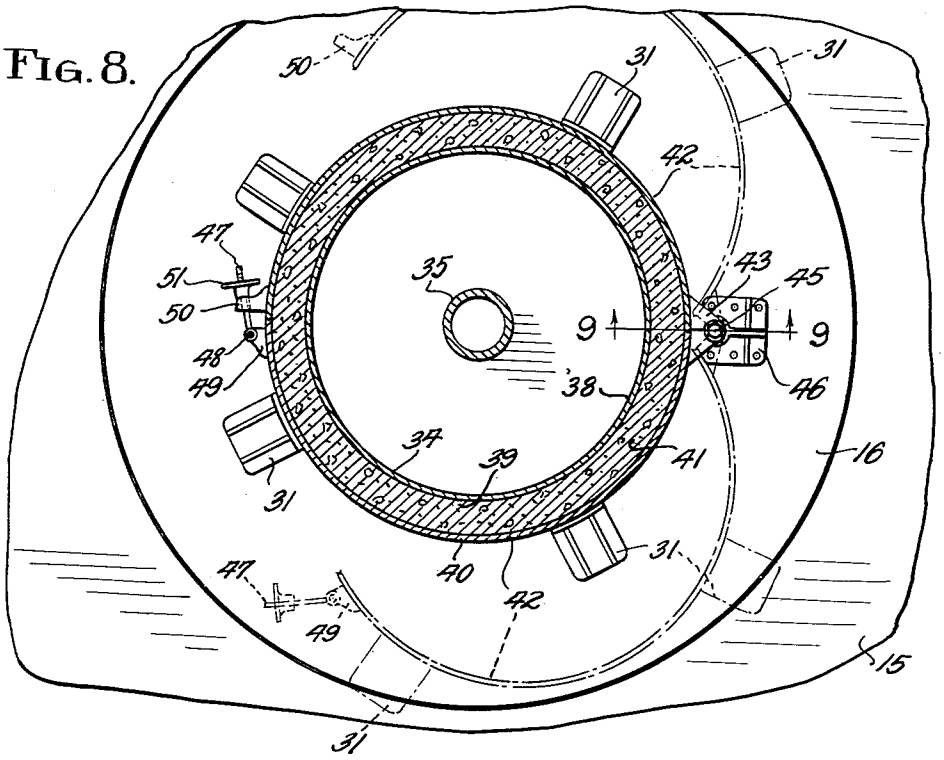
July 12, 1955 J. O. EVERHART ET AL 2,712,679

MEANS FOR FORMING ARGILLACEOUS PIPE

Filed Aug. 29, 1951

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FIG. 8.



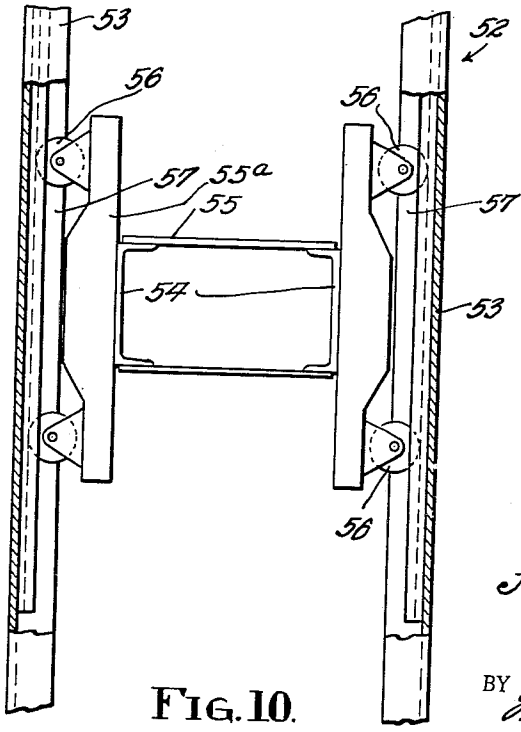


FIG. 10.

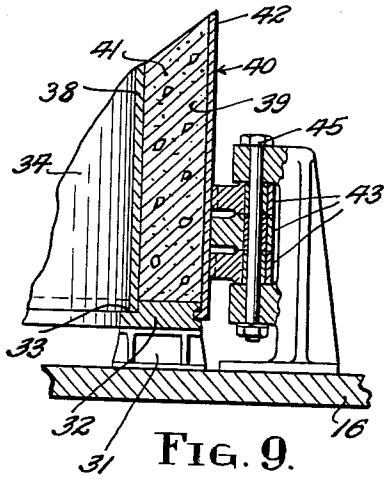


FIG. 9.

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MEANS FOR FORMING ARGILLACEOUS PIPE

Filed Aug. 29, 1951 5 Sheets-Sheet 5

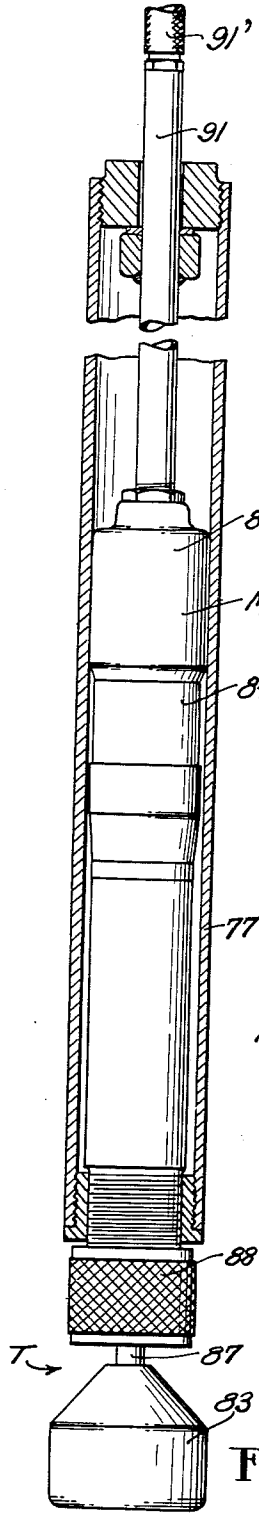


FIG. 11.

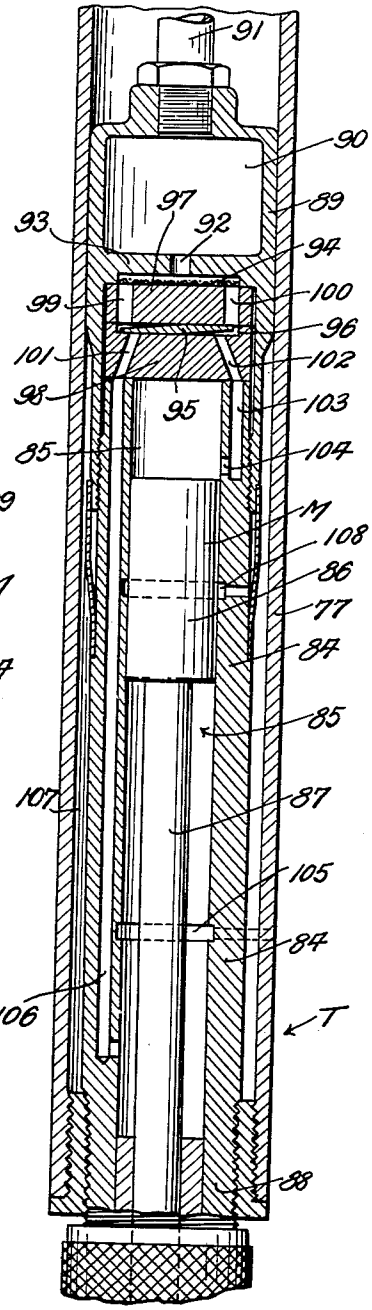


FIG. 12.

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United States Patent Office 2,712,679 Patented July 12, 1955

2,712,679

MEANS FOR FORMING ARGILLACEOUS PIPE

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Application August 29, 1951, Serial No. 244,212

12 Claims. (Cl. 25—37)

The present invention relates to molding apparatus for use in connection with the manufacture of molded cylindrical products, such as fluid-handling pipe or conduits.

Argillaceous pipe is characterized by its high mechanical strength. Its physical properties compare favorably with those of metal-reinforced pipe of cementitious composition. However, clay pipe, because of limitations imposed thereon by presently employed methods and apparatus for producing the same, is limited to sizes of comparatively small diameters with respect to concrete pipe.

Clay mixtures used in pipe manufacture require thorough mixing or pugging in the presence of water to produce a plastic body of proper consistency adapting the same to be forced under pressure into and through annular pipe-forming spaces provided in suitable molds or dies. The consistency of the clay mixture, the pressures required to force the same into and through the molding dies and the size and complexity of the apparatus needed to produce large diametered pipe, all impose such practical limitations on the manufacture of such pipe as to prevent the same from competing economically with large diametered pipe made from concrete or metal.

In concrete pipe manufacture, a slurry or relatively wet mix is introduced into an annular space of a rotatable pipe-forming mold disposed on a turntable, the mold consisting of an inner core and a surrounding outer jacket between which an annular pipe-forming space is formed. Upon being introduced into this space, the mix or slurry is tamped downwardly to fill the space and prevent the presence of voids of an undesirable character in the finished pipe. Such tamping of the mix is accomplished by the use of elongated vertically reciprocable tamping devices, which extend above the mold and are actuated by means disposed at a considerable distance from mix-engaging heads of the tamping devices.

Such a customary pipe-forming mold, as used in the manufacture of concrete pipe, cannot be employed with practical success in producing argillaceous pipe. This is attributable in large part to the inability of prior concrete pipe-forming apparatus to compact, tamp or confine a clay mix suitable for pipe formation in the vertical and annular molding space of such a concrete pipe-forming machine.

Accordingly, it is one of the objects of the present invention to produce argillaceous pipe with the use of molding apparatus employing certain of the essential constructional features of the vertical mold apparatus heretofore used in the manufacture of concrete pipe, but wherein the construction of the machine, particularly the mix-tamping mechanism thereof, is modified and improved so that the same may be brought to exert uniform compaction forces on low-moisture-content argillaceous mixes introduced into the molding space of the apparatus to impart high density compaction thereto, the molded bodies so formed being characterized by their uniformity throughout the full length thereof and high mechanical strength.

Another object of the invention is to provide a means for economically forming high strength argillaceous pipe capable of competing under comparable conditions of service with large size concrete pipe.

A further object of the invention is to provide pipe-forming apparatus of the character set forth wherein improved fluid-actuated hammers are utilized as tamping devices for the compaction of pipe-forming mixes in a vertical mold, and wherein said hammers embody reciprocatory heads having relatively short piston rods which exend into fluid-actuated head-reciprocating cylinders, the latter possessing such diameter as to occupy the mix-receiving spaces of the molds, so that relatively short-stroke tamping hammers may be utilized, the hammers being capable of delivering powerful compaction forces to the mix introduced into the molding spaces of such apparatus, whereby to form high-strength and uniformly compacted argillaceous pipe.

A still further object is to provide improved frame-mounted guiding means for governing the operating positions of the tamping devices and to cause elevation thereof by the rise of the clay undergoing tamping in the mold.

A further object of the invention is to effect the guidance of the reciprocatory tamping hammers in a manner enabling the hammers to be moved radially on a supporting frame with respect to vertical mold axes, whereby to adapt the hammers to the formation of pipe of different diameters.

Still another object is to provide pipe-forming apparatus involving an air hammer supported in a "floating" manner on the tamped clay surface of a pipe undergoing formation, said hammer being so mounted and arranged that its operation provides equalization of impact forces completely around the material undergoing tamping and pipe formation, a feature which is not possible in prior systems where the tamper is raised in positive mechanically produced increments, and wherein the same is fixed in its stroke limits.

A still further object of the invention is to provide vertical pipe-molding apparatus which is generally of new and improved construction, operates efficiently and may be built at a comparatively low and reasonable cost.

Other objects of the invention and the various advantages and characteristics of the present construction will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings, which accompany and form a part of this specification or disclosure, and in which like numerals of reference denote corresponding parts throughout the several views:

Fig. 1 is a front elevational view of pipe-molding apparatus formed in accordance with the present invention;

Fig. 2 is a side elevational view thereof;

Fig. 3 is a fragmentary vertical sectional view taken through the apparatus and disclosing more particularly the rotary turntable thereof, the inner core of the mold, its spaced outer jacket and one of the adjustable tamping hammers, the latter being disclosed in its operative position in the pipe-forming space of the associated mold;

Fig. 4 is a detail vertical sectional view disclosing the upper and center bearing construction employed in effecting the support and rotation of the inner core member of the mold;

Fig. 5 is a horizontal sectional view taken on the plane indicated by the line 5—5 of Fig. 1 and disclosing more particularly the means for radially adjusting the operating positions of the mix-tamping devices;

Fig. 6 is a detail vertical transverse cross-sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a horizontal sectional view on the plane disclosed by the line 7—7 of Fig. 6;

Fig. 8 is a similar view taken on the plane indicated by the line 8—8 of Fig. 1;

Fig. 9 is a vertical sectional view on the line 9—9 of Fig. 8, illustrating the hinge means for pivotally uniting the hinged section of the outer jacket of the mold;

Fig. 10 is a detailed vertical transverse sectional view taken on the plane indicated by the line 10—10 of Fig. 5;

Fig. 11 is a vertical sectional view disclosing the tubular casing in which is housed the fluid-actuated motor employed in imparting reciprocating movement to one of the tamping hammers;

Fig. 12 is a similar view disclosing the internal construction of the motor.

With reference to the structural details of the apparatus illustrated in the accompanying drawings, there has been shown at 15 a base or sub-structure which, in this instance, is composed of a plurality of interconnected and rigidly joined I-beams or other similar structural steel members. Mounted on this base for rotation in a horizontal plane is a turntable 16. The base to this end is provided with an upstanding stationary bearing post 17, carrying antifriction bearings 18 which are enclosed in a hub 19 depending from the central axial portion of the turntable 16. Arranged concentrically with respect to the hub 19, and spaced outwardly and radially therefrom, is a bearing ring 20, the latter being formed with and depending from the under side of the table 16. The lower portion of the ring 20 engages with antifriction bearings 21 carried by the upper portion of an upstanding complemental ring 22, the latter arising from a stationary base plate 23 and being mounted on the base or substructure 15. Through the use of these bearing members, the turntable is supported for rotary movement about a substantially vertical axis passing through the center of the mold proper.

The rotation of the turntable at controlled rates of speed is effected by providing the turntable in this instance with a ring gear 24 which is fixed to the under side of the turntable, as shown in Fig. 3. Meshing with the teeth of this gear are those of a pinion 25, the pinion being carried by the inner end of a horizontally extending shaft 26. The latter is suitably journaled for rotation in bearings carried by the base or substructure 15 and has its outer end coupled, as at 27, to the drive shaft 28 of a variable speed transmission 29, which may be driven by an electric motor or its equivalent, shown at 30.

Mounted on the upper surface of the turntable are pallet rests, indicated at 31. Removably positioned on these rests are ring-shaped pallets 32. Preferably, each pallet ring is formed inwardly thereof with a shoulder or recessed region 33, in which is positioned the lower circular edge of a vertically movable mold core 34. In this instance, the core is formed with a centrally disposed vertically and axially extending tubular hub 35. The latter is joined at its upper and lower ends with circular top and bottom walls, 36 and 37, respectively. The peripheral portions of these top and bottom walls are merged with an outer substantially cylindrical wall 38, the smooth outer surface of which defines the inner surface of an annular pipe-forming and molding space 39, the bottom of this space being closed normally by the pallet 32.

The outer portion of the molding space 39 is defined by the inner surface of a jacket shown at 40. The jacket comprises preferably a pair of hingedly united sections shown at 42. As indicated in Fig. 8, each of these sections is substantially semicircular in horizontal cross section, the same being provided with registering hinge-forming leaves 43 which receive vertically registering top and bottom pintles 44 and 45. The lower pintle 45 is joined with an upstanding bracket 46, which is carried stationarily by the upper surface of the turntable 16, thereby supporting the jacket in its operative positions on the turntable.

The outer or free edges of the jacket sections may be united by the employment of bolts 47, the latter being pivotally mounted, as at 48, on brackets 49 projecting from the upper and lower outer edge portions of one of the sections 42. The threaded ends of the bolts 47 are received in slots provided in the outer ends of brackets 50 formed on the other of the sections 42 in registering relationship with the brackets 49. The threaded ends of the bolts 47 carry tightening nuts 51 which, when positioned as shown in Fig. 8, draw the meeting edges of the two hinged sections of the jacket together and hold the same in circular relationship in a manner defining the outer boundaries of the circular mix-receiving space 39.

When the molded pipe body 41 has been completed in the space 39, the nuts 51 are backed off the threaded ends of the bolts 47, allowing the hinge sections of the outer jacket of the mold to swing to open positions disclosed by broken lines in Fig. 8 of the drawings. The forks of a lift truck may then be inserted beneath the pallet ring on which the formed pipe body rests, and the ring, together with the pipe body, may be transferred from the turntable to an associated turning cradle and a drying or firing zone.

Arising from the base or substructure 15 is a rigid vertical upstanding frame or superstructure 52. The latter, in this instance, comprises transversely spaced vertical pairs of uprights 53 arranged on both sides of the pipe mold. The uprights may be in the form of the structural steel channel members as illustrated in Fig. 5. Above the molding plane defined by the jacket 40, the uprights 53 receive between them a pair of transversely spaced, parallel, horizontally extending channel bars or girders 54, forming a core-supporting frame. At their ends, these bars or girders are united by cross members 55. At their sides, the bars 54 carry shoes 55a which include rollers 56, the latter being positioned in vertical channel-shaped tracks 57 rigidly secured to and extending vertically of the inner surfaces of the webs provided by the uprights 53, the tracks 57 serving to guide the vertically movable, horizontally extending core-carrying frame formed by the bars or girders 54.

The central upper portion of this core-supporting frame carries a swiveled coupling 58, with which is connected the lower end of a hoisting cable 59. The upper end of this cable is joined with a hoist 60 which is driven by an electric or fluid-actuated motor, or the like, 61. The hoist is supported on upper horizontally disposed frame members 62, mounted on the upper ends of the uprights 53 and thereby forming a part of the frame or superstructure 52. Through the operation of the hoist, the core and its supporting frame 54 may be raised or lowered with respect to the stationary frame 52 and the turntable 16.

The core is suitably supported from the central region of the bars or girders 54 by connecting with the latter an outer bearing housing 63, shown more particularly in Fig. 4. Interiorly the housing 63 carries antifriction bearings of the radial and thrust types, as indicated at 64 and 65. These bearings receive a spindle 66 which projects upwardly from the central portion of a plate 67 bolted, as at 68, to the upper central portion of the core 34, the upper end of the spindle 66 being threaded for the reception of a securing nut 69 which holds a washer 69a in contact with the inner race of the thrust bearing 65. By this construction, or its equivalent, the core is rotatably suspended or swiveled from the cross frame produced by the bars 54 so that the core may rotate in unison with the turntable, or, following completion of a given pipe-forming operation, may be elevated for removal from the jacket 40, allowing the latter to be opened and a formed pipe body removed from the apparatus.

The space 39, present when the pipe-forming mold is operatively positioned on the turntable, is filled usually,

though not necessarily, with an argillaceous mix by suitable means, such as the screw conveyor disclosed at 70. The discharge end of this conveyor may be provided with a spout 71 by means of which the mix, following removal thereof from a pugging mill or the like, is elevated and deposited by the spout 71 into the molding space 39 in required quantity. It will be understood that the screw conveyor 70 is preferably motor driven, and its operating speed and volume of material handled thereby are controlled by any suitable mechanism, not shown.

In order to make possible the formation of dense clay pipe in various diameters, and in a manner and with apparatus comparable to that now employed in producing cementitious pipe, there is utilized in the apparatus of the present invention an improved tamping mechanism which is especially adapted for operation in connection with relatively dry argillaceous mixes. In such mixes, the water content is normally lower than that of the usual cementitious pipe-forming mixes, and one of the problems solved by the present invention is the provision of an improved tamping mechanism for compacting such relatively dry argillaceous mixtures and obtaining uniform densities in all portions of the molded pipe.

Even in the formation of pipe from cementitious materials utilizing the usual reciprocating tamping mechanism which is arranged to be elevated progressively with a rise in the level of mix within the mold chamber, the problem of obtaining uniform density and compaction of the mix finds no solution, in that an uneven feed of material within the molding chamber results in premature elevation of the tamping mechanism, which is retained in such elevated position, thereby causing the tamping mechanism to ride over the lower or dwell portions of the mix without striking the same with sufficient force to obtain uniform compaction of the mix throughout its entire volume. The conventional tamping mechanism is mechanically weak and structurally ineffective in producing the compaction forces necessary in the formation of pipe of uniform density. Further, such devices do not permit adjustment of stroke to take care of uneven tamping surfaces caused by inequalities of feed. In clay pipe manufacture, we have found that a heavier, mechanically stronger, and more positive and direct-acting tamping mechanism is required.

To this end, the tamping mechanism T of the present invention is provided. Preferably, this mechanism is guided in connection with the vertically movable core frame produced by the channel bars 54. As shown in Fig. 6, the inner faces of these channel bars are provided with stationary gibs 72 in which are slidably mounted guide ribs 73 formed on gib bars 74. These bars are carried horizontally on opposite sides of a pair of horizontally adjustable tamper roll frames 75.

Channel members 76 of the frames 75 support at vertically spaced intervals pairs of tamper-guiding rollers 78, the latter being rotatably mounted on shafts 79 carried by the members 76. The rollers 78 are shaped to engage the cylindrical outer surfaces of the tamper casings 77, whereby to hold the latter truly vertical in all their positions of adjustment, and yet to facilitate vertical sliding movement thereof. If desired, the upper ends of the tampers may be connected with suitable counterbalancing means, not shown, to insure proper operation of the tampers. Releasable locking devices, also not shown, may be provided to secure the tamping devices to the cross frame 54 when the latter is elevated.

The guide frames for the tampers produced by the channel members 76 are horizontally adjustable, longitudinally of the frame 54, by the provision of rotatable screw shafts 81. Intermediately of their lengths, each of these shafts is received in threaded openings formed in connection with the associated tamper-carrying cross frame 54, whereby, through rotation of the shafts 81, effected in this instance by manipulation of the hand wheels shown at 82, the tamper-guiding frames 75 may

be moved back and forth longitudinally of the core-carrying frame 54, thereby centering the casings 77 of the tampers with respect to the molding space 39 and adapting the tampers to the formation of pipe of differing diameters.

In this instance, the tampers T include compaction-producing heads 83 which are arranged for reciprocation on top of the mix in the molding space 39. The heads are reciprocated preferably by means of fluid-actuated motors M which are arranged in the casing 77 of the tampers and, in operation, in the space 39. While the motors M may be one of many different types, in the form selected for illustration, and as supplied by the Ingersoll-Rand Company, the same employs compressed air as the activating fluid.

Each of the motors M involves a working barrel 84 stationarily mounted in each of the casings 77. Each barrel includes a vertical cylindrical bore or piston chamber 85 containing a reciprocating piston 86. Each of these pistons is formed with a depending stem or rod 87, the latter passing for reciprocation through a packed bearing 88 carried by the lower end of each casing 77. Below the bearings 88, each of the rods 87 is connected with one of the tamping heads 83, so that the latter will reciprocate in unison with the movement of its associated piston 86 and rod 87.

The upper section of each of the barrels 84, as indicated at 89, is formed with an internal chamber 90 to which compressed air, or other fluid under pressure, is admitted by way of a pipe 91 joined with a flexible hose or other supply line 91, the latter leading upwardly through the casing 77 and out of the open top thereof to a suitable source of fluid supply under pressure.

Compressed air, for example, admitted into the chamber 90 travels by way of a port 92 formed in the bottom wall 93 of the chamber, and after passing through a strainer or screen 94, moves around the periphery of a flapper or wabble-type valve disk 95. In each motor, the disk 95 is disposed in a flat narrow chamber 96, being confined for rocking movement between a pair of disks 97 and 98. The upper disk 97 includes ports 99 and 100, while the lower disk 98 is formed to provide complemental ports 101 and 102, the latter being upwardly and inwardly inclined so that their open upper ends may be alternately opened and closed by the wabble or oscillating action of the valve disk 95.

With the disk 95 in the position disclosed in Fig. 12, it will be noted that the port 101 is closed by the seating action of the disk 95 while the port 102 remains open. Under this condition of operation, compressed air flows from the chamber 96 through the port 102 formed in the lower disk 98 and thence through a short vertical passage 103 which, through a port shown at 104, communicates with the upper end of the piston bore or chamber 85 at a short distance below the closed top of said bore or chamber. By spacing the port 104 from the closed top of said bore or chamber, a cushioning space is provided therein, as usual, to check yieldably upward movement of the piston 86. The admission of compressed air into the chamber 85 drives the piston 86 downwardly, causing the tamper head or heads to impact a pipe-forming mix disposed in the mold space 39.

The valve disk 95 maintains the operating position disclosed in Fig. 12 during substantially the entire down stroke of the piston 86. Air or other fluid contained in the bore or chamber 85 beneath the piston 86 during its down stroke is discharged to the atmosphere by way of an exhaust port shown at 105. When this port is closed, by the engagement of the piston body therewith, continued descent of the piston compresses the air in the bottom portion of the chamber 85, producing a yielding cushion which checks the descent of the piston. Further, this cushioning air passes through a port shown at 106 into an elongated passage 107 formed in the wall of the barrel 84. Compressed air passing upwardly

through the passage 107 engages the under surface of the flapper disk 95, thereby rocking the disk in a reverse direction to the full line position thereof shown in Fig. 12, whereby to cause the valve disk to close the port 102 and open the port 101.

At this stage of the operation, compressed air entering the chamber 90 through the pipe line 91, and after passing the strainer 94, travels through the port 101 and passage 107 through the lower part of the bore or chamber 85, building up sufficient pressure therein to move the piston 86 upwardly in said bore or chamber. During this upward stroke of the piston, compressed air contained in the upper part of the chamber or bore 85 is discharged through an exhaust port 108 to the atmosphere. After the piston has advanced upwardly sufficiently so that it moves into registry with the port 108, the latter is closed by the body of the piston and air above the piston is compressed to act as a checking cushion, yieldably arresting upward movement of the piston. When the piston reaches a given position in its upward travel, the pressure of the cushioning air becomes sufficient so that its passage through the port 104 and passage 103 will automatically shift the operating position of the valve disk 95 to again open the port 102, close the port 101, and establish communication between the upper portion of the chamber or bore 85 and the incoming motor-operated air.

While we have described this tamper-actuating fluid motor in considerable detail, it will be understood that we reserve the right to employ other types of operating motors in the capacity set forth. However, the type herein disclosed is simple, compact, and efficient, and may be maintained in casings sufficiently small in diameter to admit of the introduction of the motor directly into the mix-receiving space of the mold. The air-driven tampers are each housed in a pipe section in a manner eliminating the long piston rods or prior apparatus and providing a signal improvement thereover.

With the motor disclosed, the tamping hammers may, if desired, strike the mix at a rate of approximately 750 impacts per minute. The stroke of the hammers may be of the order of five to six inches. Suitable counterweighting means may be used to vary the effective weight of the floating tampers on the upper surfaces of the mix. The tampers, because of their construction and floating action, impart uniform compaction to the mix, compensating automatically for hard and soft regions encountered in the mix in insuring the formation of a uniformly compact and dense product. The tampers are free to rise and fall with an uneven datum line in following the contour of the mix in the molding space 39.

Both the rate of material feed and turntable speed can be varied and coordinated over wide ranges so that optimum working conditions can be obtained for any particular size pipe and mix used in the manufacture thereof. If desired, the exterior of the core may be tapered slightly from top to bottom and smoothly machined for the purpose of reducing adhesion thereof with the molded pipe when the core is elevated. By adjusting the screw shafts 81, the tamper-guiding frames may be positioned to produce pipe varying, for example, in diameter from 24 inches to 60 inches. As the mold is rotated through the movement of the turntable, the pipe-forming material is tamped by the air-driven tampers, and as the material builds up in the space 39, the air tampers rise in their guides until the desired height is obtained. Thereafter, the rotation of the turntable is stopped, together with the operation of the air tampers, and the core and the tampers locked to the crosshead 54 are withdrawn from the mold by the cable hoist at the top of the apparatus. The outer jacket is then opened and the formed pipe is removed on tis pallet ring. This may be done with a conventional lift truck.

Among others, our invention possesses the following advantages in the manufacture of argillaceous pipe:

(1) Permits the production of larger diametered clay pipe than is now possible with the use of conventional machines and methods;

(2) Permits the production of pipe from drier cementitious and argillaceous mixtures having more uniformity of compaction and density than pipe produced by present ramming appliances and methods;

(3) Permits the use of ceramic mixes having very low drying and firing shrinkage, thus resulting in less warpage and distortion in the finished product;

(4) Produces pipe without interior laminations of a circular nature parallel to the cylindrical surfaces of the pipe, as are commonly present in pipe made by the stiff mud extruded process;

(5) Ware produced by our improved method and machine may be dried and fired more quickly than that made by the stiff mud extruded process;

(6) The machine of the present invention may be operated with a much smaller labor force than is required by the present stiff mud extrusion process.

While we have described our invention as being particularly applicable to the manufacture of argillaceous pipe of large diameter, nevertheless it will be understood that the apparatus may be employed with equal efficacy with the use of other pipe-forming materials, including concrete. Therefore, we reserve the right to employ our invention in any capacity in which it may be found useful and to make such variations or modifications therein as may be deemed expedient, without departing necessarily from the scope of the following claims.

While we have described the use of electric motors, it will be understood that compressed air motors may be employed in lieu thereof in instances where such prime movers are desirable, or we may utilize electric motors for operating various mechanisms, including the tamper mechanism, in place of air driven motors, as will be appreciated by those versed in the art.

We claim:

1. In pipe-molding apparatus of the type utilizing a frame structure, a turntable mounted on said frame structure, inner and outer relatively spaced and concentrically arranged molding forms rotatable with said table, there being an annular mix-receiving space formed between said forms, and a tamping mechanism for applying pounding forces to a mix introduced into said space, said tamping mechanism comprising: a vertically disposed elongated tubular casing, said casing being of a diameter enabling the same to be directly positioned in said molding space for movement therein, motor means disposed in said casing, a mix-engaging tamping head arranged at the lower end of said casing, means actuated by said motor means for imparting reciprocatory mix-pounding motion to said head, and guide means carried by said frame structure for maintaining said tamper casing in a substantially vertical position of operation and to provide for independent vertical movement of said casing on the top of said mix in automatic response to the datum level of the latter during the filling of the mold space with the tamped mix.

2. Pipe-molding apparatus of the character defined in claim 1, and wherein said motor means is of the type actuated by a fluid under pressure.

3. In pipe-molding apparatus of the type utilizing a frame structure, a turntable mounted on said frame structure, inner and outer relatively spaced and concentrically arranged molding forms rotatable with said table, there being an annular mix-receiving space formed between said forms, and a tamping mechanism for applying pounding forces to a mix introduced into said space, said tamping mechanism comprising: a vertically disposed elongated tubular casing, said casing being of a diameter enabling the same to be directly positioned in

said molding space for movement therein, motor means disposed in said casing, a mix-engaging tamping head arranged at the lower end of said casing, means actuated by said motor means for imparting reciprocatory mix-pounding motion to said head, guide means carried by said frame structure for maintaining said tamper casing in a substantially vertical position of operation and to provide for independent vertical movement of said casing on the top of said mix during and in response to the filling of the mold space with the tamped mix, and means carried by said frame structure for elevating the inner molding form and removing the same from said table to a position above the outer molding form, and means for raising and lowering said tamping mechanism in unison with the means for raising and lowering said inner molding form.

4. In pipe-molding apparatus of the type utilizing a frame structure, a turntable mounted on said frame structure, inner and outer relatively spaced and concentrically arranged molding forms rotatable with said table, there being an annular mix-receiving space formed between said forms, and a tamping mechanism for applying pounding forces to a mix introduced into said space, said tamping mechanism comprising: a vertically disposed elongated tubular casing, said casing being of a diameter enabling the same to be directly positioned in said molding space for movement therein, motor means disposed in said casing, a mix-engaging tamping head arranged at the lower end of said casing, means actuated by said motor means for imparting reciprocatory mix-pounding motion to said head, guide means carried by said frame structure for maintaining said tamper casing in a substantially vertical position of operation and to provide for unrestricted vertical movement of said casing on the top of said mix during the filling of the mold space with the tamped mix, a horizontally disposed cross frame carried by said frame structure, and means for effecting vertical movement of said cross frame relatively to said frame structure.

5. Pipe-molding apparatus of the type embodying a frame structure, a turntable, inner and outer relatively spaced and concentrically arranged molding forms positioned on said table for rotation therewith, a tamping mechanism for pounding a mix of ceramic material introduced into an annular molding space provided between said forms, said tamping mechanism comprising: a horizontally disposed cross frame guided on said frame structure for vertical movement, a cable hoist arranged at the top of said frame structure and connected with said cross frame to control the raising and lowering of the latter, tamper guides carried by said cross frame, a plurality of elongated vertically disposed tubular casings, each of said casings possessing a diameter enabling the same to be directly positioned in the annular molding space provided between said molding forms, motor means disposed in each of said casings, a mix-engaging tamping head arranged at the lower end of each of said casings, means actuated by said motor means for imparting a reciprocatory mix-pounding motion to said heads, said casings being supported for operation in vertical planes by the guide means of said cross frame.

6. Pipe-molding apparatus as defined in claim 5, and wherein said cross frame is provided with adjustable means for adjusting the operating positions of said tamper guides radially with respect to the vertical axis of said molding forms, whereby to adapt said tamping devices to the molding of pipe of varying diameter.

7. In a machine for molding ceramic pipe, an inner form member, a jacket concentrically surrounding said inner form member and spaced therefrom to define an annular mix-receiving space, means for introducing a pipe-forming mix into said space, and movable impact-devices positioned in said space in direct engagement with the top of a mix disposed therein, and motor mechanism

arranged in said space immediately above said impact devices for imparting reciprocatory movement thereto.

8. Pipe-molding apparatus comprising: a rigid, vertically disposed frame structure, a turntable supported for rotation on the lower portion of said frame structure, relatively spaced, concentrically disposed, inner and outer molding forms positionable on said table for rotation in unison therewith, a pair of tampers, each of said tampers having a cylindrical outer casing arranged to enter the space formed between the inner and outer molding forms while the latter are positioned on said turntable, actuating motor means mounted directly in each of said casings, a cross frame, means supporting the ends of said cross frame in the sides of said frame structure for confined sliding movement in a vertical plane, a cable hoist carried by the top of said frame structure and joined with said cross frame for raising and lowering the latter, bearing means uniting the cross frame axially with the upper end of said inner molding form, and vertical guides carried in conjunction with said cross frame for the reception of the vertical casings of said tampers.

9. Apparatus as defined in claim 8, and wherein the tamper guides carried by the cross frame are formed with threaded openings, and adjusting screws rotatably supported on said cross frame and engaged with the threaded openings of said tamper guides to adjust the latter radially with respect to said bearing.

10. Pipe-molding apparatus as defined in claim 8, and wherein said tamper guides are provided with a plurality of transversely spaced spool-shaped rolls disposed on opposite sides of tamper casings positioned therebetween.

11. Tamper apparatus for deep molds of the type utilizing a cyindrical outer jacket and an internal concentrically placed core, said jacket and core defining an annular mix-receiving and molding space therebetween, said apparatus comprising a frame including a vertically adjustable cross member; guide means carried by said cross member in registry with opposite sides of said annular molding space; a tamper casing mounted for confined vertical movement in each of said guide means, said casing being proportioned to extend directly into said annular molding space; fluid pressure-actuated motor means mounted in each of said casings in the portions of the latter occupying said molding space; a tamping head carried by the lower end of each of said casings and engageable with molding materials deposited in said space to produce compaction thereof; and relatively short piston rods uniting said motor means with said head, said piston rods extending through but a minor part of the total height of said space.

12. Tamper apparatus for deep molds of the type employed in molding cylindrical pipe members, said molds being formed to comprise an outer jacket and an inner cylindrical core, the core and jacket being concentrically disposed and relatively spaced to define between the same an annular molding space for the reception of a compacted material, said tamper apparatus comprising: a frame including a vertically adjustable and horizontally disposed cross member; means carried by said frame for raising and lowering said cross member; a pair of spaced guide devices carried by said cross member; means for adjusting said guide devices relatively to cause the same to register with annular spaces of varying diameter; a tamper casing mounted for confined vertical movement in each of said guide devices, each of said casings extending directly into the annular molding space of an associated deep mold; motor means mounted in each of said casings in the portion thereof extending into and occupying said molding space during normal operation of said tamping apparatus; reciprocatory heads carried by the lower ends of said casings; and rod means carried by said motor means and extending beyond and below the lower part of each casing for connection with an associated

head, said rod means occupying but a portion of the total height of said space.

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