A. W. CASH.

TAPPING MACHINE.

APPLICATION FILED SEPT. 19, 1913.

1,094,425.

Patented Apr. 28, 1914.

3 SHEETS—SHEET 1.

Fig 1.

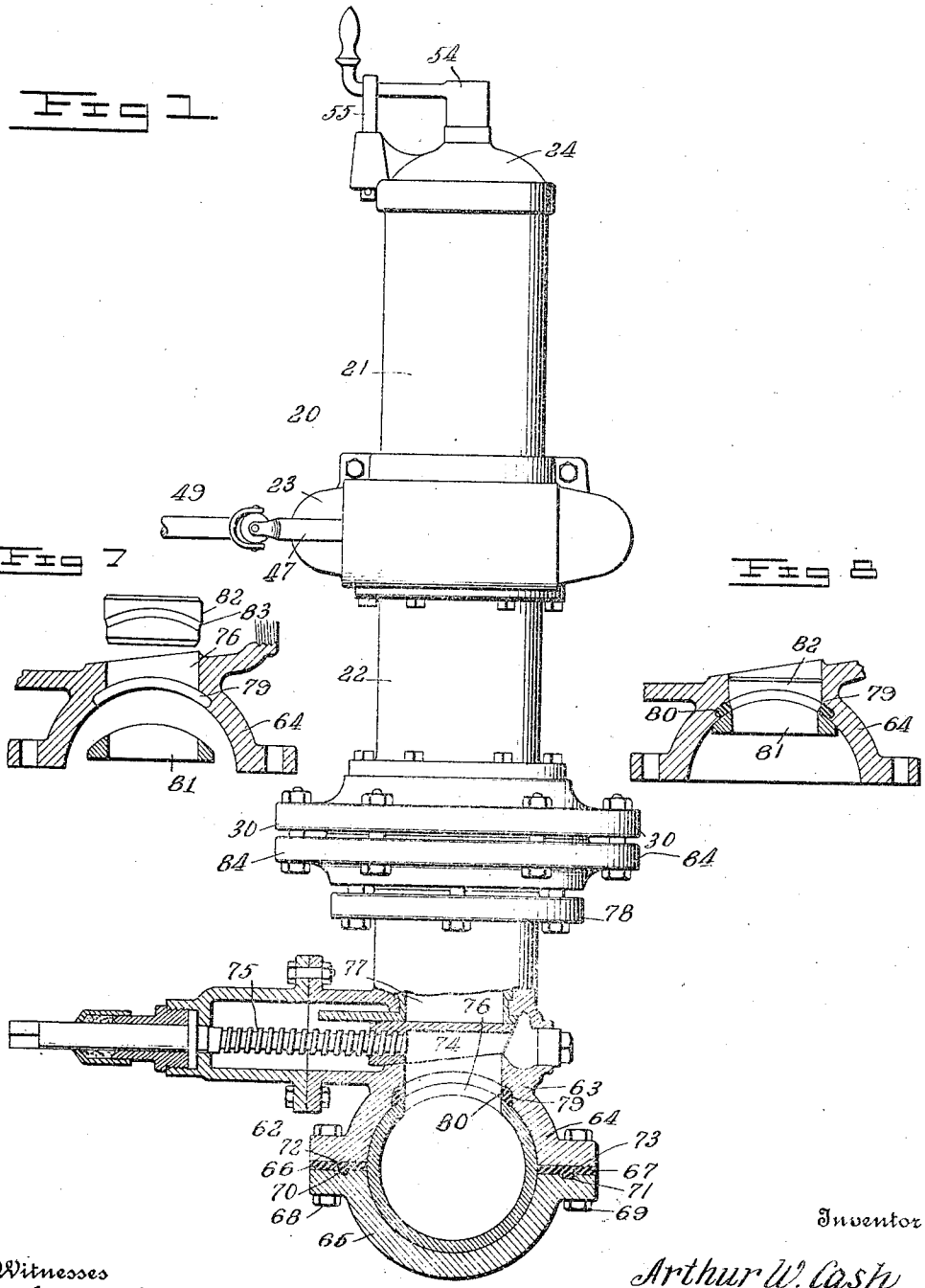


Fig 7

Fig 8

Witnesses

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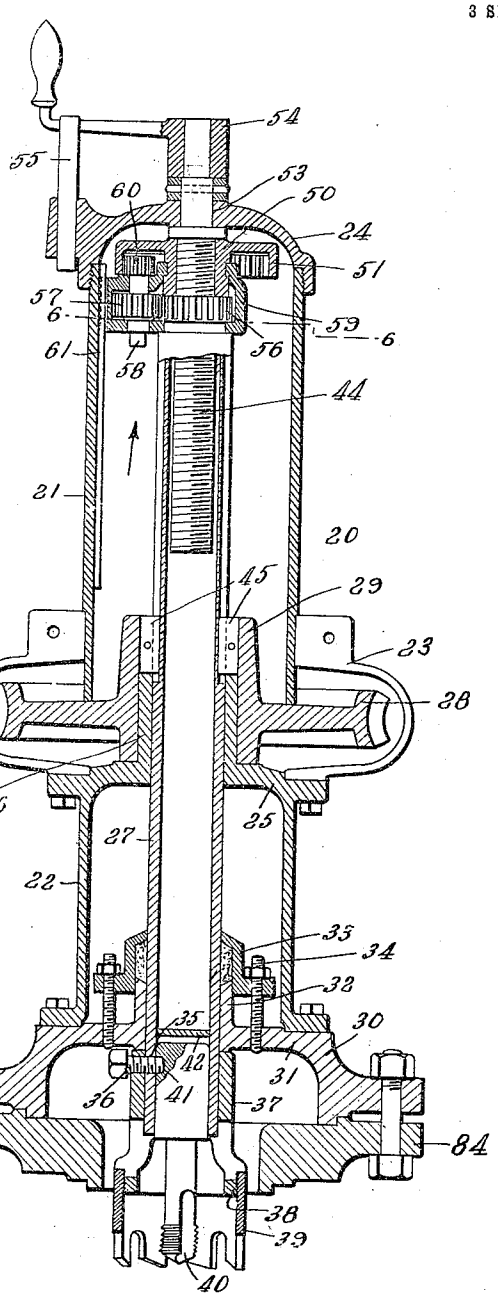
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3 SHEETS—SHEET 2.



Witnesses

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3 SHEETS—SHEET 3.

Fig 3

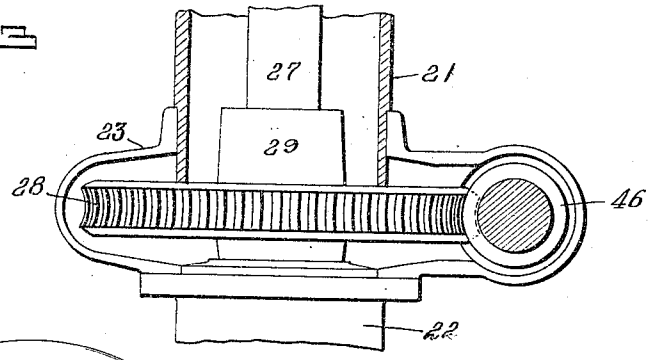


Fig 4

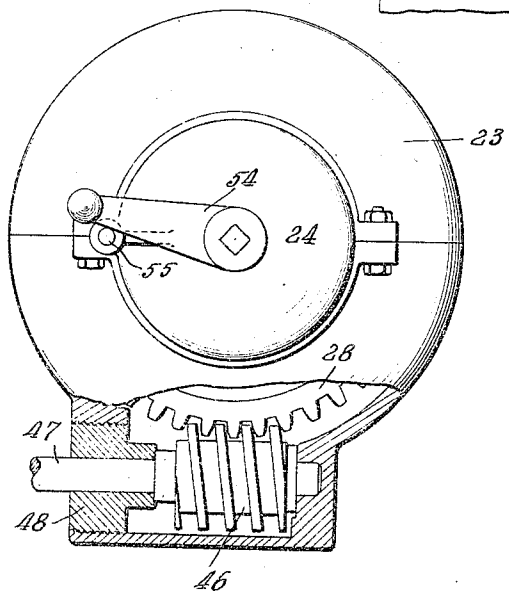


Fig 5

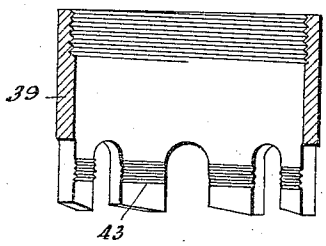
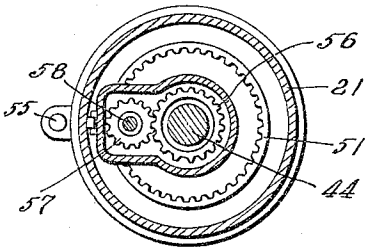


Fig 6



Witnesses

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UNITED STATES PATENT OFFICE.

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TAPPING-MACHINE.

1,094,425. Specification of Letters Patent. Patented Apr. 28, 1914.

Application filed September 19, 1913. Serial No. 790,672.

To all whom it may concern:

Be it known that I, ARTHUR W. CASH, a citizen of the United States, residing at Decatur, in the county of Macon and State of Illinois, have invented new and useful Improvements in Tapping-Machines, of which the following is a specification.

This invention has reference to improvements in tapping machines, and more particularly to that class of machines which are used for cutting into, and making branch or other connections with pipes or mains under fluid pressure.

The present invention is particularly applicable to tapping machines whereby the main may be cut into and the connection formed without the necessity of shutting off the fluid pressure in the main, a source of much annoyance and inconvenience to residents in the vicinity where the cutting operations are being carried on because of a more or less prolonged deprivation of the gas or water supply, as the case may be.

An object of this invention is to provide means whereby the machine may be either manually or power driven from the top of the excavation after being applied to the main, and means for feeding the cutter automatically at a constant rate of advance into working contact with the main during the progress of the boring operation, making it unnecessary for an attendant to remain within the excavation while the machine is working.

A further object is to provide means for quickly applying the cutter to the main prior to starting the machine into operation.

A further object is the provision of improved means whereby the piece of pipe cut from the main by the action of the cutter is guarded against falling into the main.

Another object is to provide an improved construction of valve for shutting off the flow of fluid after the opening has been cut in the main, and previous to the removal of the cutting mechanism and the connection of the branch pipe to the outlet of the valve. This improvement consists in forming the means for securing the valve to the main and the valve body in one-piece thereby avoiding the necessity of an extra joint between the valve body and said means, which has the advantage of shortening the distance to the outer face of the valve, resulting in a similar shortening of the shaft of the cutting mechanism and the distance which it has to travel prior to reaching its cutting position on the main. A further advantage of forming the valve body securing means integrally is that the inlet to the body adjacent the main may be machined uniformly concentric with the bore of the outer flange of the valve whereby a guide or bearing is provided for the cutter carried on the end of the shaft of the cutting mechanism, so that said cutter may be started in uniformly correct position and without vibration usually caused by commencing the cutting operation on the curved or uneven surface of the main. It will be also noted that the bearings thus formed guard the cutter against side-wise shifting movement so that preliminary piercing of the walls of the main by pilot drills is avoided thereby effecting a saving of much time and labor usually spent with this purpose in view and accomplishing a consequent reduction in the expense of carrying on the tapping operation.

A further object is to assemble the working parts of the machine in compact form, permitting its operation in excavations, smaller than have been required previously in machines of this type so that a reduction in the size of the excavation is obtained and a consequent reduction in the expense. In addition the use of the machine on mains in close proximity to building walls or other obstructions is made possible, a use not possible in machines of less compact construction.

A further object is to provide an outer casing entirely inclosing all driving mechanism of the machine, thereby preventing dirt and grit from falling into the machine, a condition causing excessive friction with a resultant increase in power necessary for the operation of the machine, as well as a rapid wearing away and destruction of the driving mechanism.

With these and other objects in view, the invention consists in the novel construction and combination of parts hereinafter more fully described in a preferred form, reference now being made to the accompanying drawings in which,—

Figure 1 is an elevation of the tapping machine connected to the main. Fig. 2 is a longitudinal section of the cutting mechanism. Fig. 3 is a detail longitudinal section

at right angles to Fig. 2, showing the connection with the valve on the main. Fig. 4 is an outer end view partly in section of the driving mechanism. Fig. 5 is a detail view of the cutter head showing means for preventing the cut-out portion from falling into the main. Fig. 6 is a transverse section on the line 6—6 of Fig. 2 looking in the direction of the arrow.

Similar characters of reference refer to similar parts throughout the several views.

In the drawings 20 is the casing of the cutting mechanism, formed of two hollow cylinders 21 and 22 open at each end and connected to their inner and outer extremities, respectively, to the worm gear case 23 by any suitable means. A screw cap 24 closes the open outer end of the casing 20. The outer extremity of the cylinder 22, forming a part of the casing 20, has an inwardly curved portion 25 terminating in a hollow neck 26 which forms on its inner circumference a bearing in which rotates the cutter shaft 27. The outer circumference of the neck 26 forms a rigid shaft on which rotates the hub 29 of the worm gear 28. Coupled to the inner extremity of the casing 20 is a base plate 30 having a similarly inwardly curved portion 31 fashioned to form a bearing 32 for the inner end of the cutter shaft 27. To provide a fluid tight joint around the shaft 27 and keep the fluid pressure from entering the cylinders 21 and 22 a gland cap 33 is positioned over and slightly above the bearing 32, and fastened to the base plate by means of adjustable studs 34. At some point near the inner end of the shaft 27 is a screw threaded opening 35 for the reception of a set screw 36 which secures the cutter hub 37 on the shaft. The outer extremity of the cutter hub is fashioned to form an annular recess 38 screw-threaded to mesh with a similar screw threaded portion on the inner circumference of the cylindrical cutter 39. The shaft 27 being hollow from end to end a center combined drill and tap 40 may be inserted in the opening at the lower end of the shaft in which case the shank of the center drill is provided with a seat 41 for the reception of the set screw 36 which secures the drill on the shaft. A plug 42 is expanded tightly into the hollow shaft 27 to prevent the fluid under pressure from entering the rear part of the shaft.

If desired the center drill and tap 40 may be dispensed with, its only function being to pierce and hold the circular piece cut from the main against falling within the main. In this case the cylindrical cutter is provided on its inner circumference with thread cutting teeth 43, see Fig. 5, of the same lead or pitch as the feeding screw 44, the reason for which will be hereinafter described. As the boring operation is being carried on the teeth 43 will thread the circular piece cut from the main and guard it against falling into the main, preventing a stoppage of the pipe.

The shaft 27 is driven by the worm-gear 28 fastened thereon by suitable keys 45. Meshed with the face of the worm gear 28 is a worm 46 on a shaft 47 journaled in suitable bearings 48 formed by an extension of the gear case 23. The shaft 47 may be rotated either by a hand lever coupled directly thereon, but it is preferable to rotate the shaft by means of a flexible jointed shaft 49 which extends to the top of the excavation, thereby rendering it unnecessary for an attendant to remain within the excavation during the operation of the machine.

At its outer extremity the shaft 27 abuts the hub 50 of the internal gear 51. This hub is screw threaded to mesh with the feed screw 44 which rotates in a central opening 53 in the cylinder cap 24 and is provided at its outer end with a hand crank 54. A stop pin 55 engages the crank 54 and prevents the feed screw from rotating when the cutter has been brought into contact with the outer surface of the main.

A series of gear teeth 56 on the end of the shaft 27 mesh with and drive a pinion 57 keyed on one end of the counter shaft 58 journaled in suitable bearings in the housing 59. On the other end of the shaft 58 is a drive pinion 60 meshing with the teeth on the internal gear 51 and causing it to rotate in a direction opposite to the shaft 27. The housing 59 encircles the end of the shaft 27 and seats at its lower end in an angular recess in the said shaft and a like recess in the hub of the internal gear 51; but is prevented from rotating therewith by means of the spline slide-way 61 fastened in the casing 21, the entire set of gears and the housing being capable of longitudinal movement on the slide-way 61, when either the shaft 27 or the screw 44 is revolved.

The valve 62 consists of the main body portion 63 and the sleeve portion 64 which forms a part of the means for securing the valve around the main. A sleeve section 65 similar to the sleeve portion of the valve 62, is assembled on the opposite side of the main, and suitable rubber or lead packing strips 66 and 67 are interposed between the two sleeve sections and machine bolts 68 and 69 couple the two sections around the main. Formed in the lower sleeve section 65, are grooves 70 and 71 in which set tongues 72 and 73 on the packing strips, the tongues being somewhat deeper than the grooves so that they come into contact with the bottom of the groove before the sleeve faces meet and are crushed when the machine bolts 68 and 69 are tightened, thereby rendering the joint between the two sleeve sections impervious to fluid. The valve proper may

be of any desired construction but in the present instance is of the reciprocating type, having a gate 74 which shuts off the flow of water from the opening in the main, and a screw threaded stem 75 meshing with a screw threaded portion in the head of the gate 74, operated by any suitable means to open and close the valve.

The sleeve section 64 and the valve body 63 being integral, the throat or inlet 76 to the valve adjacent the main may be machined uniformly concentric with the bore 77 of the outer flange of the valve to which the machine is connected, thereby providing a guide or bearing for the hollow cylindrical cutter carried on the outer end of the machine shaft. Encompassing the valve inlet 76 and adjacent the main is an annular recess or groove 79 which receives and retains a ring or strip 80 of resilient or expansible material whereby to form an impervious joint between the valve body and outer surface of the main.

Another feature of this invention is the semi-circular formation of the packing receiving groove 79 encircling the valve inlet 76, this peculiar form being given to the groove 79 whereby to retain the packing 80 in the coupling member 64. Heretofore it has been the custom to place a coupling member of this character upon the main and to then pour in the lead or other material constituting the packing ring, but this method has been found very unsatisfactory since the operator tapping the main cannot tell whether or not the ring has been cast in full. To overcome this difficulty applicant provides a pair of casting-members 81 and 82, Figs. 7 and 8, which are placed against the opposite sides of the member 64, preferably at the factory where the machines are manufactured, and which when assembled, as shown in Fig. 8, constitute a mold for receiving and holding the poured metal in the groove 79 until the metal is set. The member 81 conforms to the inner curvature of the member 64 and bears against the inner side of the groove 79, the member 81 being slightly reduced in diameter as compared with the diameter of the opening through the member 64, whereby the cast ring 80 is constructed at its lower side so as to provide for a tight fitting connection between the member 64 and the main. The member 82 fits through the opening 76 in the outer end of the member 64 and snugly engages into the member 81. The member 82 has a peripheral inwardly inclined face 83 adapted to close the inner side of the groove 79 and mold the packing ring 80 into a tapered face at its inner side. When the members 81 and 82 are withdrawn from the member 64 the packing 80 is held in place by reason of the semi-circular formation of the groove 79. Secured by any suitable means to the outer flange 78 is an adapter flange 84 which is in turn fastened to the base plate 30 on the lower end of the casing 20 of the cutting mechanism.

In operation the valve body 63 and sleeve part 64, which carries the cast packing ring 80, is placed on the main to be tapped or cut into and the other half 65 of the sleeve is assembled on the opposite side of the main, the packing strips 66 and 67 placed between the two sleeve sections with the tongues 72 and 73 in the grooves 70 and 71 respectively, and the machine bolts 68 and 69 tightened to bind the sleeve sections about the main to thus render the joint between the sleeve sections impervious to water. Should lead packings be used instead of the rubber packings 66 and 67 all joints should be calked before the machine is bolted to the valve. The valve body 63 having been thus attached to the main, the cutter 39 is secured to the hub 37 and the latter mounted on the end of a shaft 27. The cutting mechanism is now ready for mounting on the valve preparatory to cutting into the main. The cutting mechanism is now secured to the valve 63 by means of the adapter flange 84, machine bolts being usually employed for this purpose, although any suitable securing means may be substituted. The tapping machine is now in position for operation upon the main. This having been done, the stop pin 55 is pushed out of the path of the crank handle 54 and the said crank handle is rotated thereby rotating the feed screw 44 without causing the gears to rotate which causes the shaft 27, with the gears on its upper extremity, to move forwardly until the cutter 39 comes into contact with the outer surface of the main. Then, the stop pin 55 is pulled out into the path of the crank handle 54, stopping the rotation of the latter which causes the shaft 27 and the cutter 39 to automatically feed forward as the shaft is driven by the worm gear 28 and the worm 46. This automatic forward feed is accomplished by means of the gears journaled in the gear case 59. As the shaft 27 is being rotated by the worm 28, the pinion 57 which meshes with the teeth 56 formed on the upper end of the said shaft, will be caused to rotate in a direction opposite to the shaft. The drive pinion 60 on the other end of the counter shaft 58 meshes with the teeth on the internal gear 51 causing the same to rotate in a direction opposite to the direction of rotation of the shaft 27 thereby causing the cutter shaft to be fed forwardly on the feed screw 44 as the cutting operation is being carried on. It will be noted that the gears 57 and 60 being of a smaller diameter than the shaft 27 will cause the screw threaded hub of the internal gear 50 to revolve about the feed screw 44 at a less rapid rate than that at which the shaft and cutter are revolving thereby causing the

cutter to advance at each revolution an amount considerably less than the pitch of the screw threads on the feed screw. In this connection, however, it will be necessary to regulate the pitch of the thread cutting teeth 43 on the cutter 39 or the threads on the combined drill and tap 40 so that they will advance at the same rate as the shaft. It will be observed that by using the reducing gears the necessity of threading the screw to a very fine pitch on the feed screw 44 is avoided.

What I claim is:—

1. In a machine for tapping mains, a casing, a shaft rotating in the casing, a feed screw revolubly mounted in the outer end of the casing, a locking device for the feed screw to hold the same from turning, a gearing member threaded to the feed screw and having connection with the shaft for advancing the latter upon the rotation of the shaft, and a key mounted longitudinally in the casing and engaging said member to hold the same from turning with the shaft whereby the shaft is automatically fed by its rotation, said key being of a length equal to the distance of travel of the shaft, whereby said feeding means is held from turning throughout the entire length of movement of the shaft.

2. In a machine for tapping mains, a casing, a feed-screw adapted to be held stationary in the casing, a train of gears carried on the shaft and engaging said feed screw and adapted to be turned by the shaft, and a key in the casing engaging said gears to hold the same from turning about the axis of the shaft whereby said shaft is fed by its rotation, said key extending longitudinally within the casing whereby the gears are held from turning about the shaft throughout the entire length of travel of the shaft.

3. In a device for tapping mains, the combination with a shaft, of a cutter on the end of said shaft, means for rotating said shaft, a feed screw extending into the shaft, a rotary member threaded on the feed screw and having connection with the shaft for advancing the same when turned, a crank handle on the outer end of the feed screw for manually advancing the shaft, and means for holding the crank handle against revolution upon the operation of said rotating means.

4. In a device of the character described, a casing, a shaft in said casing, means for rotating the shaft, a cutter on one end of the shaft, a feed screw mounted in the casing and projecting into the opposite end of the shaft, an internal gear having a hub threaded upon said feed screw, a gear fixed upon said shaft, a frame mounted for rotation upon the shaft about said gear, a counter shaft mounted in said frame, gears upon the opposite ends of the counter shaft respectively engaging said internal gear and said gear on the shaft, and an elongated key mounted in the casing longitudinally of the shaft and engaging said frame to hold the latter from turning whereby upon the rotation of said shaft said internal gear rotates on the feed screw to advance said shaft in the casing.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ARTHUR W. CASH.

Witnesses:
CHARLES G. AUER,
CATHERINE E. MCKEOWN.