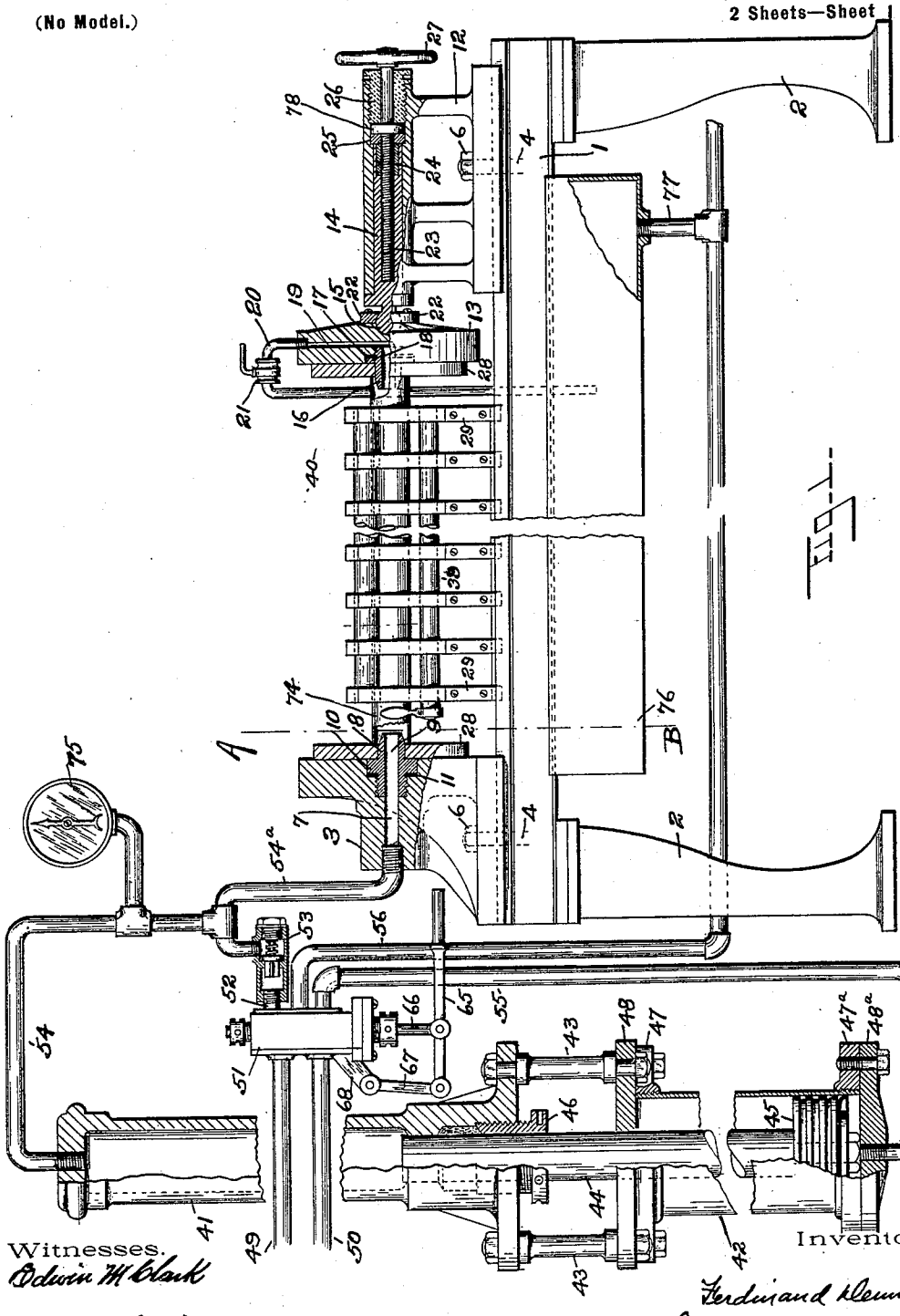
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F. DEMING.

HYDRAULIC TUBE TESTING MACHINE.

(Application filed Nov. 27, 1897.)

(No Model.) 2 Sheets—Sheet 1



Witnesses.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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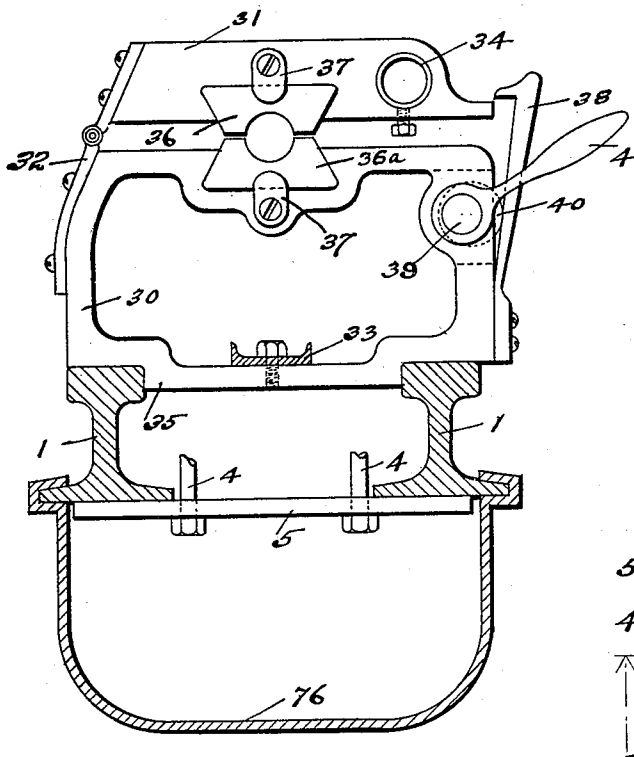


Fig. 2.

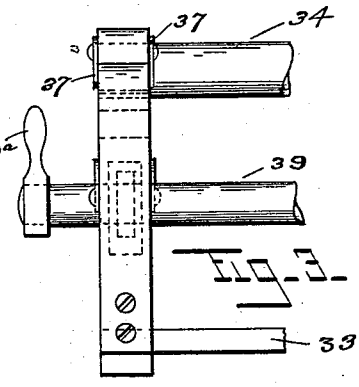


Fig. 3.

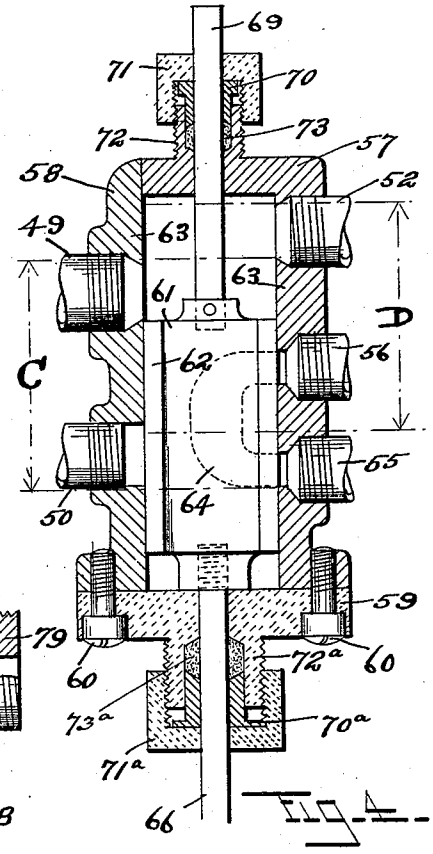


Fig. 4.

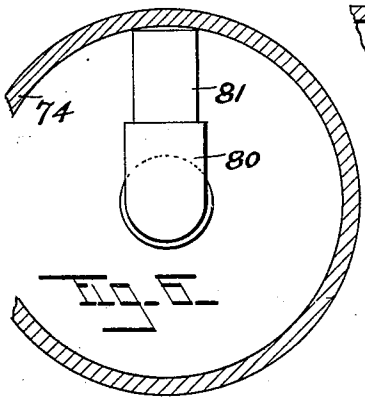


Fig. 6.

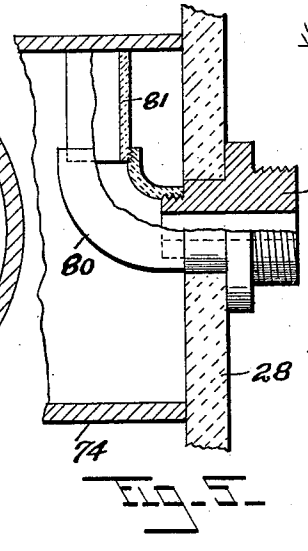


Fig. 5.

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UNITED STATES PATENT OFFICE.

FERDINAND DEMING, OF WATERBURY, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO MAMIE B. CLOWES, OF SAME PLACE.

HYDRAULIC TUBE-TESTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 640,881, dated January 9, 1900.

Application filed November 27, 1897. Serial No. 659,962. (No model.)

To all whom it may concern:

Be it known that I, FERDINAND DEMING, a citizen of the United States, residing at Waterbury, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Hydraulic Tube-Testing Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to means for testing the internal strength of tubes by hydraulic pressure, and has for its object the construction of a machine that will test tubes quickly, efficiently, and at a small cost.

To this end my invention consists in the hydraulic tube-testing machine constructed and operating as hereinafter fully described.

Referring to the drawings, in which like numerals designate like parts in the several views, Figure 1 is a front elevation of the machine shown partly in section. Fig. 2 is an enlarged transverse section upon line A B of Fig. 1. Fig. 3 is a front elevation of one of the tube-rests. Fig. 4 is a vertical section of the five-way valve. Fig. 5 is a sectional side elevation of the tail-stock nipple and a tube mounted thereon in operative position and in section. Fig. 6 is a front elevation of the same.

The numerals 1 1 designate two horizontal rails of the ordinary type, which rest upon suitable legs 2 2 at either end and form the bed of the machine. A head-stock 3 is mounted upon the rails 1 1 at one end of the machine and rigidly secured thereon by means of the bolts 4, which project through the tie-plate 5 and the base of the head-stock 3, with the jam-nut 6 upon its upper end. Concentric with the central bore 7 of the head-stock and projecting from the face thereof is the centering-nipple 8, which is screwed into said head-stock and provided with a central bore 9 of the same diameter as the bore 7 of the head-stock. The face of the head-stock is counterbored to receive the packing-ring 11 and the shoulder 10 of the nipple 8. On the other end of the machine from the head-stock end is the tail-stock 12, which is held against longitudinal displacement by the same means heretofore described in reference to the head-stock 3. An adjustable plate 13 is mounted upon the ball end 15 of the spindle 14 within said tail-stock and held permanently by the split bearing-collars 22 22, screwed to the back of the said plate 13. By connecting the plate 13 and the spindle 14 with a ball-joint the plate 13 is thereby enabled to adjust itself to the irregular end of the tube, which may be at any angle to the spindle-axis. A centering-nipple 16, constructed with an enlarged shoulder 18 and having a central bore, is screwed into the face of the plate 13, and the packing-ring 17 is inserted back of said shoulder to insure a water-tight joint.

The numeral 19 represents an air-passage within the plate 13, leading radially from the center thereof and connecting with the bore of the nipple 16. The water-outlet pipe 20 is screwed into the outer end of the said air-passage 19, and secured midway between the ends of said pipe is a stop-cock 21. A longitudinal motion is imparted to the spindle 14 by means of the screw-shaft 23, operating in the nut 24, driven into the rear end of the spindle. A hardened collar 25 upon one side and the externally-threaded nut 26 upon the other side of the shoulder 78 hold the screw-shaft in a stationary position, but do not prevent the rotary motion which is imparted through the hand-wheel 27.

Upon the face of the head-stock 3 and the adjustable plate 13 is secured a circular disk 28, of rubber, so that when the tube is placed in the machine and the plate 13 screwed up to the ends of the tube the rubber is compressed, and even though the end of the tube be irregular the ends thereof are sealed, and a water-tight joint is thereby insured.

In tubes of large diameter a support upon each end is sufficient to hold them rigid during the operation of testing; but in tubes of small diameter and of great length the internal pressure causes the tube to buckle and warp while submitted to the testing strain, and in consequence it is necessary to provide supports for the tube in the course of its length, so that it may be held rigid. The supports or steady-rests, Fig. 2, which I have

provided comprise a series of tube-rests 29, which are made either of wood or metal. The tube-rest 29 is made in two parts—a lower portion 30 and an upper portion 31—the said parts being united by the hinge 32. The lower portions of each of the series of tube-rests are joined by a tie-bar 33, which is rigidly secured to the base of the lower portion 30. A tie-tube 34 extends through the upper portions 31 of the series of tube-rests, and being rigidly secured to each upper portion provides means for raising or lowering synchronously each one of the upper portions in the series. Any transverse movement of the tube-rests 29 is prevented by the integral depending lip 35, which reaches down between the rails 1 1. Half-boxes 36 36ª, with a central semicircular bore of the same diameter as the tube to be tested, are fitted into a recess formed in the upper and lower portions of the tube-rests and there held against accidental displacement by the clips 37 upon either side of the steady-rests 29.

A pair of boxes must be provided for each size of tube to be tested, so that by simply changing the boxes, which is an operation requiring but a few moments, any number of different-sized tubes may be held without a shift of tube-rests.

Fastened rigidly to the lower portion 30 is the latch 38, which locks the two portions of the tube-rests together. Mounted upon the rock-shaft 40, in a recess formed in the front of the lower portion 30 of the tube-rests, is the cam 39, and upon the same shaft are keyed one or more operating-handles 40ª. When the shaft 40, through the handles 40ª, is given a slight rotary movement, the cams 39 bear against the latches 38 and by forcing them outward release the upper portions 31.

The intensifier-accumulator, which I use for generating the pressure required to test a tube, operates upon the well-known principle of such devices and may be located in any convenient position adjacent to the machine. My intensifier-accumulator comprises two cylinders—an upper 41 and a lower 42—separated by the bolt-rods 43. A single plunger 44, with a piston-head 45 of common construction, operates in both of said cylinders. The cylinder 41 is the smaller of the two and is made of cast-iron, with one solid end. A packing-gland 46 is screwed into the lower end thereof to hold the necessary packing. A metal tube screwed at either end into an annular head-ring 47 47ª and the said rings bolted to the cylinder-heads 48 48ª unite to form the lower cylinder 42.

In operating my machine I procure the necessary water from two different sources which reach the machine under two different pressures—one a low and the other a high pressure source. When hydraulic testing-machines are operated solely from a city supply, the expense for water is very great, as the water cannot be returned to the source of supply and then used over again; but in my machine I provide means whereby the greater bulk of the water used is derived from a local supply, such as an Artesian well, a stream from which water is taken for factory purposes, or any other analogous source common to a manufacturing plant, and when it has been used in the machine it can be returned to its original reservoir. This water-supply is denoted the "low-pressure" water, as it ordinarily has but sufficient pressure to carry it through the factory. The high-pressure water may be derived from an ordinary city main; but this is not essential, as the low-pressure water above referred to may be conveyed through a suitable pump and its pressure increased. A pipe 49 conveys the low-pressure water and the pipe 50 the high-pressure water to the five-way valve 51. The low-pressure water flows out of said valve 51 through pipe 52, check-valve 53, and pipes 54 54ª into the head-stock 3 and cylinder 41. Pipe 55 conveys the high-pressure water from the valve 51 to the cylinder 42, and the exhaust-water from said valve flows through the outlet-pipe 56. The five-way valve 51 (see Fig. 4) is constructed with a body 57, having a rectangular chamber, an independent side 58, rigidly secured to said body, and a cap 59, secured to the said body 57 and side 58 by suitable screws 60. Valve 61 is square in cross-section, with two narrow bearing-surfaces 62 62 upon each of the two free sides that do not slide upon the valve-seats 63 63. The port 64 in said valve (shown in dotted lines in Fig. 4) is provided with two openings designed to allow the water from pipe 55 to flow through the valve 61 and out the exhaust-pipe 56. The valve 61 is operated by means of the lever 65, fulcrumed midway of its length to the lower end of the valve-rod 66, and the outer end is connected with the link 67, which is pivotally secured to the integral projecting lug 68 upon the valve side 58. An equalizing-rod 69 of the same diameter as the valve-rod 66 is secured to the upper end of the valve 61, so that the area of the opposite ends of the valve will be equal. Where the rods 66 and 69 pass through the outer ends of the valve-body and valve-cap, suitable stuffing-boxes are provided to prevent leakage. Said stuffing-boxes consist of a gland 70 70ª and an internally-threaded nut 71 71ª, covering said gland and adjustable upon the stem 72 72ª, whereby the packing 73 73ª may be compressed sufficiently to prevent leakage of water from said valve.

The operation of my improved hydraulic tube-testing machine is as follows: The series of hinged upper portions of the tube-rests 29 are thrown back. The tube 74 is laid in said rests and locked therein by the latches 38. The adjustable plate 13 is screwed up to the end of the tube, so that the respective ends of the tube are slightly embedded in the rubber disks of the head-stock and the said plate. As the adjustable plate is connected with the tail-stock spindle by a ball-joint, the said plate

will accommodate itself to the end of the tube if it should perchance be cut at an angle to the sides thereof. When the tube is being placed in position, the valve 61 covers both the inlet-ports of the low and high pressure pipes 49 50, and the location of the ends of the valve in such position is represented by the broken lines C in Fig. 4. At this stage of the operation the valve 61, operated by the lever connection 65, is brought to the position where the inlet-port from the low-pressure pipe is uncovered and the water flows through said valve 51, pipe 52, check-valve 53, and into pipe 54, which conveys it to the cylinder 41, and through pipe 54ª into the tube 74 through the central bore 7 of the head-stock. The air in the tube is forced out through the centering-nipple 16 in the adjustable plate 13, and thence escaping by the air-passage 19 and pipe 20, the stop-cock 21 being open. In tubes of large diameter when the level of the water reaches a point above the bore in the nipple 16 the means heretofore described for exhausting the air is effectually closed and the pipe is filled with a mixture of both air and water, which impairs the efficiency of the testing process; but in small tubes, however, the amount of air remaining therein would not seriously interfere with the testing thereof. The device shown in Figs. 5 and 6 is used when testing large tubes, the nipple 79 being the same as nipple 16, with the exception of the outer end, which is threaded to receive the pipe-elbow 80, in which is screwed a short length of pipe 81, reaching to the wall of the tube. As the end of the pipe 81 is flat and the inside surface of the tube-wall rounded, a space is left between them which provides means for the air to escape when forced out by the water, which it does until the tube is entirely filled with water and the air exhausted. When all of the air has been exhausted, which fact can be readily determined by the flow of water through the pipe 20, the stop-cock 21 is closed. The valve 61 is now raised to the position where the inlet-port of the low-pressure water is closed and the inlet-port of the high-pressure water is opened, which position is represented by the broken lines D in Fig. 4. It can be seen that in this position the supply of low-pressure water is shut off and no water is flowing into the tube, while, on the other hand, the high-pressure water is flowing through the valve 51 and pipe 55 into the lower cylinder 42. As the volume of water increases in the cylinder 42 the plunger 44 is raised and this increases the pressure upon the water in the cylinder 41, the pipes 54 54ª, and in the tube 74, which has been filled with water, as heretofore described. When the pressure required has been reached, which is indicated by a suitable pressure indicator or gage 75, the valve 61 is brought to the position shown in Fig. 4, in which position the inlet-port of the high-pressure water is closed. As the plunger 44 falls the water in cylinder 42 is forced out through the pipe 55, valve 61, and exhaust-pipe 56, where it may be conveyed to the source of supply of low-pressure water, if desired. The difference in the sectional area of the piston-head 45 and the plunger 44 enables me to multiply the pressure of the high-pressure water, so that almost an unlimited pressure can be applied to a tube in the machine. The check-valve 53 is of the ordinary construction and operates automatically. When the valve 61 is in the position shown in Fig. 4, the check-valve is open, allowing the water to flow through; but when valve 61 is in positions C or D the check-valve 53 is closed and no water can set back into the valve-body 57. When the tube has been tested, the operator opens the latches on the tube-rests by means of the rock-shaft 39 and cams 40, throws back the hinged upper portions of the tube-rests, draws back the adjustable plate 13, allows the water in the tube to flow into the trough 76 under the machine, and then lifts the tube from its seat in the tube-rests, completing the operation.

The trough 76 is made of sheet metal and held in position by springing its upper edges over the base of the rails 1 1, as seen in Fig. 2. A pipe 77 connects the trough with the exhaust-pipe 56 and carries off the surplus water.

On account of the great length of some of the tubes it is designed that two persons shall operate this machine, one at the head-stock end operating the valve mechanism, and the other at the tail-stock end operating the stop-cock and adjustable plate.

By the operation of my machine, as herein described, the larger quantity of water used is derived from the low-pressure supply, and hence the machine can be operated at a very small cost compared to the expense if the machine were operated solely by the high-pressure water or city supply.

As the result of actual tests, it is found that the internal strength of tubes can be ascertained in a very efficient manner at a low cost and in a comparatively short space of time compared with the previous methods heretofore used.

Many minor changes can be made within my invention, and I would therefore have it understood that I do not limit myself to the exact construction herein shown and described, but hold myself at liberty to make such changes and alterations as fall fairly within the spirit and scope of my invention; but

What I do claim as new, and desire to secure by Letters Patent, is—

1. In a tube-testing machine, a series of tube-rests having lower members, upper members hinged thereto, a half-box fitted into each of the said members, a latch device attached to each of said rests and adapted to secure the said lower and upper members in a locked position and mechanism adapted to free all of said latch devices at one and the same

time and thereby unlock the said members from their locked engagement, substantially as set forth.

2. In a tube-testing machine, the combination with a head-stock provided with a flexible face attachment and having a central bore therethrough, a nipple in one end and an inlet-pipe secured in the other end of said bore, of a tail-stock, an adjustable plate having a flexible face attachment and centering devices, mounted on the spindle in said tail-stock so that it may adjust itself to any angle from the axis of said spindle, a series of tube-rests joined together and adapted to be opened and closed synchronously, the head and tail stock and the said tube-rests being mounted upon a common bed and having an unlimited adjustment thereon, substantially as set forth.

3. In a tube-testing machine, in combination with the rails 1 1 supported by the legs 2 2 at either end thereof, of a head-stock 3 having a centering device in the face thereof, a tail-stock 12, an adjustable plate 13, a series of tube-rests 29 joined and operated together and a trough 76 suspended from said rails, substantially as set forth.

4. In a tube-testing machine, the combination of a series of tube-rests, the lower portions of which are united by the tie-bar 33 and the upper portions united by the tie-bar 34, the said rests comprising a lower portion 30, an upper portion 31 hinged to said lower portion, half-boxes 36 36^a fitted into each of the said upper and lower portions, latch 38 rigidly secured to said lower portion, a rock-shaft 39 having bearings within said lower portion and extending throughout the series of tube-rests, cams 40 upon the said rock-shaft and handles 40^a by means of which the said rock-shaft is caused to operate, substantially as set forth.

5. In a tube-testing machine, the combination of an intensifier-accumulator, mechanism for supporting the tube at both ends thereof, means for conveying water into the said tube and the upper cylinder of the said accumulator, means for conveying water into the lower cylinder of said intensifier-accumulator, mechanism for shutting off the supply of water from said tube and said upper cylinder simultaneously with the opening of the supply to the lower cylinder, substantially as set forth.

6. In a tube-testing machine, the combination of an intensifier-accumulator, tube-supporting mechanism comprising a head-stock and a tail-stock, an adjustable plate upon the spindle of said tail-stock, pipe connections between the upper cylinder of the said accumulator and the said head-stock, a valve located between the sources of water-supply and the tube-supporting mechanism constructed and operating substantially as described, pipe connections from said valve to the upper and lower cylinders of said accumulator and a check-valve between the said valve and the upper cylinder, all constructed and operating substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

FERDINAND DEMING.

Witnesses:
W. F. PECK,
GEO. E. HALL.