

March 6, 1945.

N. BREWER

2,370,634

ROTAMETER

Filed Aug. 13, 1943

5 Sheets-Sheet 1

Fig. 1.

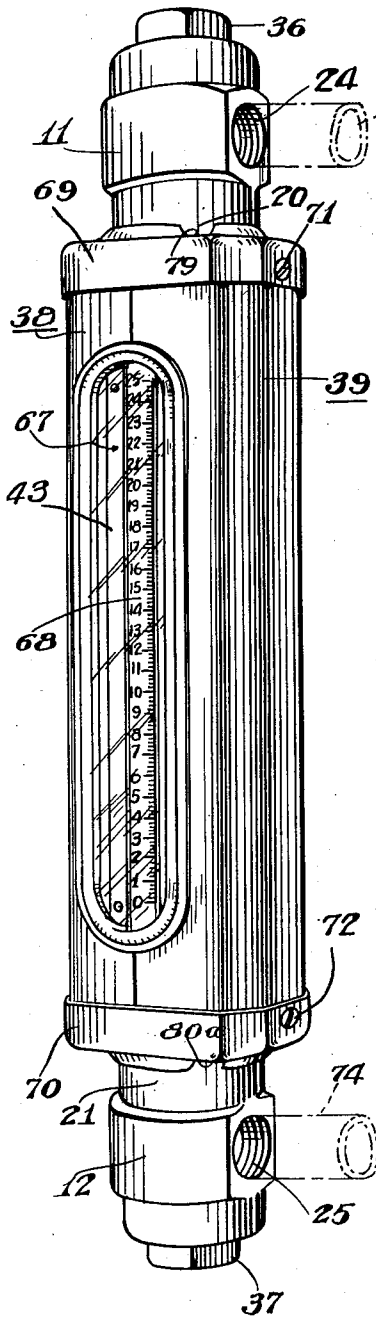


Fig. 2.

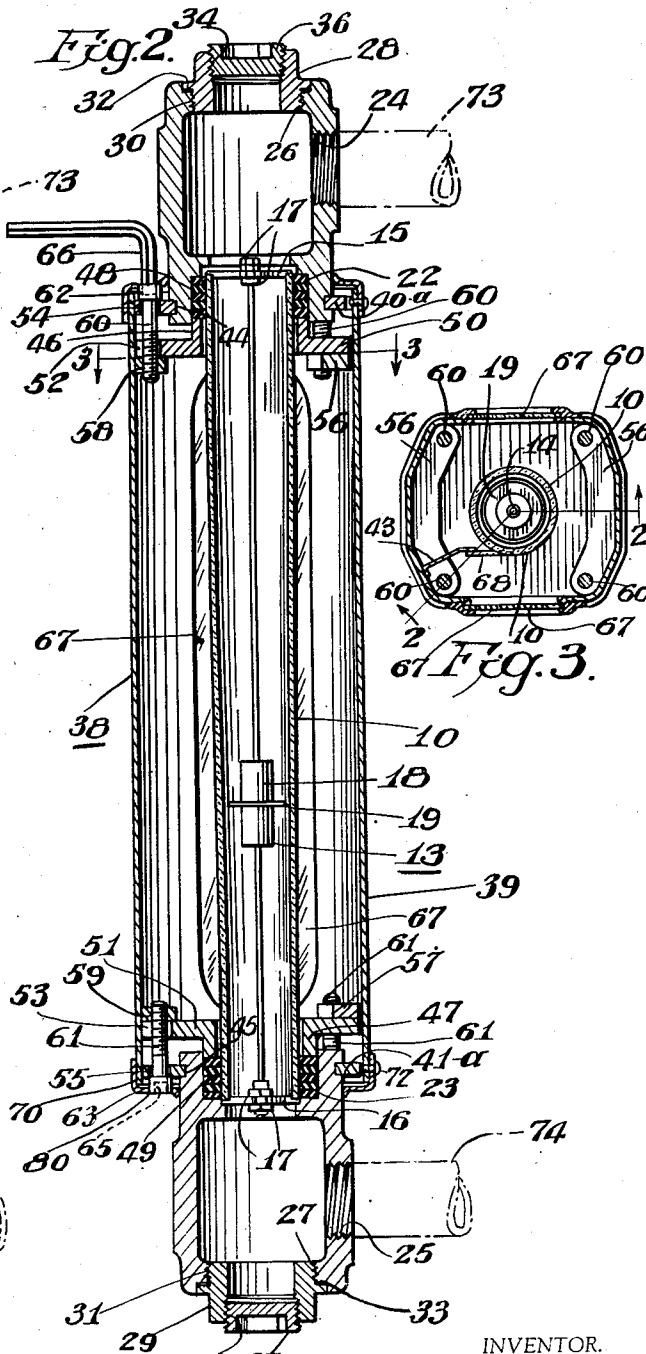
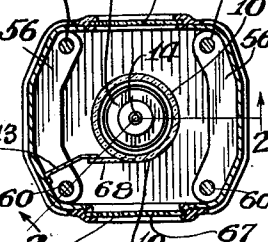


Fig. 3.



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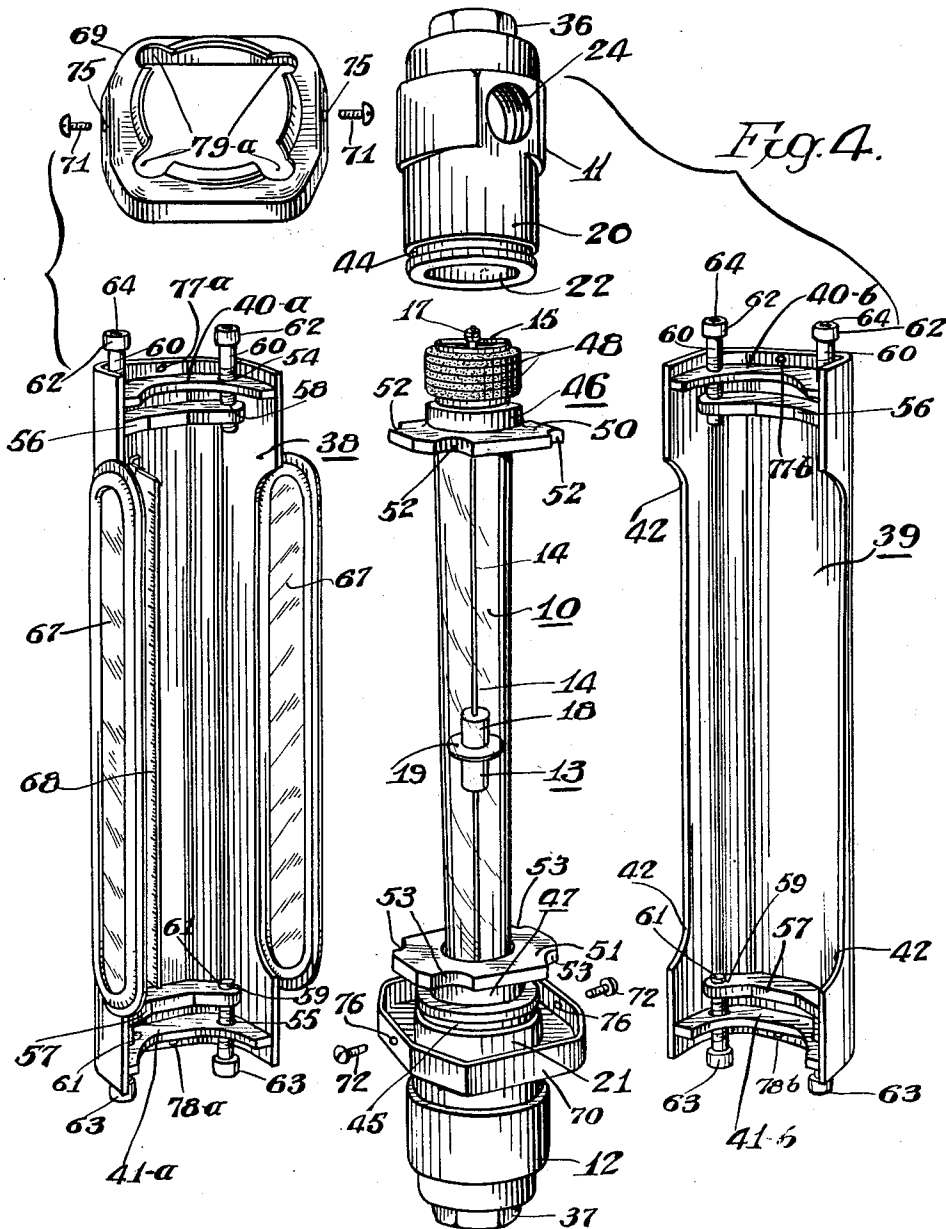
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5 Sheets-Sheet 2



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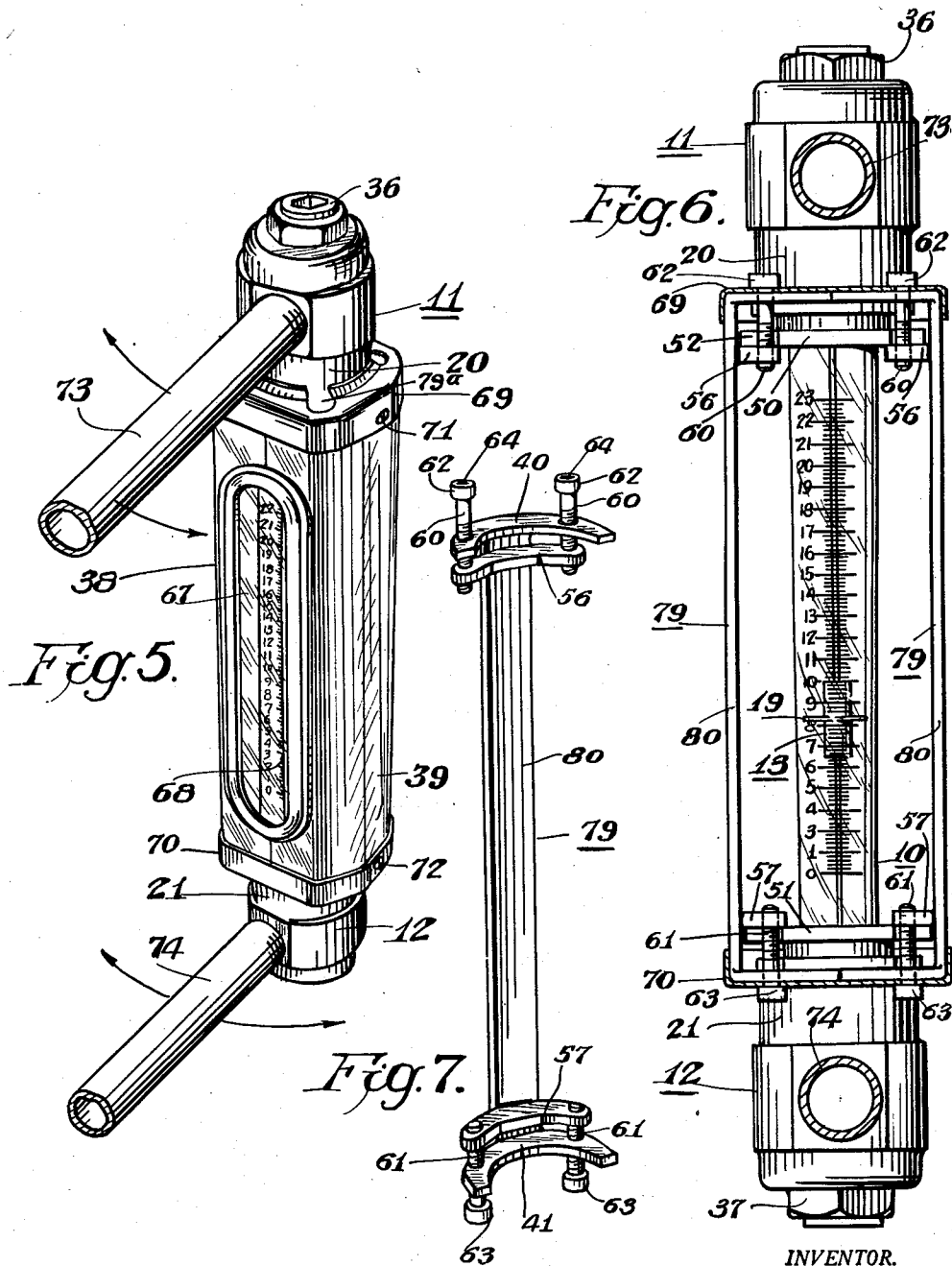
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5 Sheets-Sheet 3



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ROTAMETER

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5 Sheets-Sheet 4

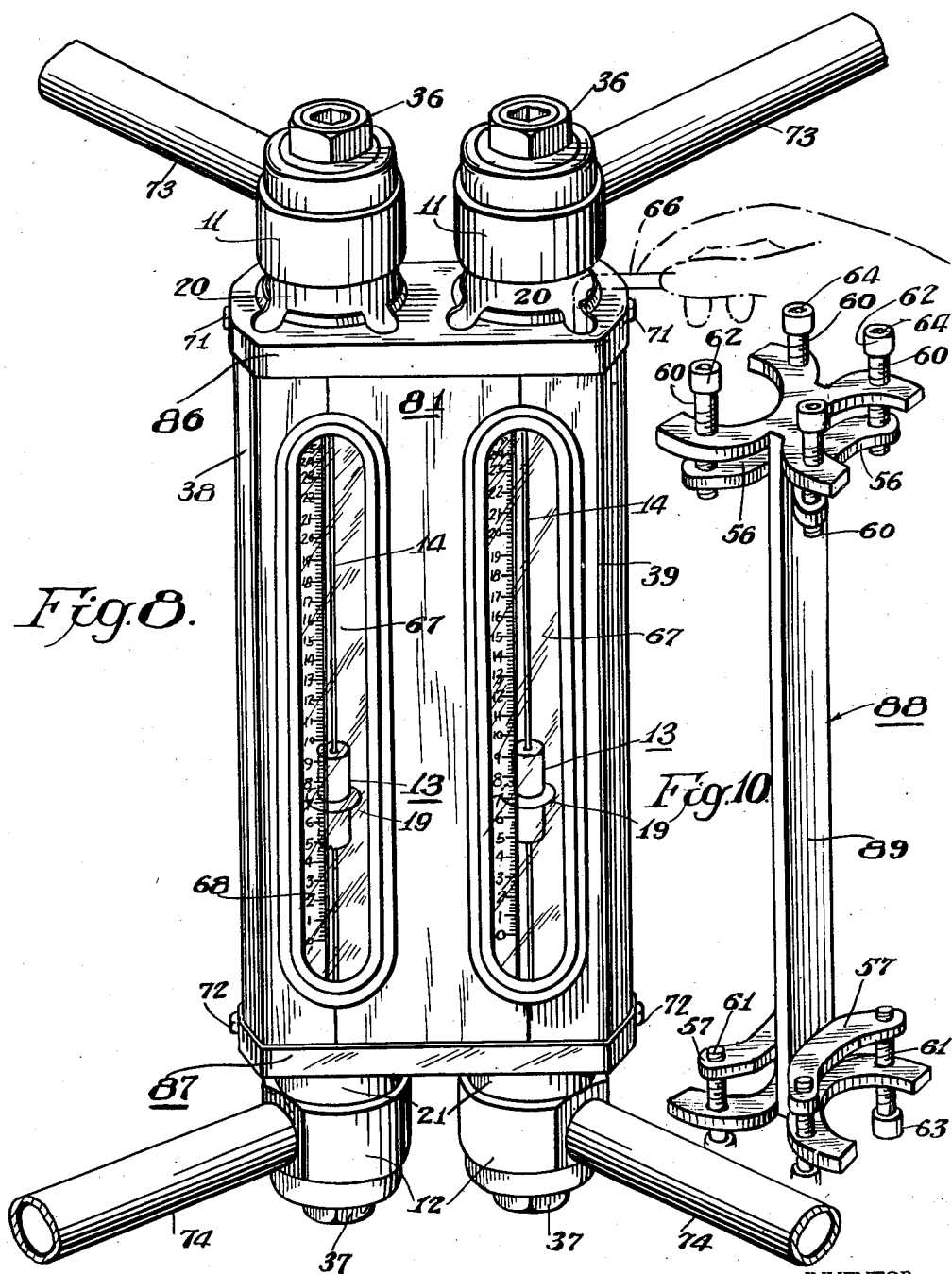


Fig. 8.

Fig. 10

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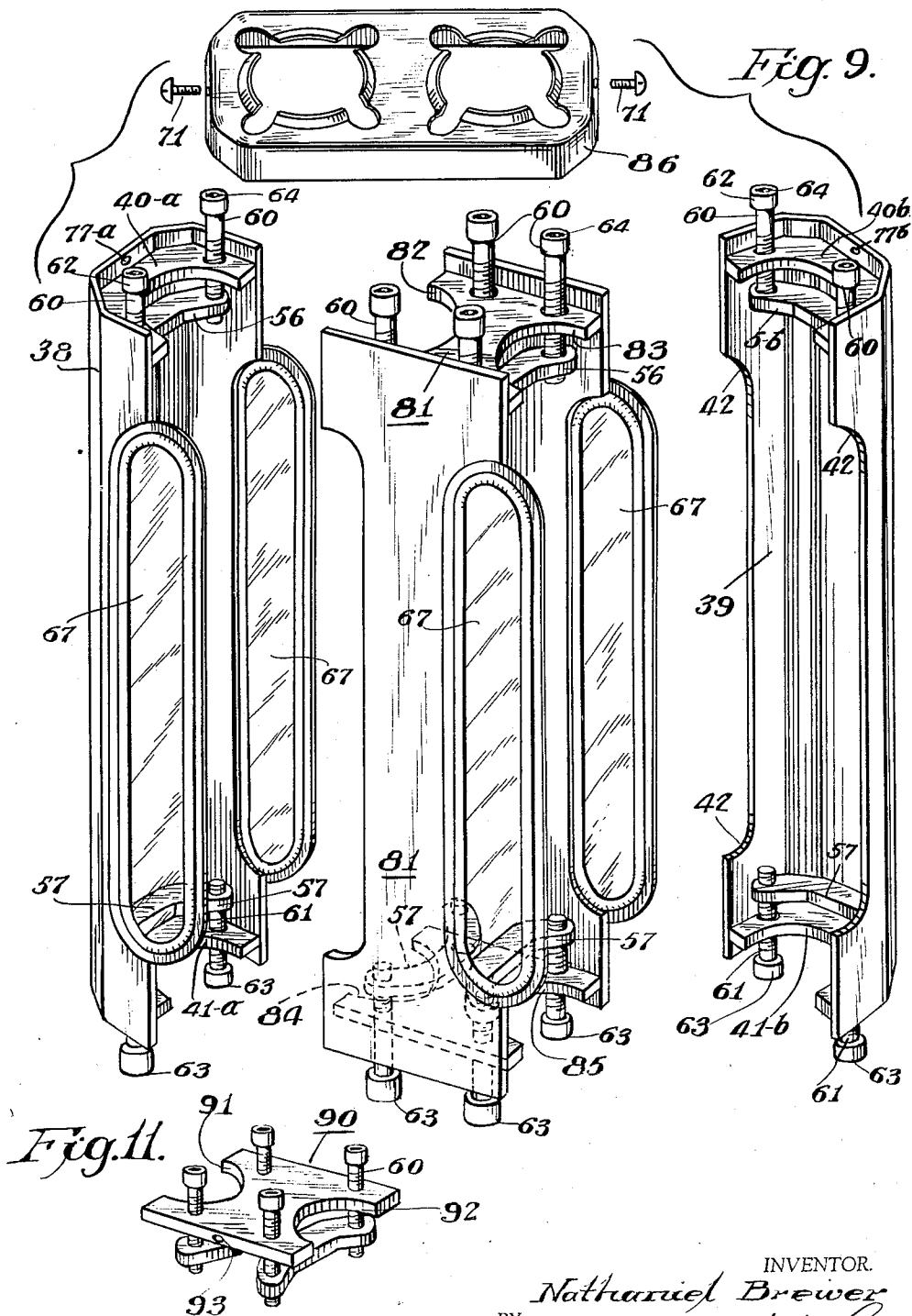
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2,370,634

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Filed Aug. 13, 1943

5 Sheets-Sheet 5



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2,370,634

ROTAMETER

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Application August 13, 1943, Serial No. 498,444

24 Claims. (Cl. 73—209)

The present invention relates to flow-meters for fluids, and it relates more particularly to certain new and useful improvements in flow-meters of the type commonly referred to as rotameters.

An object of the present invention is to provide a rotameter which is relatively inexpensive and which is adapted quickly and easily to be assembled and disassembled. Another object of the present invention is to provide a rotameter which is adapted for "universal" connection with a pipe-line or the like and which, more particularly, can be installed in any horizontal pipe-line without any special fittings or adaptors, regardless of the angular relationship between the inlet and outlet sides of the horizontal pipe-line. An additional object of the present invention is to provide a rotameter having adjustable fluid-sealing means being quickly and easily adjustable from the outside of the rotameter. A further object of this invention is to provide an enclosed rotameter, the outer removable casing of which serves to hold the "heads" in aligned vertically-spaced relationship with each of the "heads" horizontally rotatably adjustable.

Other objects and advantages of the present invention are apparent in the following detailed description, appended claims, and accompanying drawings.

For the purpose of illustrating the invention, there are shown in the accompanying drawings forms thereof which are at present preferred, since the same having been found in practice to give satisfactory and reliable results, although it is understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

In the accompanying drawings in which like reference characters indicate like parts throughout:

Figure 1 represents a perspective view of one embodiment of the present invention as it appears in use.

Figure 2 represents a vertical cross-sectional view generally along the line of 2—2 of Figure 3 of the embodiment of Figure 1.

Figure 3 represents a horizontal cross-sectional view generally along the line 3—3 of Figure 2.

Figure 4 represents a perspective view of the embodiment of Figure 1 as it appears when partially disassembled.

Figure 5 represents a perspective view of the embodiment of Figure 1 illustrating the manner

in which the top and bottom fittings can be adjusted to any horizontal angle.

Figure 6 represents a front elevational view of another embodiment of the present invention.

5 Figure 7 represents a perspective view of one of the structural members forming part of the embodiment of Figure 6.

Figure 8 represents a perspective view of a modified form of the embodiment of Figures 1 to 5 in which two rotameter metering tubes are enclosed side by side in a single unit.

Figure 9 represents a perspective view of the housing elements forming part of the embodiment of Figure 8.

15 Figure 10 represents a perspective view of an intermediate structural element adapted for use with elements of the character shown in Figure 7 for mounting two or more metering tubes side by side.

20 Figure 11 represents a perspective view of a spacer element which may be used in place of the intermediate structural element shown in Figure 10.

In one embodiment of the present invention 25 shown generally in Figures 1 to 5, a tapered transparent metering tube 10 of glass or other suitable material is adapted to be vertically mounted between upper and lower metallic "heads" or fittings 11 and 12 respectively. An apertured metering float 13 is slidably mounted upon a 30 guide-rod 14 which extends generally axially of the metering tube and which is supported by upper and lower spiders 15 and 16; spiders 15 and 16 being connected to the guide-rod 14 at their 35 centers by nuts 17 and being supported at their outer ends by the ends of the metering tube 10.

The float 13 is provided with a generally cylindrical vertically-extending body portion 18 and a thin transversely-extending disc-like flow-constricting head portion 19; the diameter of the head portion 19 being approximately the same as the smallest inside diameter of the metering tube 10.

The float 13 has a specific gravity somewhat 45 greater than that of the fluid being metered and, when there is no flow of fluid, rests at the bottom of the metering tube 10. Upon upward flow of fluid through the metering tube 10, the float 13 rises, the greater the rate-of-flow, the greater the rise of the float 13 within the tube 10. The position of the float 13 within the tube 10 indicates the rate-of-flow of the fluid in a manner well known in the art.

The metering tube and float shown in the 55 drawings are not the subject of the present in-

vention and are merely illustrative; other forms of metering tubes and metering floats being equally usable with the rotameter construction of the present invention.

The fittings 11 and 12 include vertically-extending apertured necks 20 and 21 respectively; stuffing boxes 22 and 23 being provided within the necks 20 and 21 and being adapted to receive and to hold the ends of the metering tube 10 in fluid-tight relationship as will be described hereinafter.

The heads 11 and 12 are provided with internally screw-threaded side openings 24 and 25 respectively which are adapted screw-threadedly to engage with the pipe-line in which the rotameter is to be connected; the opening 25 in the lower head 12 serving as the inlet opening of the rotameter and being adapted for connection to the inlet pipe-line 74 and the opening 24 in the upper head 11 serving as the outlet opening of the rotameter and being adapted for connection to the outlet pipe-line 73.

The heads 11 and 12 are also provided with internally screw-threadedly vertical openings 26 and 27 respectively; the vertical openings 26 and 27 being disposed in alignment with the apertured necks 20 and 21.

Apertured adaptors 28 and 29 are provided for the openings 26 and 27 respectively; the adaptors 28 and 29 being externally screw-threaded at their inner ends as at 30 and 31 respectively whereby they can be removably connected within the internally screw-threaded openings 26 and 27. Upper and lower gaskets 32 and 33 provide fluid-tight seals intermediate the adaptors 28 and 29 and the openings 26 and 27.

The adaptors 28 and 29 are internally screw-threaded at their outer ends as at 34 and 35 respectively and are adapted to receive either the closure plugs 36 and 37 or the pipe-line. That is, when the rotameter is to be connected into a horizontal pipe-line, the lines 73 and 74 are connected to the side openings 24 and 25 and the plugs 36 and 37 are inserted within the adaptors 28 and 29. When, on the other hand, the rotameter is to be inserted within a vertical pipe-line, the lines 73 and 74 are connected within the internally screw-threaded openings 34 and 35 of the adaptors 28 and 29 while the plugs 36 and 37 are used to close off the side openings 24 and 25 of the heads 11 and 12. It is apparent that either of the plugs 36 or 37 can be shifted to accommodate a piping arrangement in which the inlet pipe-line is horizontal and the outlet pipe-line is vertical and vice versa.

The rotameter is provided with a metallic outer casing or housing made up of a pair of laterally-disposed vertically-extending matching sections 38 and 39. The housing sections may be of pressed sheet-metal or may be cast or otherwise formed and may have an inner coating of white enamel to facilitate reading of the rotameter. The sheet-metal for said housing sections should preferably be thick enough to be rigid (so that the heads 11 and 12 will be maintained in rigid vertical alignment thereby) but thin enough to permit them to be formed by conventional sheet-metal bending, shearing, punching and other forming operations.

The section 38 is provided with inwardly-extending split-rings 40—a and 41—a adjacent the top and bottom ends thereof respectively. The section 39 is provided with similar inwardly-extending split-rings 40—b and 41—b adjacent the top and bottom ends thereof respectively. The

split-rings may be welded or otherwise attached to the housing sections or may be formed integrally therewith.

Annular grooves 44 and 45 are formed on the outside of the necks 20 and 21 respectively. The grooves 44 and 45 are adapted to receive the split-rings 40—a and 40—b and 41—a and 41—b when the sections 38 and 39 are fitted together.

Upper and lower stuffing glands 46 and 47 are provided for the stuffing boxes 22 and 23 respectively and are adapted to compress upper and lower packing rings 48 and 49 to provide fluid-tight seals between the ends of the metering tube 10 and the upper and lower heads 11 and 12.

The glands 46 and 47 are provided with annular flanges 50 and 51 respectively which extend laterally beyond the necks 20 and 21.

A plurality (as for example four) of circumferentially distributed notches 52 are provided at the outer edge of the flange 50 and similar notches 53 are provided in the flange 51.

A plurality (as for example two in each) of openings 54 are provided in the upper split-rings 40—a and 40—b and similar openings 55 are provided in the lower split-rings 41—a and 41—b. The openings 54 are in alignment with the notches 52 while the openings 55 are in alignment with the notches 53.

A pair of draw bars 56 are disposed underneath the flange 50 adjacent the outer edge thereof, and similar draw bars 57 are disposed on top of the flange 51.

Each of the draw bars 56 has a pair of internally screw-threaded openings 58 adjacent the ends thereof, while each of the draw bars 57 is provided with similar openings 59.

The openings 58 are somewhat smaller than, and in alignment with, the notches 52 and the openings 54 and the openings 59 are similarly related to the notches 53 and openings 55.

A plurality (as for example four) of bolts 60 are adapted to pass downwardly through the openings 54 in the split-rings 40—a and 40—b and are adapted screw-threadedly to engage with the openings 58 in the draw bar 56 as shown particularly in Figure 4. Similar bolts 61 extend upwardly through the openings 55 and engage with the openings 59 in the draw bars 57.

The bolts 60 are provided with enlarged heads 62 which rest against the top side of the split-rings 40—a and 40—b. The bolts 61 are provided with similar heads 63 which rest against the bottom side of the split-rings 41—a and 41—b.

The heads 62 are provided with polygonal sockets 64 while similar sockets 65 are provided on the heads 63. The sockets 64 and 65 are adapted to receive a polygonal-headed turning tool 66 for rotating the bolts 60 and 61.

One of the casing sections, as for example the section 38, may be provided with elongated removable front and back windows 67 of glass or synthetic plastic or other suitable transparent material to allow reading of the position of the metering float 13 within the tube 10. The other casing section 39 is notched as at 42 to receive the windows 67.

A capacity scale 68 may be supported from the inside of the casing in any suitable manner, as for example by being removably fastened to the support 43, and may be disposed adjacent the metering tube 10 so that the position of the metering float 13 can be read off against the capacity scale 68. The scale 68 may be calibrated directly in units of rate-of-flow, as for example

gallons per minute, or it may be calibrated merely as an arbitrary scale, from the reading of which the rate-of-flow can be determined by reference to a suitable calibration table or chart. The scales may be made interchangeable to indicate different flow-rates with different metering tubes and/or floats.

Instead of employing a separate capacity scale as shown in Figures 1, 4 and 5 of the drawings, it is possible to apply the calibrations directly to the metering tube 10 by etching or otherwise, as is well known in the art.

The method of assembling the rotameter of the present invention will now be described.

The float 13, the guide-rod 14, and the spiders 15 and 16 are first assembled within the metering tube 10 by tightening of the nuts 17, so that the metering tube and float form a more or less integral unit which can be inserted and removed as such from the rest of the rotameter.

The packing rings 48 and 49 have the same outside diameter so that they can fit into the stuffing boxes 22 or 23; the upper and lower heads 11 and 12 being identical and changeable.

The upper packing rings 48 are first slipped over the metering tube 10 from the bottom and moved to position adjacent the upper end of the tube; the inside diameter of the rings 48 being substantially the same as the outside diameter of the upper end of the tube 10.

The upper stuffing gland 46 is then slipped over the tube 10 and the lower stuffing gland 47 is next put on. The lower packing rings 49 are next placed in position at the lower end of the tube 10; the rings 49 having an inside diameter substantially the same as the outside diameter of the ring 10.

The collars 69 and 70 are placed over the necks 20 and 21 respectively and the heads 11 and 12 are then placed upon the ends of the metering tube 10 so that the stuffing boxes 22 and 23 enclose the packing rings 48 and 49 respectively. It should be noted that the rings 48 and 49 have the same outside diameter so that they will fit into either of heads 11 and 12 which are identical and interchangeable.

The bolts 60 are then inserted through the openings 54 and are engaged within the opening 58 of the draw bars 56 and are given a few turns by the tool 66 loosely to connect the draw bars to the split-rings 40—a and 40—b. The lower bolts 61 are then similarly inserted through the openings 55 and are connected within the opening 59 in the draw-bars 57 loosely to connect the draw bars to the split-rings 41—a and 41—b.

The casing sections 38 and 39 are then placed about the metering tube so that the split-rings 40 and 41 fit within the grooves 44 and 45 respectively of the heads 11 and 12 and so that the flanges 50 and 51 of the stuffing glands 46 and 47 are respectively intermediate the upper and lower split-rings and draw bars; the bolts 60 and 61 fitting within the notches 52 and 53 respectively.

The ends of the split-rings 40—a and 40—b and of the split-rings 41—a and 41—b abut each other to encircle the grooved heads 11 and 12 and to maintain the necks 20 and 21 in spaced vertical alignment.

The upper and lower collars 69 and 70 are then moved inwardly and are fitted over the ends of the matching sections 38 and 39 to hold the sections together. Upper and lower screws 71 and 72 pass through openings 75 and 76 in the col-

lars 69 and 70 and engage in corresponding upper and lower internal screw-threaded openings 77—a and 77—b and 78—a and 78—b in the casing sections to lock the collars upon the matching sections.

The collars 69 and 70 are provided with notches 79—a and 80—a through which the heads 62 and 63 of the bolts 60 and 61 can be reached by the turning tool 66.

When the bolts 60 and 61 are untightened, it can be seen that the upper and lower heads are freely rotatable within the split-rings 40 and 41 of the casing sections.

The upper and lower heads 11 and 12 are then rotated to the exact angle required to receive the outlet and inlet pipe-lines 73 and 74. The pipe-lines 73 and 74 are then connected within the openings 24 and 25 of the heads 11 and 12.

After the pipe-lines have been connected within the openings 24 and 25, the bolts 60 and 61 are tightened to pull the draw bars 56 and 57 and to tighten the stuffing glands 46 and 47. The upper and lower collars 69 and 70 are then moved inwardly and connected to the casing by the bolts 71 and 72, as described above.

It can be seen that the heads 62 and 63 of the bolts 60 and 61 are easily accessible for tightening of the screws 60 and 61.

Thus, the systematic tightening of the stuffing glands which is required from time to time in order to maintain a fluid-tight seal between the ends of the metering tube 10 and the heads 11 and 12 can be effected quickly and easily by means of the turning tool 66 without any danger of breakage of the frangible metering tube which is enclosed and protected by the casing.

Where the rotameter is to be connected with a vertical pipe-line, the procedure is generally the same as described hereinabove in connection with the installation in a horizontal pipe-line, except that the closure plugs 36 and 37 are transferred to the side openings 24 and 25 and the pipe-line is connected at 34 and 35. In this case, while, of course, rotation of the heads 11 and 12 is not necessary to match with the pipe-line, such rotation may be desirable in order to effect the final screw-threaded attachment of the pipe-line at 34 and 35, particularly where, for any reason, it is impractical or undesirable to rotate the pipe-line to effect the connection.

After the pipe-line has been connected at 34 and 35, bolts 60 and 61 are tightened as described hereinabove.

In disassembling the rotameter from the pipe-line, the steps described hereinabove are carried out in inverse order.

It is possible to open the casing by removing only one of the casing sections whereupon the heads and the metering tube are still supported in alignment by the other section.

Another embodiment of the present invention is shown in Figures 6 and 7. The embodiment of Figures 6 and 7 is generally the same as the embodiment of Figures 1 to 5 except that, in place of the casing sections 38 and 39, a pair of identical structural elements 79 are employed to hold the heads 11 and 12 in spaced vertically aligned relationship.

The elements 79 are provided with split rings 40 and 41, bolts 60 and 61, and draw bars 56 and 57, all identical with those heretofore described. However, the elements 79, instead of enclosing the metering tube 10, merely have side columns 80 which serve rigidly to support the heads 11 and 12.

This modification is desirable where no external protection is required for the metering tube. The metering tube shown in Figure 6 has the capacity graduations applied directly to the glass in place of the separate scale 68 of Figures 1, 4 and 5.

Another modification of the present invention is shown in Figures 8 and 9 and is adapted for mounting two or more rotameter tubes side by side in an enclosed casing.

The embodiment is generally similar to that of Figures 1 to 5, having the same type metering tubes and having the same casing sections 38 and 39.

However, an intermediate section 81 is also employed to accommodate an extra metering tube.

The section 81 is provided with a pair of oppositely-extending split-rings 82 and 83 at the tip thereof and similar split-rings 84 and 85 at the bottom. Bolts 60 and 61 and draw bars 56 and 57, similar to those previously described are provided for each of the split-rings 82, 83, 84 and 85.

The section 81 is provided with windows 67 at one side thereof (to fit into the notches 42 of the end section 39) and notches 42 at the other side thereof (to receive the windows 67 of the other end section 38).

The split-rings 82 and 84 match with the rings 40—a and 41—a of the section 38, while the rings 84 and 85 match with rings 40—b and 41—b of the section 39 to support and enclose the two metering tubes.

Two-hole collars 86 and 87 are adapted to fit over the entire assembly and to be connected to the end sections 38 and 39 by the screws 71 and 72 as heretofore described, to tie the assembly together.

It can be seen, particularly in Figure 8, that the present construction can be adapted for connection to horizontal inlet and outlet pipe-lines regardless of their angular relationship.

It is apparent that three or more metering tubes can be installed side by side in the manner shown in Figure 8 by simply adding an additional intermediate section 81 for each additional tube and by employing top and bottom collars having the required number of head openings.

It is also apparent that the structural elements 79 of Figures 6 and 7 can also be adapted to hold two or more tubes by using an intermediate section 88 shown in Figure 10 for each extra tube.

The section 88 is generally like the section 81 of Figure 9 except that it has a vertical structural column 89 intermediate the top and bottom split-rings.

In place of the section 88 shown in Figure 10, it is possible to employ simply top and bottom spacer elements 90 which have oppositely-extending split-rings 91 and 92 similar to those of Figure 10 but which do not have any vertical column intermediate the heads.

The spacer elements 90 may be provided with front and back screw-threaded openings 93 whereby they may be bolted to the top and bottom collars to derive support therefrom, elements similar to 86 being employed.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

Having thus described the invention, what I claim as new and desire to protect by Letters Patent, is:

1. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, an outer casing separably positioned about said tube, and means rotatably connecting each of said fittings to said casing whereby said fittings are supported in rigid vertically-spaced alignment and whereby each of said fittings is independently rotatably adjustable to permit universal positioning of its connection opening throughout a horizontal plane and around the axis of said metering tube.

2. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, an outer casing separably positioned about said tube, means rotatably connecting each of said fittings to said casing whereby said fittings are supported in rigid vertically-spaced alignment and whereby each of said fittings is independently rotatably adjustable to permit universal positioning of its connection opening throughout a horizontal plane and around the axis of said metering tube, and means for adjusting each of said sealing means, said adjusting means being operable from the outside of said casing.

3. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, a laterally removable frame rigidly supporting said fittings in vertically-spaced alignment, and means permitting independent rotational adjustment of each of said fittings relative to said frame and to said metering tube, whereby the connection opening of each of said fittings can be universally positioned throughout a horizontal plane and around the axis of said metering tube.

4. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means including a stuffing-gland providing a fluid-tight seal intermediate each of said fittings and said tube, a frame rigidly supporting said fittings in vertically-spaced alignment, means permitting independent rotational adjustment of each of said fittings relative to said frame and to said metering tube, whereby the connection opening of each of said fittings can be universally positioned throughout a horizontal plane and around the axis of said metering tube, and means for adjusting each of said sealing means, said adjusting means being operable from the outside of said frame and including a bolt rotatably mounted in said frame with its head on the outside thereof and a yoke screw-threadedly mounted

upon said bolt, said yoke bearing against said stuffing-gland and being adapted to tighten said stuffing-gland when said bolt is turned.

5. A rotameter comprising an elongated vertically-extending tapered transparent metering tube having an axially movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, an outer casing separably positioned about said metering tube, said casing having an elongated window therein to permit observation of the position of said float within said tube, and means rotatably connecting each of said fittings to said casing whereby said fittings are rigidly supported in vertically-spaced alignment and whereby each of said fittings is independently rotatably adjustable to permit universal positioning of its connection opening throughout a horizontal plane and around the axis of said metering tube.

6. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, an outer casing made up of a pair of vertically-extending laterally-disposed matching sections of metal or the like removably positioned about said tube, and means rotatably connecting each of said fittings to said casing whereby said fittings are supported in rigid vertically-spaced alignment and whereby each of said fittings is independently rotatably adjustable to permit universal positioning of its connection opening throughout a horizontal plane and around the axis of said metering tube.

7. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, a vertically split outer casing removably positioned about said tube, and means rotatably connecting each of said fittings to said casing whereby said fittings are supported in rigid vertically-spaced alignment and whereby each of said fittings is independently rotatably adjustable to permit universal positioning of its connection opening throughout a horizontal plane and around the axis of said metering tube.

8. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, a frame rigidly supporting said fittings in vertically-spaced alignment, said frame comprising a pair of elongated vertically-extending laterally-disposed members of metal or the like, and means permitting independent rotational adjustment of each of said fittings relative to said frame and to said metering tube, whereby the connection opening of each of said fittings can be universally positioned

throughout a horizontal plane and around the axis of said metering tube.

9. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, a vertically-split removable frame rigidly supporting said fittings in vertically-spaced alignment, and means permitting independent rotational adjustment of each of said fittings relative to said frame and to said metering tube, whereby the connection opening of each of said fittings can be universally positioned throughout a horizontal plane and around the axis of said metering tube.

10. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, a casing made up of a pair of vertically-extending laterally-disposed matching sections of metal or the like, removably positioned about said tube, means holding said laterally-disposed sections together comprising a pair of collars fitting over the matching ends of said sections and detachably secured to each of said sections, and means rotatably connecting each of said fittings to said casing whereby said fittings are supported in rigid vertically-spaced alignment and whereby each of said fittings is independently rotatably adjustable to permit universal positioning of its connection opening throughout a horizontal plane and around the axis of said metering tube.

11. A rotameter comprising a vertical metering tube having a movable metering float therein, separate upper and lower fittings disposed at the ends of said tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and said tube, a frame rigidly supporting said fittings in vertically-spaced alignment, said frame comprising a pair of separate elongated vertically-extending laterally-disposed members of metal or the like detachably connected to each other at their ends, and means permitting independent rotational adjustment of each of said fittings relative to said frame and to said metering tube, whereby the connection opening of each of said fittings can be universally positioned throughout a horizontal plane and around the axis of said metering tube.

12. A multiple rotameter unit for measuring the rates-of-flow in a plurality of pipe-lines or the like comprising a plurality of vertical laterally adjacent metering tubes having metering floats therein, separate upper and lower fittings disposed at the ends of each tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and its tube, an outer casing removably positioned about said tubes, and means rotatably connecting each of said fittings to said casing whereby each pair of fittings is rigidly supported in spaced vertical alignment and whereby each of said fittings is independently rotatably adjustable to permit

universal positioning of its connection opening throughout a horizontal plane and around the axis of its tube.

13. A multiple rotameter unit for measuring the rates-of-flow in a plurality of pipe-lines or the like comprising a plurality of vertical laterally adjacent metering tubes having metering floats therein, separate upper and lower fittings disposed at the ends of each tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and its tube, a frame rigidly supporting said pairs of fittings in vertically-spaced alignment, and means permitting independent rotational adjustment of each of said fittings relative to said frame and to its metering tube, whereby the connection opening of each of said fittings can be universally positioned throughout a horizontal plane and around the axis of its metering tube.

14. A multiple rotameter unit for measuring the rates-of-flow in a plurality of pipe-lines or the like comprising a plurality of vertical laterally adjacent metering tubes having metering floats therein, separate upper and lower fittings disposed at the ends of each tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and its tube, an outer casing removably positioned about said tubes, said casing including vertically-split end sections of metal or the like and a matching section intermediate each pair of tubes and connecting means detachably securing said sections, and means rotatably connecting each of said fittings to said casing whereby each pair of fittings is rigidly supported in spaced vertical alignment and whereby each of said fittings is independently rotatably adjustable to permit universal positioning of its connection opening throughout a horizontal plane and around the axis of its tube.

15. A multiple rotameter unit for measuring the rates-of-flow in a plurality of pipe-lines or the like comprising a plurality of vertical laterally adjacent metering tubes having metering floats therein, separate upper and lower fittings disposed at the ends of each tube, each of said fittings having an opening for connection to a pipe-line, the axes of said openings being horizontal, means providing a fluid-tight seal intermediate each of said fittings and its tube, a frame rigidly supporting said pairs of fittings in vertically-spaced alignment, said frame including separate vertically-extending end structural elements of metal or the like and a separate matching spacer element intermediate each pair of tubes and connecting means detachably securing said structural elements and said spacer element, and means permitting independent rotational adjustment of each of said fittings relative to said frame and to its metering tube, whereby the connection opening of each of said fittings can be universally positioned throughout a horizontal plane and around the axis of its metering tube.

16. In a rotameter having a vertical metering tube, a metering float adapted for up-and-down movement within said tube, and separate upper and lower fittings disposed in fluid-tight sealing relationship at the ends of said tube; an outer casing made up of a pair of vertically-extending sections of sheet-metal removably posi-

tioned about said tube, and means connecting each of said fittings to said casing whereby said fittings are supported in rigid vertically-spaced alignment, said connecting means including a groove formed in each of said fittings, tongues formed at the ends of said casing and adapted to fit within said grooves, and collars positioned about the ends of the casing sections and detachably secured thereto.

17. In a rotameter having a vertical metering tube, a metering float adapted for up-and-down movement within said tube, and separate upper and lower fittings disposed in fluid-tight sealing relationship at the ends of said tube; a frame made up of a pair of vertically-extending laterally-disposed supporting members, and means connecting each of said fittings to said frame, said connecting means including a groove formed in each of said fittings, tongues formed at the ends of said frame and adapted to fit within said grooves, and collars adapted to pass over said fittings and to enclose the ends of said supporting members.

18. In a rotameter having a vertical metering tube, a metering float adapted for up-and-down movement within said tube, and separate upper and lower fittings disposed in fluid-tight sealing relationship at the ends of said tube; a frame made up of a pair of vertically-extending laterally-disposed supporting members, and means connecting each of said fittings to said frame whereby said fittings are supported in rigid vertically-spaced alignment, said connecting means including tongue-and-groove connections between the ends of said supporting members and each of said fittings, and a collar adapted to pass over each of said fittings and to enclose the ends of said supporting members.

19. In a rotameter having a vertical metering tube, a movable metering float disposed within said tube, upper and lower fittings disposed at the ends of said tube and adapted for connection to a pipe-line, and each having a stuffing-box, a packing ring and a stuffing-gland for providing a fluid-tight seal intermediate each of said fittings and said tube; a frame connecting said fittings and supporting them in rigid vertically-spaced alignment, and means for adjusting said stuffing-glands, said adjusting means including bolts rotatably mounted at the ends of said frame with their heads accessible from the outside thereof, and yokes screw-threadedly mounted upon said bolts and bearing against said stuffing-glands whereby rotation of said bolts will cause tightening of said stuffing-glands.

20. In a rotameter having a vertical metering tube, a movable metering float disposed within said tube, upper and lower fittings disposed at the ends of said tube and adapted for connection to a pipe-line, and each having a stuffing-box, a packing ring and a stuffing-gland for providing a fluid-tight seal intermediate each of said fittings and said tube; a frame connecting said fittings and supporting them in rigid vertically-spaced alignment, and means for adjusting said stuffing-glands, said adjusting means including transversely-extending notched flanges formed at the outer ends of said stuffing-glands, bolts rotatably mounted at the ends of said frame with their heads accessible from the outside thereof, and yokes screw-threadedly mounted upon said bolts and bearing against said stuffing-glands whereby rotation of said bolts will cause tightening of said stuffing-glands, said bolts passing through the notches of the stuffing-gland flanges.

21. In a rotameter having a vertical metering tube, a metering float adapted for up-and-down movement within said tube, and separate upper and lower fittings disposed at the ends of said tube, each of said fittings having a stuffing-box and a stuffing-gland for providing a fluid-tight seal with said tube; a frame including a pair of vertically-extending laterally-disposed supporting members, an annular groove formed on each of said fittings, split-rings formed at the ends of said supporting members and adapted to engage within said grooves, collars adapted to pass over said fittings and to enclose the ends of said supporting members thereby to lock said supporting members in position to support said fittings in rigid vertically-spaced alignment, and means for adjusting the fluid-tight seal intermediate each of said fittings and said tube, said adjusting means including bolts rotatably mounted in said split-rings with their heads exposed for operation on the outer sides thereof, and yokes screw-threadedly mounted upon said bolts and engaging said stuffing-glands whereby rotation of said bolts will cause tightening of said stuffing-glands.

22. In a rotameter having a vertical metering tube, a metering float adapted for up-and-down movement within said tube, and separate upper and lower fittings disposed at the ends of said tube, each of said fittings having a stuffing-box and a stuffing-gland for providing a fluid-tight seal with said tube; a frame including a pair of vertically-extending laterally-disposed supporting members, an annular groove formed in each of said fittings, split-rings formed at the ends of said supporting members and adapted to engage within said annular grooves, collars adapted to pass over each of said fittings and to enclose the ends of said supporting members thereby to lock said supporting members in position to support said fittings in rigid vertically-spaced alignment, and means for adjusting the fluid-tight seal intermediate said fittings and said tube, said adjusting means including bolts rotatably mounted

in said split-rings with their heads exposed for operation on the outer sides thereof, and yokes screw-threadedly mounted upon said bolts and engaging said stuffing-glands whereby rotation of said bolts will cause tightening of said stuffing-glands, said collars having openings therein to permit insertion of a bolt-tightening tool.

23. In a multiple rotameter unit adapted to measure the rates-of-flow in a plurality of pipelines and having a plurality of vertical laterally-adjacent metering tubes, metering floats movably disposed within said tubes, separate upper and lower fittings disposed in fluid-tight sealing relationship at the ends of said tubes, each of said fittings having an opening for connection to a pipe-line; an outer casing removably positioned about said tubes, said casing including vertically-split end sections of metal or the like, a matching section intermediate each pair of tubes, and means detachably connecting each of said fittings to the ends of said sections thereby to hold said fittings in rigid vertically-spaced alignment, said connecting means including tongue-and-groove connections intermediate said fittings and said sections.

24. In a multiple rotameter unit adapted to measure the rates-of-flow in a plurality of pipelines and having a plurality of vertical laterally-adjacent metering tubes, metering floats movably disposed within said tubes, separate upper and lower fittings disposed in fluid-tight sealing relationship at the ends of said tubes, each of said fittings having an opening for connection to a pipe-line; a frame rigidly supporting said fittings in vertically-spaced alignment, said frame including separate vertically-extending structural end elements, a separate matching spacer element intermediate each pair of tubes, and means detachably connecting said fittings to the ends of said structural and spacer elements, said connecting means including tongue-and-groove connections intermediate said fittings and said elements.

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