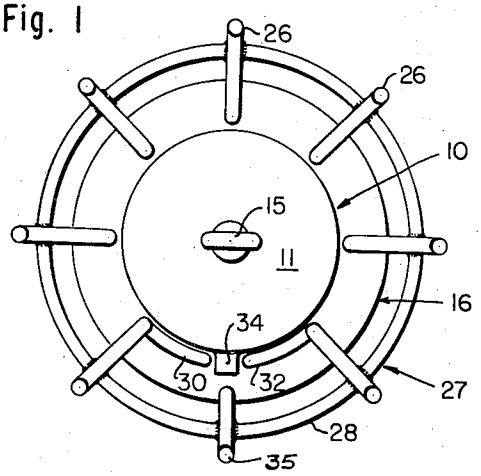
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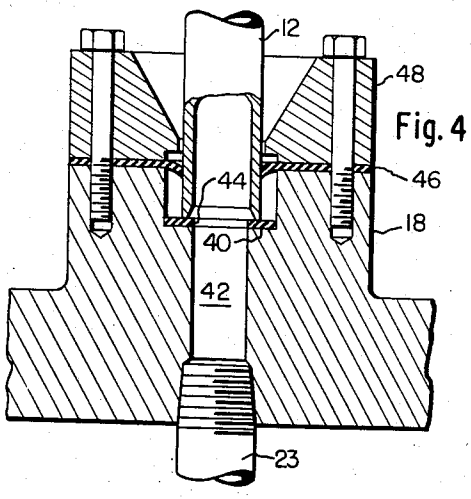
FLUID-HANDLING APPARATUS

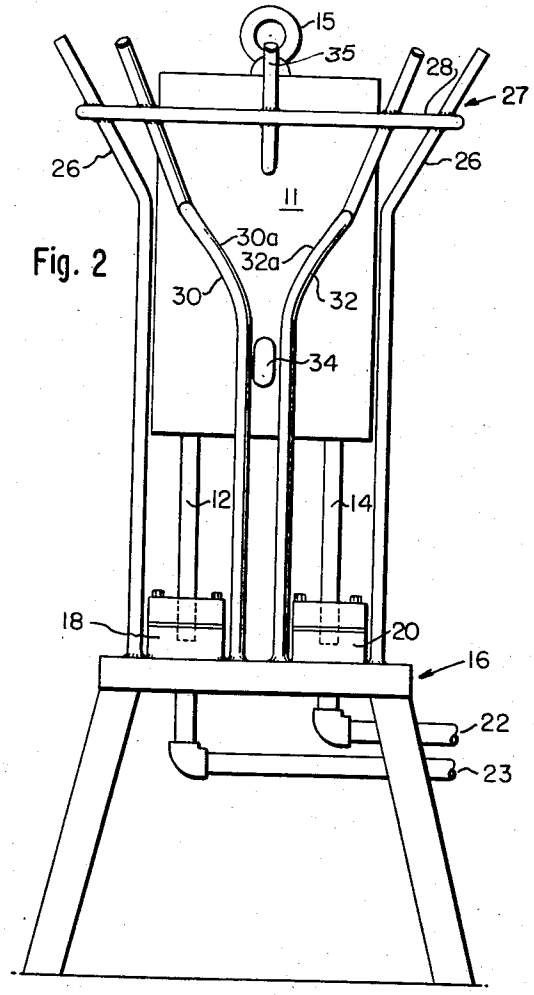
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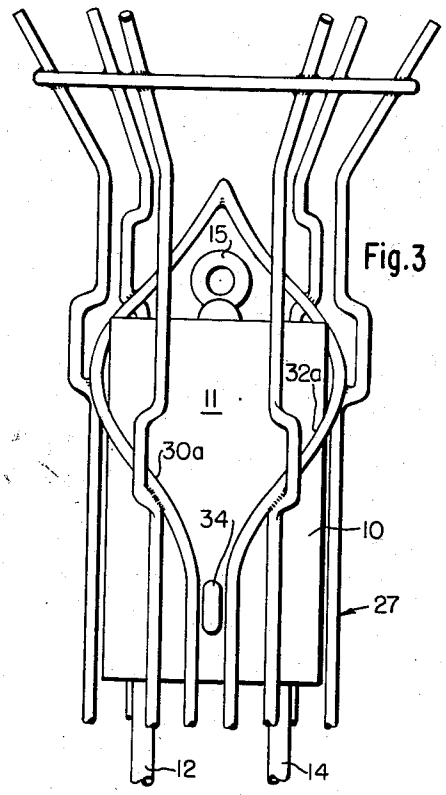
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Fig. 1









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Fig. 5

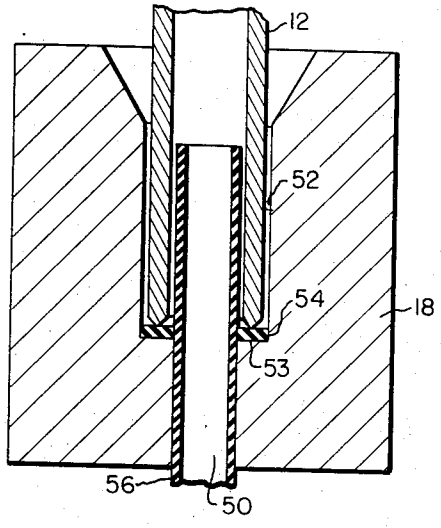


Fig. 6

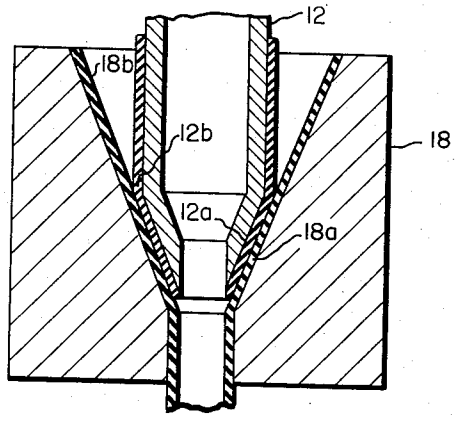
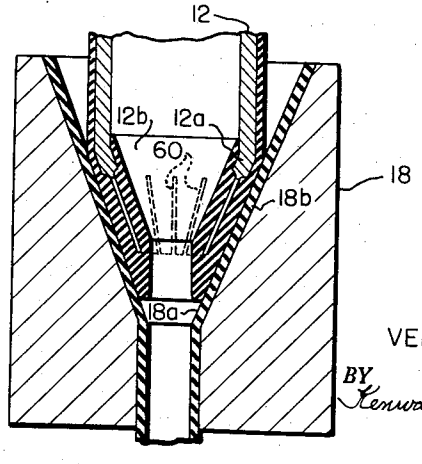


Fig. 7



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FLUID-HANDLING APPARATUS

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5 Claims. (Cl. 137—315)

This invention relates to apparatus for handling fluids, particularly apparatus of the type which includes a unit that is periodically removed and replaced. The object of the invention is to provide apparatus in which the unit may be removed and replaced quickly and by remotely controllable means such as by means of a traveling crane, without requiring the nearby presence of human beings.

Although numerous applications may obviously be made of apparatus of this type, a particularly useful apparatus in which this invention may be embodied is an ion exchange demineralizer for treating solutions containing radioactive matter. Such units are commonly used in nuclear energy installations to treat process waters prior to their ultimate disposal. The ion exchangers used to remove the radioactive matter become highly radioactive and present the problem of being removed and replaced without exposing the plant personnel to dangerous levels of radiation.

The present invention provides apparatus of utmost simplicity which may be placed in a fluid-treating system by lowering it into place. The connections to and from it, including the aligning, connecting and fastening of the mating conduit portions are made simultaneously with the placing of the unit into position and without any additional operations or manipulations.

In general the invention comprises a base member which includes inlet and outlet connection receptacles for incorporating the apparatus into a fluid-handling system, and a fluid-treating unit which is seated on the base member. The fluid-treating unit may embody any of numerous well-known types of processing equipment such as the ion exchanger described above, or a filter, heat exchanger, adsorber or other apparatus which is commonly removed and replaced from time to time. Such equipment will include inlet and outlet channels, and in the unit of this invention these are formed to mate with the inlet and outlet connection receptacles of the base member in a manner such that connection between the channels and receptacles are respectively made by vertical rectilinear motion, and are held together by the force of the weight of the unit resting on the base member.

The unit accordingly includes a housing having inlet and outlet channels and means for engaging the housing to lift or lower it, such as a ring, hook or other similar device.

Proper positioning of the unit with respect to the base member, including the prealigning of the inlet and outlet channels of the unit with the inlet and outlet connection receptacles of the base member is also assured. For this purpose the base is arranged with guide means over it for centering the unit over the base member while it is lowered into place. The centered unit is further positioned to bring the inlet and outlet channels into proper alignment by a circularly inclined race or track which engages a guide key on the unit to cause its rotation as required for this alignment. The unit itself is accordingly centered over the base with its inlet and outlet

channels in proper alignment, while the unit is being lowered. When the unit is finally seated on the base member the fluid couplings to it are established as the unit is placed in serviceable condition.

A preferred embodiment of the invention is shown in the accompanying drawings in which

Fig. 1 is a top plan view of one embodiment of this invention;

Fig. 2 is a side elevation of the embodiment shown in Fig. 1;

Fig. 3 is a side elevation showing the top portion of a second embodiment of the invention; and

Figs. 4, 5, 6 and 7 are longitudinal cross sections through the connection receptacles and channels showing typical types of connections that may be used.

As shown in Figs. 1 and 2, the fluid-treating unit **10** comprises a generally cylindrical housing **11** having downwardly projecting inlet and outlet conduits **12** and **14** through which a fluid may be introduced and removed from the unit. The unit **10** is supported in use on a base member **16** having a pair of fluid connection receptacles **18** and **20** which connect with appropriate conduits **22** and **23** for supplying the fluid to the apparatus. The inlet and outlet conduits **12** and **14** are received in the connection receptacles **18** and **20**, connection and disconnection being made by the simple vertical rectilinear motion attendant upon the unit being lowered or lifted from the base **16**. The unit **10** rests on the base member **16** by its own weight and may be lifted and replaced for which purpose an eye **15** is provided at the top.

Guide means over the base **16** is formed from several upwardly extending rods **26** which surround the unit **10** and flare outwardly at their upper ends to define a receiving cage **27** having an upper section of generally conical form centered over the base **16** and having a lower section of generally cylindrical form. The lowermost part of the conical upper section is at a level to center the unit **10** when it is well above the base. The upper ends of the rods **26** are conveniently joined by a ring **28** which lends rigidity to the structure.

The receiving cage **27** also includes guide members **30** and **32** having circularly inclined race or track portions **30***a* and **32***a* which converge at their lower ends in closely spaced vertical sections. These race portions engage a guide key **34** projecting outwardly from the unit **10** and bring it to a predetermined location corresponding to the unit being in proper alignment with the base member **16**. The inclined track portions **30***a* and **32***a* accordingly span a vertical distance such that the guide key **34** is engaged only after the unit is centered by the upper conical portion of the receiving cage and is brought to aligned position between the lower vertical sections before the inlet and outlet conduits **12** and **14** engage the connection receptacles **18** and **20**. The unit **10** is thus brought into complete alignment prior to being seated on the base **16** and connected with the conduits **22** and **23**.

Since the upper ends of the rods **30** and **32** are widely spread, an auxiliary guide rod **35** located generally in and as part of the upper conical section of the cage **27** is carried by the ring **28** to leave no space between the rods through which the unit might pass without interception by the upper portion of the cage **27**.

In the embodiment shown in Figs. 1 and 2 the upper ends of the inclined tracks terminate at an angular separation of about 90° measured about the axis of the unit **10** and it is contemplated that in use means capable of holding the unit by the eye **15** at within 45° of each side of aligned position will be used so that when the unit is centered the guide key **34** will be located somewhere within the 90° spanned by the upper ends of the inclined tracks.

Where rough alignment of this type is not possible, the

guide tracks may be extended farther around the cylindrical lower portion of the receiving cage 27. In the embodiment shown in Fig. 3 each of the guide tracks 30*a* and 32*a* extends halfway around the unit and they meet at the back. No preliminary rough alignment is therefore needed since at any position the key 34 is bound to meet some part of one of the inclined tracks 30*a* or 32*a* and be brought to its aligned position. As shown, the tracks 30*a* and 32*a* are supported by the vertical rods 26 with their inner edges lying in the same cylindrical surface as the inner surface of the rods 26. Where connected to the tracks, each rod is bent outwardly to permit the guide key 34 to pass by in following along the track.

The connection between the inlet and outlet conduits 12 and 14 and the respective connection receptacles 18 and 20 may be made through any of numerous types of fluid-coupling devices which permit connection to be made by rectilinear motion. One preferred type is shown in Fig. 4 with specific reference to the receptacle 18 and conduit 12. The receptacle is formed with an interior annular shoulder 40 surrounding the fluid passage 42, and the conduit 12 is formed with bevelled edge which rests on a soft resilient gasket 44 carried by the shoulder 40. An auxiliary sealing gasket 46 in the space over the shoulder 40 extending inwardly into light contact with the conduit is also provided. The auxiliary gasket 46 is conveniently held by a cover ring 48, bolted to the receptacle base 18. The cover ring 48 is preferably formed with a downwardly converging conical upper surface which terminates in an opening slightly larger than the conduit 12 and centered over the channel 42 and shoulder 40. The ring cover 48 thereby serves further to assure proper alignment of the conduit and receptacle prior to final seating.

Alternative types of connections between the conduit, e. g. 12, and receptacle, e. g. 18, are shown in Figs. 5, 6 and 7.

In that shown in Fig. 5 the receptacle 18 is formed with a lower bore 50 and an upper bore 52 which terminates at its lower end in a shoulder 53 surrounding the top of the lower bore. At its upper end the upper bore merges into a downwardly converging conical portion. The shoulder supports a gasket 54 surrounding an elastic tube 56 which extends upwardly from the gasket 54 and downwardly into the lower bore 50. The conduit 12, when lowered into position, rests on the gasket 54 and surrounds the upper part of the tube 56, which may then expand, under the pressure of the fluid being treated, into contact with the conduit 12.

In the connection shown in Fig. 6 the receptacle 18 and conduit 12 engage at mating conical sections 18*a* and 12*a* respectively, each of which carries a coating 18*b* and 12*b* respectively of a resilient material, such as rubber, to assure a tight connection. An advantage of this type of connection is that the force normal to the mating surfaces is extremely high relative to its vertical component which supports the weight of the unit.

A similar connection is shown in Fig. 7, except that the end of the conduit 12 is formed to be resilient to permit reaction to the pressure of the fluid being treated. In the illustrated embodiment, the lower end of the conduit 12 is formed with resilient fingers 60 which are embedded in the resilient coating 12*b* on the conduit 12.

From the foregoing description it will be seen that the fluid-treating unit of this invention is well suited for use in numerous types of fluid-treating operations, particularly those which require removal and replacement of units with a minimum of human contact. Such may be easily done with apparatus of this invention simply by lifting the unit from its base, as by means of a crane or derrick by which the eye 15 is engaged, and the renewed unit may be placed in service merely by lowering it into place. The upper portion receiving cage 27 provides a guide that serves to center the unit while the interaction of the guide key 34 and track 30*a*—32*a* brings the inlet and outlet conduits 12 and 14 into preliminary alignment before they are received in the connection receptacles 18 and 20.

Tight connection between the conduits 12 and 14 and connection receptacles 18 and 20 is provided by the force of the weight of the unit which is substantially entirely borne by the conduits. The total fluid pressure which may be handled will vary with the weight of the unit and the cross sectional area of the conduits 12 and 14, and these may be varied considerably to accommodate a wide range of conditions. These considerations are believed to be well within the understanding of those skilled in the art.

Although described with specific reference to the presently preferred embodiments of this invention, it is contemplated that modifications will occur to those skilled in the art and that such may be made without departing from the scope of the invention.

Having thus disclosed my invention and described in detail its preferred embodiments, I claim and desire to secure by Letters Patent:

1. Fluid processing apparatus comprising a base having inlet and outlet conduit means for incorporating the apparatus into a fluid flow system, and inlet and outlet connection members communicating with said conduit means; a fluid-treating unit comprising a housing having inlet and outlet conduits terminating in connector members connectible with said inlet and outlet connection members by vertical rectilinear motion, said fluid-treating unit being seated on said base with its inlet and outlet connector members being held in connected relation with the inlet and outlet connection members by the vertical force of the weight of the fluid-treating unit; means engageable for raising and lowering said fluid-treating unit; and guide means over said base comprising a downwardly converging upper portion adapted to engage said unit while it is being lowered and center it over said base, and a lower portion having means for rotating said unit while it is being lowered to bring said members into connected alignment.

2. The system defined by claim 1 wherein the lower portion of said guide means includes an inclined track and the unit is formed with a key member engageable with said track, said key member and track being effective to cause said unit to rotate while it is being lowered.

3. Fluid processing apparatus comprising a base having inlet and outlet conduit means for incorporating the apparatus into a fluid flow system, and inlet and outlet connection member communicating with said conduit means; a fluid-treating unit comprising a housing having inlet and outlet conduits terminating in connector members connectible with said inlet and outlet connection members by vertical rectilinear motion, said fluid-treating unit being seated on said base with its inlet and outlet connector members being held in connected relation with the inlet and outlet connection members by the vertical force of the weight of the fluid-treating unit; means engageable for raising and lowering said fluid-treating unit; guide means over said base comprising a downwardly converging upper portion adapted to engage said unit while it is being lowered and center it over said base, and a lower cylindrical portion adapted to hold said unit centrally over said base, said lower cylindrical portion having at its periphery a circularly inclined track; and a guide key on said unit engageable with said track.

4. Fluid processing apparatus comprising a base having inlet and outlet conduit means for incorporating the apparatus into a fluid flow system, and inlet and outlet connection members communicating with said conduit means, including a receptacle having an annular shoulder and a downwardly converging guide surface centered over said shoulder; a fluid-treating unit comprising a housing having inlet and outlet conduits terminating in connector members extending past said guide surfaces and engaging said shoulder whereby said connector members are con-

nectible with said inlet and outlet connection members by vertical rectilinear motion, said fluid-treating unit being seated on said base with its inlet and outlet connector members being held in connected relation with the inlet and outlet connection members by the vertical force of the weight of the fluid-treating unit; means engageable for raising and lowering said fluid-treating unit; guide means over said base comprising a downwardly converging upper portion adapted to engage said unit while it is being lowered and center it over said base, and a lower cylindrical portion adapted to hold said unit centrally over said base, said lower cylindrical portion having at its periphery a circularly inclined track; and a guide key on said unit engageable with said track.

5. Fluid processing apparatus comprising a base having inlet and outlet conduit means for incorporating the apparatus into a fluid flow system, and inlet and outlet connection members having vertical axes communicating with said conduit means; a fluid-treating unit comprising

a housing having inlet and outlet conduits terminating at their lower ends in connector members having vertical axes and connectible with said inlet and outlet connection members by vertical rectilinear motion, said fluid-treating unit being seated on said base with its inlet and outlet connector members being held in connected relation with the inlet and outlet connection members by the vertical force of the weight of the fluid-treating unit; means engageable for raising and lowering said fluid-treating unit; and guide means over said base adapted to intercept said unit while it is being lowered to center and align said unit with said base and to align said connector members with said connection members.

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