

Dec. 9, 1952

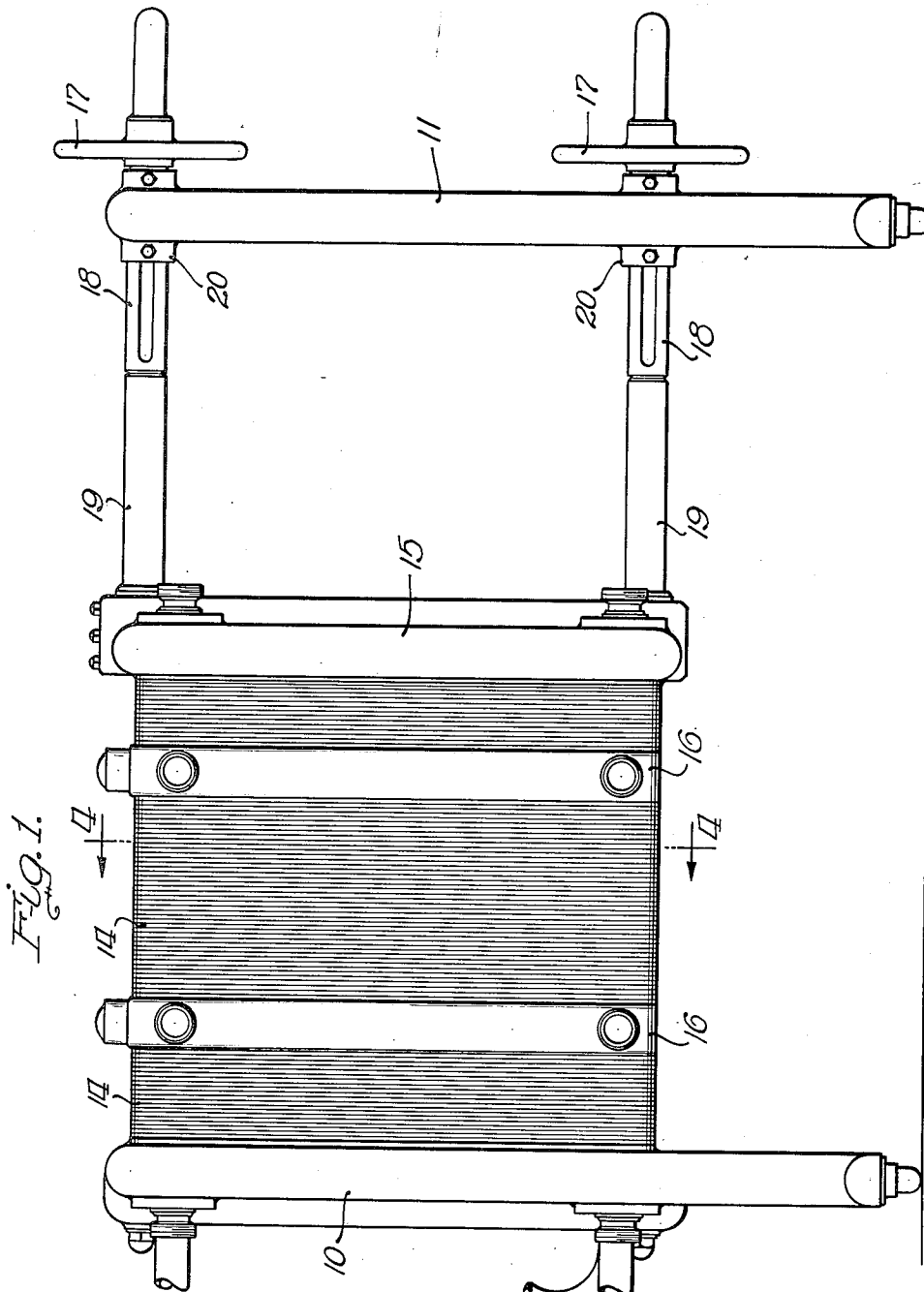
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2,621,028

PLATE TYPE HEAT EXCHANGER SUPPORT

Filed Feb. 24, 1947

5 Sheets-Sheet 1



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PLATE TYPE HEAT EXCHANGER SUPPORT

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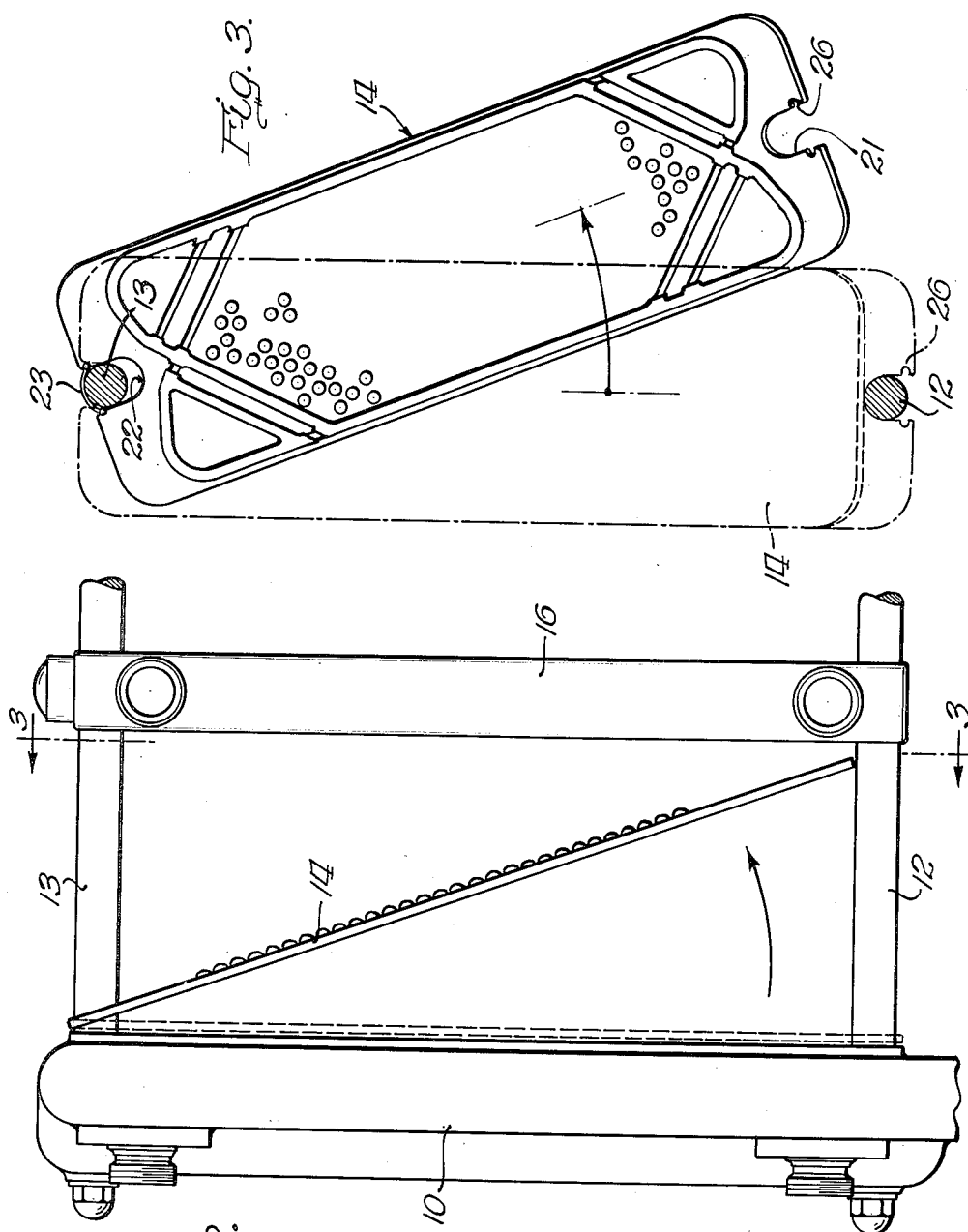


FIG. 2.

FIG. 3.

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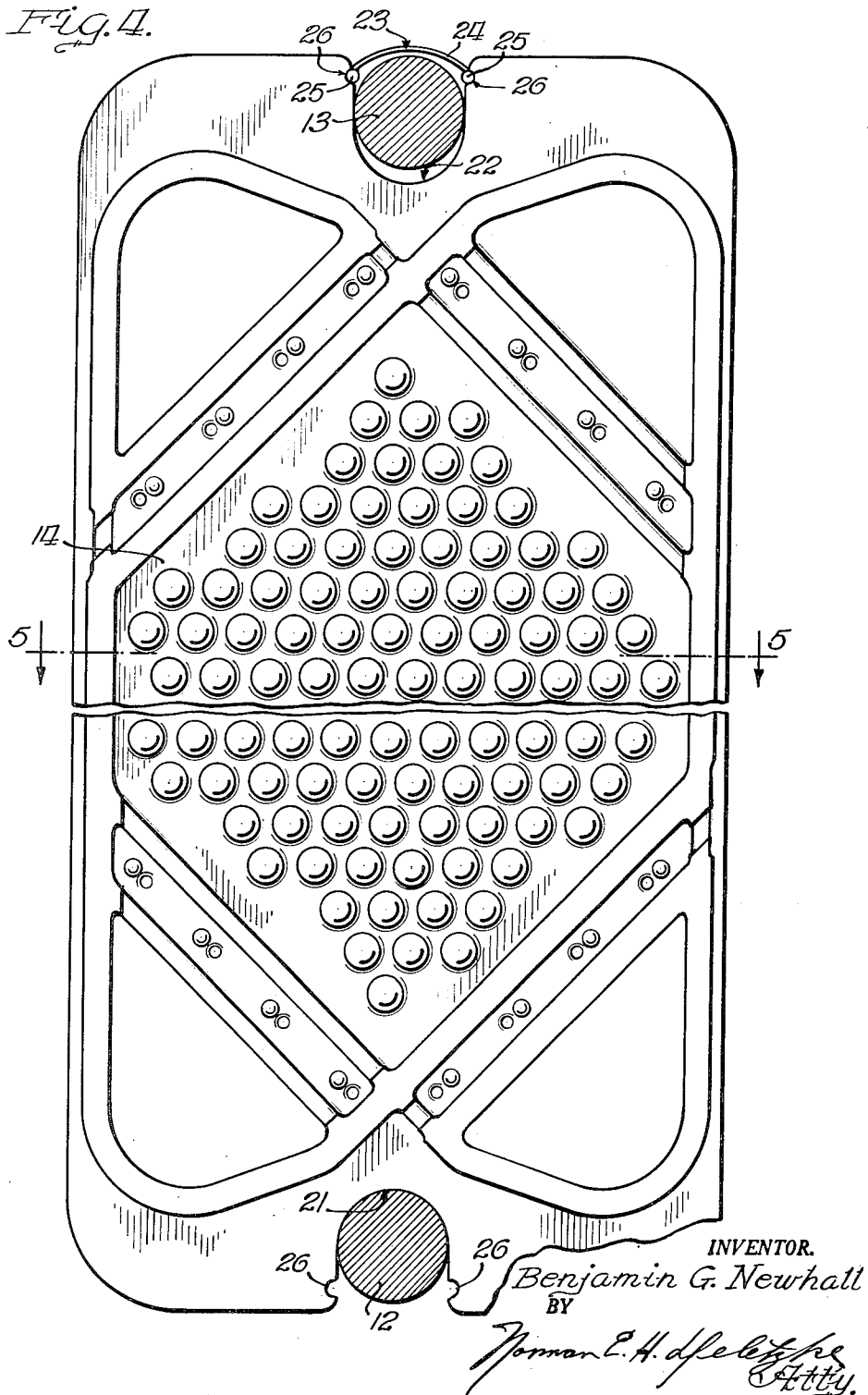
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PLATE TYPE HEAT EXCHANGER SUPPORT

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Fig. 5.

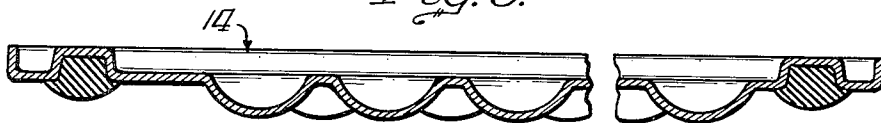


Fig. 7.

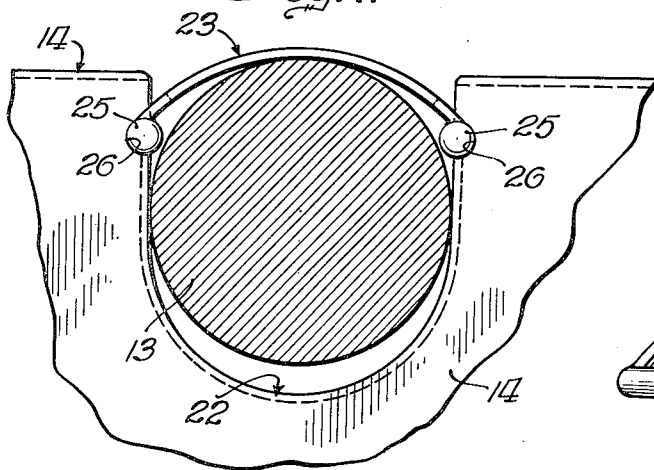


Fig. 6.

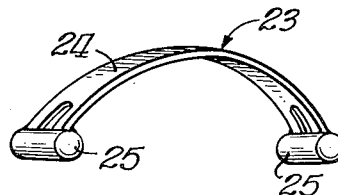


Fig. 9.

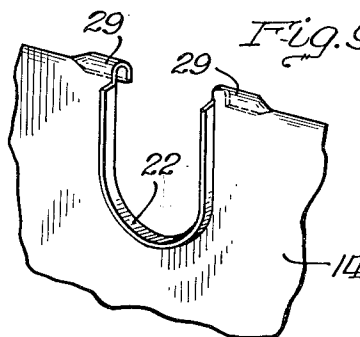


Fig. 10.

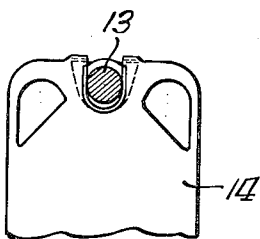


Fig. 12.

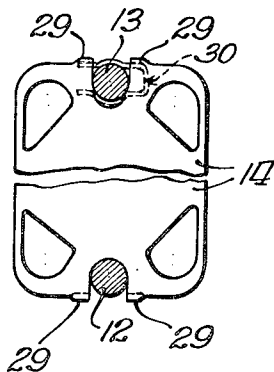
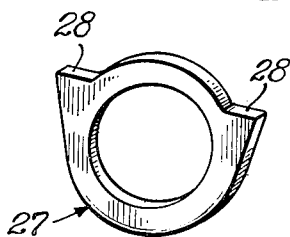


Fig. 8.



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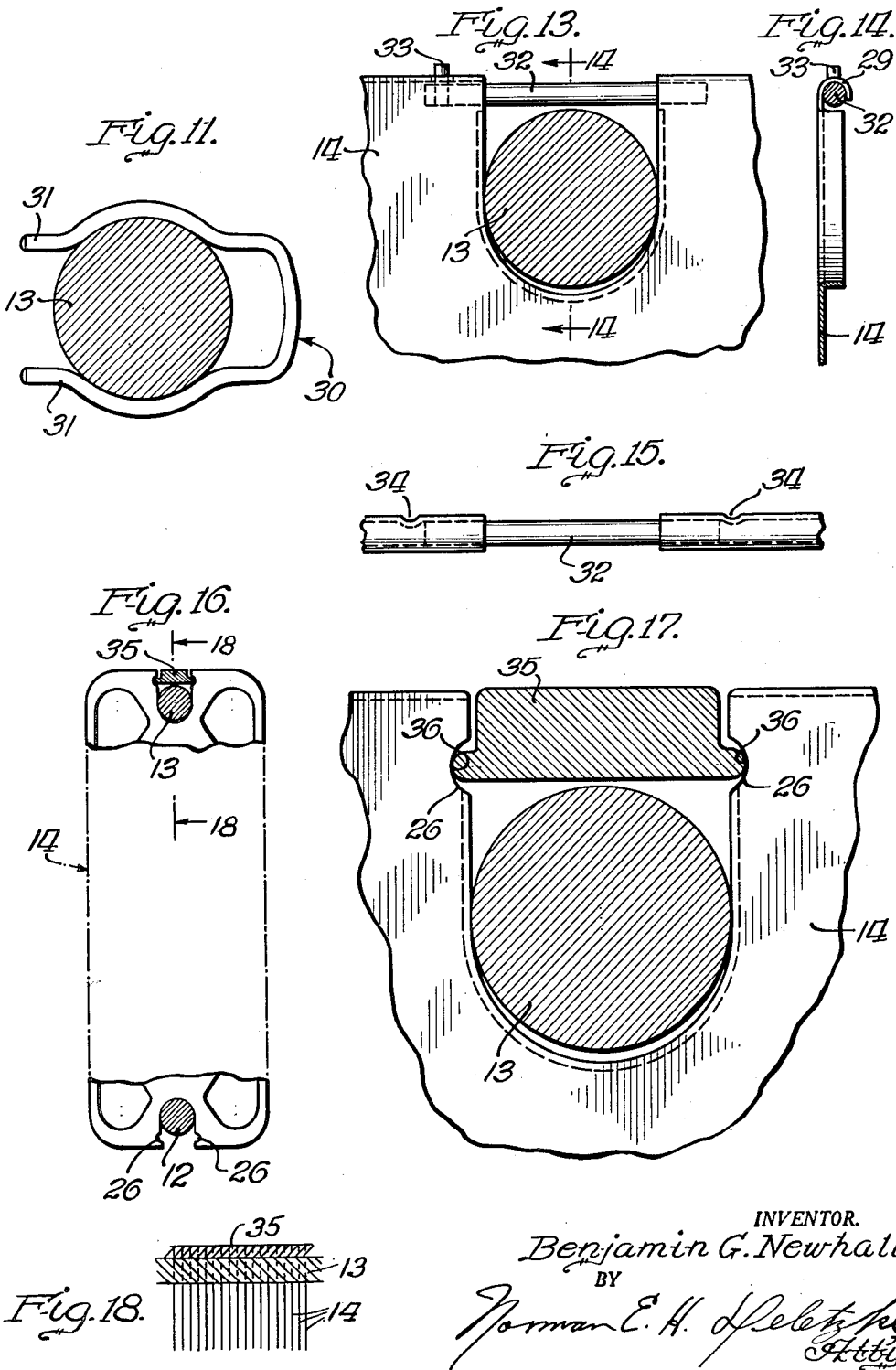
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PLATE TYPE HEAT EXCHANGER SUPPORT

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,621,028

PLATE TYPE HEAT EXCHANGER SUPPORT

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Application February 24, 1947, Serial No. 730,641

1 Claim. (Cl. 257-245)

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This invention relates to apparatus such, for example, as plate type heat exchangers, filter presses and the like, in which a plurality of plate-like elements or plate-like elements and spacers or frame-like elements are operatively supported in a press in close side by side position. More particularly, this invention relates to the novel improvements in the arrangement and construction of the supporting framework, the plate-like elements and releasable retainers, whereby the plate-like elements are properly supported in operative position or in position for inspection and cleaning.

This invention is particularly well adapted for use in connection with a plate type of heat exchanger of the class commonly used in the processing of milk and like products. The preferred embodiment of this invention will, therefore, be described, without however being limited thereto, in connection with the adaptation thereof in a sanitarily designed plate type heat exchanger of the class commonly used in dairies for the heat treatment of milk and other dairy products.

Plate type of heat exchangers commercially used in dairies are preferably made of stainless metals, such as stainless steel, which add appreciably to the cost and usefulness of the devices. Attainment of satisfactory heat exchange efficiency between the heat exchange media requires the use of relatively thin metal in the plate-like elements as well as the operation of the device under conditions involving reasonably rapid flow of the heat exchange media and the associated reasonably high pressures within the flow passages of the heat exchange apparatus.

Sanitary processing of food products requires the frequent inspection and thorough cleaning of the individual plates and other elements of the device, particularly those elements which come in contact with the food being processed to determine the sanitary condition of the apparatus and to determine whether or not failures have occurred in the plates.

It is, therefore, the primary object of this invention to provide a new and novel arrangement for a plate type of heat exchanger or the like device; in which the plate-like elements are slidably supported on and disengageably secured to the supporting framework; in which the individual plate-like elements, when in operative position, are supported upon a main support element; in which the individual plate-like elements may readily be moved from operative position to a position in which they may easily be inspected or cleaned and in which they may be

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pivotally supported on a secondary or stabilizing support or slidably supported upon a primary support and stabilized upon a secondary support or stabilizer against excessive tilting when supported out of contact with the remaining plates; from which secondary or stabilizing support the plate-like elements may easily be removed for further inspection, cleaning or replacement; and in which device the plate-like elements may easily be replaced or reinserted into the press and arranged into operative position.

Other objects and advantages of the present invention will be pointed out and more fully described in the following description when read in connection with the accompanying drawings, in which:

Figure 1 is a side elevation of a plate type heat exchanger, embodying the present invention, in which the plate-like elements, compression elements, and spacing elements are assembled into the supporting framework in operative position.

Figures 2 and 3 are explanatory views, illustrating the procedure to be followed in removing plate-like elements from a press or frame for a plate type heat exchanger embodying the present invention.

Figure 4 is a front elevational view taken along line 4-4 of Figure 1 of the drawings, of an improved plate-like element for a plate type heat exchanger, embodying the present invention and one of the variants of a retaining means for the plate-like element, as outlined along line 4-4 of Figure 1.

Figure 5 is a sectional view, taken along the lines 5-5 of Figure 4 of the drawings.

Figure 6 is a perspective view of the plate retaining element, illustrated in connection with Figures 2, 3 and 4 of the drawings.

Figure 7 is a partial side elevation of a plate-like element, equipped with the retaining clip of the type illustrated in Figure 6 of the drawings when assembled in a supporting frame in such a fashion as to be freely pivotable upon the secondary support member.

Figure 8 is a perspective view of a modified form of retainer for a plate-like element.

Figure 9 is a partial, perspective view of a portion of the plate-like element adapted for use in connection with the retainer illustrated in Figure 8 of the drawings.

Figure 10 is a view similar to Figure 7, illustrating the upper portion of a plate of the type shown in Figure 9 of the drawings, mounted on a secondary support rod by the use of the re-

tainer, such as illustrated in Figure 8 of the drawings.

Figure 11 illustrates a further variant of a plate retainer in the form of a hairpin-like spring clip mounted on a secondary support rod.

Figure 12 is a view similar to those illustrated in Figures 7 and 10 of the drawings, and illustrates a partial view of a plate, such as shown in Figure 9 of the drawings, mounted in operative position upon the primary and secondary support rods and secured to the secondary support rods by the hairpin-like clip of the type illustrated in Figure 11 of the drawings.

Figure 13 is a partial side elevation of a further variant of a plate retainer supporting a plate on the secondary support element of the support frame.

Figure 14 is a view taken along the lines 14—14 of Figure 13 of the drawings.

Figure 15 is a modified form of the retainer illustrated in Figure 13 of the drawings.

Figure 16 illustrates a further variant of a plate retainer mounted on a plate assembly in operative position upon the primary and secondary support rods of the support frame.

Figure 17 is an enlarged partial side elevation of a plate, supported by a retainer of the type illustrated in Figure 16 of the drawings upon the secondary support rod of the frame.

Figure 18 is a sectional view of the line 18—18 of Figure 16.

Referring to the drawings, in which like elements are identified by like numerals, 10 and 11 represent the vertical risers or base elements of the plate heat exchanger frame or press, which includes a transverse and horizontally disposed lower supporting and stabilizing rod-like element or support 12 and horizontally disposed upper stabilizing and supporting rod-like element or support 13, all secured together to form a rigid supporting framework for a plate type of heat exchanger.

A suitable number of plate-like elements or plates, generally identified by the numeral 14, are, when in operative position in the manner illustrated in Figure 1 of the drawings, primarily supported and stabilized against lateral motion upon the primary or lower support rod or element 12 in the manner illustrated in Figure 4 of the drawings, and further stabilized against lateral motion in that position by the upper support rod or secondary support element 13. In such operative position the plates 14 are compressed between the adjacent faces of the vertical riser 10 of the framework, the compression element 15 and the header or spacing elements 16. The compression element 15 and spacing elements 16 are slidably supported and stabilized upon the support and stabilizing elements or rods 12 and 13. Each of these rods 12 and 13, in turn, is provided at its free end with a hand-wheel 17, threaded thereto. Suitable sleeve members 18 are telescoped over the rods 12 and 13. The members 18 extend through appropriate bushings 20 in the front vertical riser 11. This assemblage is used to apply compressive force against the compression element 15 and in turn against the assembled plates 14 and spacing elements 16 upon the appropriate rotation of the handwheels 17. By the use of the described arrangement, it is possible to maintain the individual movable plates 14, spacing elements 16 and compression element 15 in desired operative relation with respect to one another and to seal the edges of the flow spaces formed between

the gasketed plates 14. In a conventional manner, the left vertical riser 10, compression member 15 and the spacing elements 16 are provided with suitable connections, whereby the various heat exchange media may be introduced into the flow spaces formed intermediate the adjacent, juxtaposed, gasketed and apertured plates 14 when assembled in the desired operative position in the supporting framework.

Each of the plate-like elements 14 is provided with the opposed set of lower and upper, peripheral support and stabilizer engaging slots 21 and 22, into which are received the corresponding lower and upper support and stabilizing rods 12 and 13, respectively. In the variant of the invention illustrated in Figures 2, 3 and 4 of the drawings, each of the plate-like elements 14 is disengageably secured to the upper support rod 13 by a retainer or securing element, generally identified by the numeral 23. The retainer 23, when in operative position, consists of a flexed, resilient, substantially flat, spring clip 24, provided at each end with anchor bars or anchor elements 25, complementary to and adapted to engage the opposed anchor bar engaging detents or notches 26 in the side of the slot 22 associated with the upper support rod 13. It is, of course, obvious to those skilled in the art that the anchor bars 25 and detents 26 may readily be modified in various manners, too numerous to illustrate. It is equally obvious that as a matter of convenience the anchor detents 26 are also provided in the walls of the lower slot 21, so that when the plate 14 is inverted, as is common practice, the retainer 23 may be engaged in the notches 26 of the slot 21.

Upon an inspection of Figure 4 of the drawings, it will be observed that the plate 14 rests upon and is primarily supported upon the lower or primary support rod or element 12 and stabilized when in such operative position against lateral motion of its lower portion by the engagement with the lateral sides of rod 12. Plate 14 is stabilized against lateral motion of its upper end by engagement with the lateral sides of the stabilizing rod 13. It will also be observed that the rod 13 is not in engagement with the retainer 23 when the plates 14 are thus mounted in operative position. Such engagement is obviously not necessary, in view of the fact that the corresponding or complementary elements, such as gaskets, flow apertures and knobs, of the adjacent compressed, juxtaposed plates are placed in the desired alignment by the manner in which the plates are mounted upon the lower support rod 12 and stabilized by rods 12 and 13.

It will be noted also that the spacing of the anchor bars 25 from the rod 13, when seated in the notches 26, is such that they may not be released or withdrawn from the notches or detents 26, excepting when the plate 14 is raised to approximately its maximum elevation, intermediate the rods 12 and 13, to thereby provide the necessary clearance between the outer periphery of the rod 13 and the walls of the slots 22 and the openings of the notches or detents 26 to permit the withdrawal or release of the anchor bars 25 from the detents 26. This is done by taking up the clearance between the lower portion of the rod 13 and the adjacent portion of the plate at the bottom of slot 22. The relative sizes and proportions of the rod 13, the spacing of the rod 13 from the portion of the walls of the slot 22 where the notches 26

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are located, the size of the anchor bars 25, the notches 26 and the configuration of the clip 24 must be so selected and arranged as to make possible the said release or withdrawal of the anchor bars 25 when the rod 13 is seated in the lower portion of the slot 22.

To remove the plates 14 from the supporting framework of the plate type heat exchanger, as illustrated in Figures 1, 2 and 3 of the drawings, it is first necessary to suitably rotate the hand-wheel 17 to release the compression upon the compression element 15, and thereafter separate the plates 14 and the spacing element 16 and the compression element 15 in the manner clearly indicated in Figure 2 of the drawings, to a degree sufficient to permit the hereinafter described plate removal operation.

Having thus separated the plates 14 and the spacing element 16 and the compression element 15 a sufficient distance, the plate 14 is pivoted transversely with respect to the remaining assembled plates in the manner indicated in the illustration of Figure 2 of the drawings. Such pivoting motion is continued until the slot 21 in the lower periphery of the plate 14 is disengaged from the primary support or rod 12. After the rod 12 has thus been cleared from the support engaging elements, such as slot 21, in the lower portion of the plate 14, the plate 14 may then be pivoted laterally with respect to the remaining assembled plates upon the upper rod 13 and the retaining element 23 in a manner illustrated in Figure 3 of the drawings. In this laterally pivoted position, the pivoted plate 14 is supported by the disengageable retainer 23, which has then been placed in sliding contact with the surface of the upper rod 13 by the slight lowering of the plate 14 incidental to the described pivoting operation. The laterally pivoted plate may be stabilized by the operator at any desired angle suitable for further inspection or cleaning of the plate.

To remove one or more plates from the supporting framework or press, it is necessary only to pivot each of the plates 14 to be removed on its respective retainer element 23 in sequence in the manner as just described. By raising the plate 14 toward the upper support rod 13 until the rod 13 is seated or about to be seated in the lower portion of the upper slot 22, the spring clip or retainer 23 may then be flexed sufficiently to enable the removal or disengagement of the anchor bars 25 from the detents 26. When the plate 14 has been elevated in the manner as just mentioned, the rod 13 will no longer obstruct the disengagement of the anchor bars 25 from the notches 26. When the retainer 23 has been removed from the plate 14, the plate may then be withdrawn from rod 13 until the support engaging slot 22 has been released entirely from the rod 13, whereupon the plate 14 may then be entirely removed from the press or framework.

To replace a plate or the like in the supporting framework, it is necessary only to place the plate in the mentioned laterally tilted position with the rod 13 received into the lowermost portion of the slot 22. After the plate is supported in such a position, the operator then flexes the spring element 24 of the retainer 23 and inserts the retainer 23 into the mouth of the slot 22 until the anchor bars 25 are in alignment with the detents 26. Upon the release of the flexion of the spring 24 while in such a position, the anchor bars 25 will engage or be seated in the detents 26, thereby disengageably securing the plate 14

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to the rod 13. By following a tilting and pivoting motion opposite to that just described and illustrated in Figures 2 and 3 of the drawings for the removal of a plate from the supporting framework or press, the plate, thus secured to the upper stabilizing and supporting rod 13, may be replaced in the press in such a manner as to be supported upon the lower support rod 12 in the fashion illustrated in Figure 4 of the drawings.

In the normal cleaning and inspecting operations, it is necessary only to release the compression upon the plates, as heretofore described, and separate a plate from the remaining plates by transverse sliding of the plate upon the rods 12 and 13. The thus separated plate will be self-sustaining in that it is stabilized against lateral motion by the engagement of the rods 12 and 13 in the slots 21 and 22, and is stabilized against excessive tilting by the engagement of the retainer 23 with the rod 13.

In the foregoing portion of this specification, there has been set forth a description of one of the preferred variants of applicant's invention in a plate retainer for a plate type apparatus. Figures 8, 9 and 10 illustrate a second variant of applicant's invention. In the second variant of applicant's invention, a ring-like plate retainer element or washer 27, which has been telescoped over the upper rod support and stabilizing rod 13, is provided with two opposed, outer, peripheral offset shoulders 28. The shoulders 28 are adapted to be engaged in overlapping relationship by the oppositely positioned peripheral flanges 29, provided on the edge of the plate 14 at the juncture of the mouth of the slot 22 and the outer peripheral edge of the plate 14. Flanges 29, which extend outwardly and downwardly from the upper edge of the face of the plate 14, as clearly illustrated in Figure 9 of the drawings, are of such proportions with respect to the shoulders 28 of the ring 27 as to permit a reasonable degree of hinging motion sufficient to enable the hereinbefore described transverse pivoting of the plates 14, as illustrated in Figures 2 and 3 of the drawings, during the removal or replacement operation, in which a plate is either removed or replaced into the supporting framework or press. The tolerances and proportions are also such as to permit the free transverse sliding of the plates and to prevent excessive transverse tilting of the top of a plate supported upon the lower rod 12 out of contact with the remaining plates. To insert a plate into a press provided with the retaining ring 27, it is necessary only to move the upper edge of the plate 14 into position with respect to the lower support rod 13, so that the rod 13 is received into the lowermost portion of the slot 22. In this position, the outwardly and downwardly turned flanges 29 may be placed in overlapping relation with the complementary shoulders 28 of the ringlike plate retainer 27. When the flanges 29 have thus engaged the shoulders 28 of the rings 27, the plate may then be laterally and transversely pivoted into operative position in the manner clearly illustrated in Figures 2 and 3 of the drawings, and as hereinbefore described, for inserting a plate into a press when the plate is provided with a retainer of the type illustrated in Figure 6 of the drawings. To remove a plate from a press provided with the retainer ring 27, the opposite procedure is followed.

In Figures 11 and 12 of the drawings, there is illustrated a third variant of applicant's inven-

tion in the form of a hairpin-like spring clip, also adapted to be used as a retainer for the type of plate illustrated in Figure 9 of the drawings. In this variant of applicant's invention, it is contemplated that the hairpin-like clip, generally indicated by the numeral 30, will be disengageably clasped or engaged on the rod 13 in such position that the flexed arms 31 thereof, generally speaking, will be in a horizontal position and extending in a gripping contact on either side of the rod 13 a sufficient distance as to overlap the mouth of the slot 22 and in turn to be overlappingly engaged by the outwardly and downwardly turned flanges 29 of the plate 14. By this arrangement, the plates 14 may be pivotally supported in a hinge-like fashion upon the upper branch 13 of the hairpin-like clip 30 when released from the main support rod 12 and will be stabilized against excessive transverse tilting in those instances where an individual plate is supported independently upon rod 12 out of contact with the remaining rods. To remove a plate 14 from the supporting framework or press or to replace a plate 14 into the supporting framework or press, when using a variant of applicant's invention involving the hairpin-like clip pin 30, illustrated in Figure 11 of the drawings, substantially the same procedure is followed as when using the retainer ring 27, illustrated in Figure 8 of the drawings.

In Figure 12 of the drawings there is illustrated a partial view of a plate 14 of the type partially illustrated in Figure 9 of the drawings, in an assembled, operative position in a supporting press or framework, clearly indicating the manner in which the plate 14 is supported upon the lower rod 12 and stabilized by the combined action of the retainer 30, the rod 13 and the flanges 29 at the upper end of the plate 14.

Figures 13 and 14 illustrate a further modified variant of applicant's invention, also adapted to be used with a plate of the type illustrated in Figure 9 of the drawings, and which is provided with the outwardly and downwardly turned flanges 29. Figure 15 illustrates a modification of the variant of the invention illustrated in Figures 13 and 14. In these variants of the applicant's invention, illustrated in Figures 13, 14 and 15 of the drawings, a retainer pin 32 is secured to one or both of the flanges 29 after the plate 14 has been brought into position with respect to the upper supporting rod 13 in such a manner that the support rod 13 has been received into the lower portion of the slot 22. When the plate 14 and the rod 13 have thus been brought into relative position, the pin 32 is placed across the mouth of the slot 22, so as to completely span the same, and to be overlappingly engaged by the outwardly and downwardly turned flanges 29 at the upper edge of the plate 14. When in such position, the pin 32 is then locked to the plate 14 by driving a key pin 33 through suitable openings in the flange or flanges 29 and the pin 32. A modified form of retaining the pin 32 in proper position with respect to the flanges 29 is illustrated in Figure 15 of the drawings, and contemplates that after the pin 32 has been placed in position in the manner illustrated in Figure 13 of the drawings, suitable detents 34, such as may be made by the use of an appropriate punch, are formed in each of the flanges 29 beyond the outer ends of the retainer pin 32, thus locking the pin 32 in position on the plate 14.

The manner of pivoting the plate 14 into and

out of operative position in the supporting press when the plate 14 is equipped with a retainer pin 32 is accomplished by following the same procedure as that hereinbefore described for use with the mentioned variants of applicant's invention and as generally illustrated in Figures 2 and 3 of the drawings. To completely remove the plate from the press, when using a retainer pin 32, it will, of course, be necessary to either remove the key pin 33 or to remove the detents 34 and then withdraw the pin 32 from the flanges 29. The transverse stabilization of the upper portion of a plate supported independently upon the rod 12 out of contact with the remaining plates results from the engagement of the pin 32 with the rod 13, whereby excessive tilting of the plate is prevented.

In each of the hereinbefore described variants of the applicant's invention, such as the variants contemplating the use of the spring clip retainer 23 or the ring 27 or the hairpin-like retainer 30 or the retainer pin 32, it is contemplated that such retainer, when in operative position, will completely span the mouth of the slot 32 outwardly of the supporting and stabilizing rod 13. It is further contemplated that each plate 14 be individually provided with a retainer element, thereby permitting the transverse and lateral tilting of the individual plates in the operation of inserting plates in the supporting framework or the operation of withdrawing plates from the supporting framework or in the operation of tilting the plates for inspection and cleaning, all in the manner as hereinbefore described, or as diagrammatically illustrated in Figures 2 and 3 of the drawings.

In Figure 17 of the drawings, there is illustrated a further variant of applicant's invention, which contemplates the use of the plate 14 of the type illustrated in Figure 7 of the drawings, in which at least the upper slot 22 is provided with opposed notches or detents 26.

After all of the plates 14 have been assembled on the supporting framework or press, with the supporting rods 12 and 13 in the complementary peripheral slots 21 and 22 of the plates 14, a locking bar 35, provided with outwardly extending flanges 36 at its lower face, is telescoped through the outer openings of the slots 22 of the assembled plates 14 with the flanges 36 of the bar 35 engaging the complementary detents 26 in the wall of the slots 22. By this arrangement, the locking bar 35 will span the outer opening of the slot 22 outwardly of the supporting rod 13, thereby locking the plates 14 in position on the supporting framework which includes the rods 12 and 13.

It may appear obvious that any appreciable transverse or any lateral tilting of the plates 14, in the manner as diagrammatically illustrated in Figures 2 and 3 of the drawings, will not be possible when using the locking bar 35, illustrated in Figure 17 of the drawings. However, upon a release of the compression upon the compression element 15, the spacing element 16 and the plates 14, the plates 14 may be separated one from another any desired distance as limited by the expanse of the supporting press or framework, so as to enable inspection and cleaning of the plates. When thus separated, any individual plate may be supported in substantially vertical arrangement out of contact with any remaining plates. To remove any plate 14 from the supporting press or to insert any plate 14 into the supporting press when using the retainer bar 35

of the type illustrated in Figure 17 of the drawings, it is necessary first to withdraw the bar 35 from the assembled plates 14, after which the transverse and lateral tilting motion of the plates, as diagrammatically illustrated in Figures 2 and 3 of the drawings, may be utilized either to replace or remove plates into the press or supporting framework.

From the foregoing description of applicant's invention it is apparent that applicant has provided a simple, unique and novel means for detachably securing plates or the like to the supporting and stabilizing framework of the plate type apparatus. Plate retainers of this particular nature are of great importance and utility, in that they enable the ready handling, cleaning and inspection of numerous plates in a plate type heat exchanger, without the necessity of entirely removing each individual plate from the supporting framework and press and at the same time avoiding the danger of freed plates dropping from the press, thereby preventing the probable damage to the relatively fragile and gasketed plates.

It will be appreciated by those skilled in the art that in a device embodying the present invention the supporting elements or rods may readily be arranged in a different order with respect to one another. For example, the supporting rods may be arranged in a substantially horizontal plane instead of being arranged horizontally in a substantially vertical plane, as illustrated in the various modifications of the preferred embodiment of this invention. Similarly, it will be obvious to those skilled in the art that elements other than rods may readily be used for supporting and stabilizing the plates in the supporting framework or press.

Accordingly, it is desired that this invention should not be limited to the specifically described vertical arrangement of the plate-like elements or the use of supporting rods referred to in the preceding description.

Having thus described the illustrated and preferred embodiments of this invention in a plate

type apparatus, the invention is not to be restricted to the specifically illustrated embodiment thereof, as set forth in the drawings and as heretofore described, excepting insofar as necessary by the prior art disclosures and by the appended claim.

This invention is hereby claimed as follows:

A device, for example for heat exchange or filtering purposes, of the type in which a number of plate-like elements are held in closely spaced or abutting relation, if desired under compression, upon a pair of support members forming part of a frame which is provided with means for increasing the space available to the plate-like elements on the support members, each element being provided with notches at opposite ends for receiving said support members, characterized by the feature that each plate-like element is carried by one of said support members and is stabilized against lateral displacement by engagement of the other support member with the notch in the associated end of the element, and that a retaining member is disengageably associated with the plate-like element in a position to bridge the last mentioned notch, there being a clearance between said retaining member and either the plate-like element or the stabilizing support member to permit movement of the plate-like element in the direction of a line connecting the two notches.

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