June 30, 1936. R. H. HAMMELL 2,045,596

REACTION APPARATUS AND ASSEMBLY OF SAME

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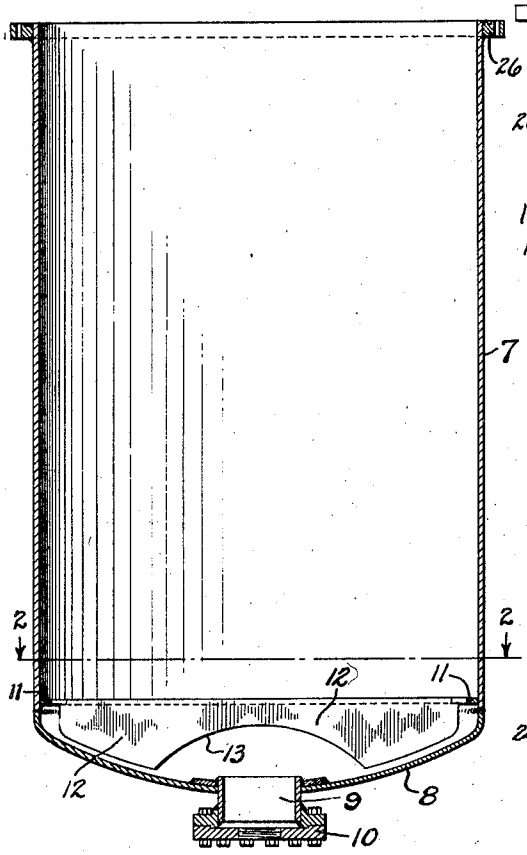
Fig. 1



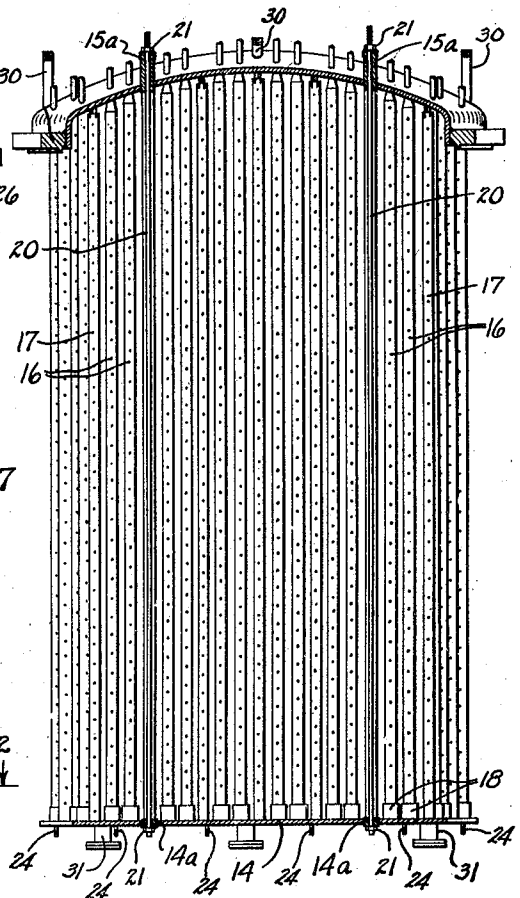


Fig. 3

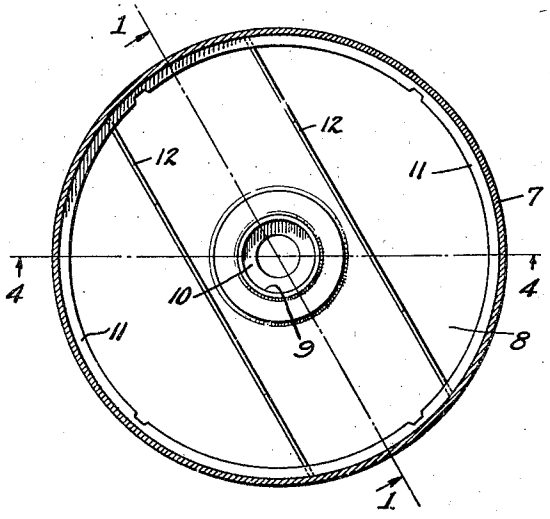


Fig. 2

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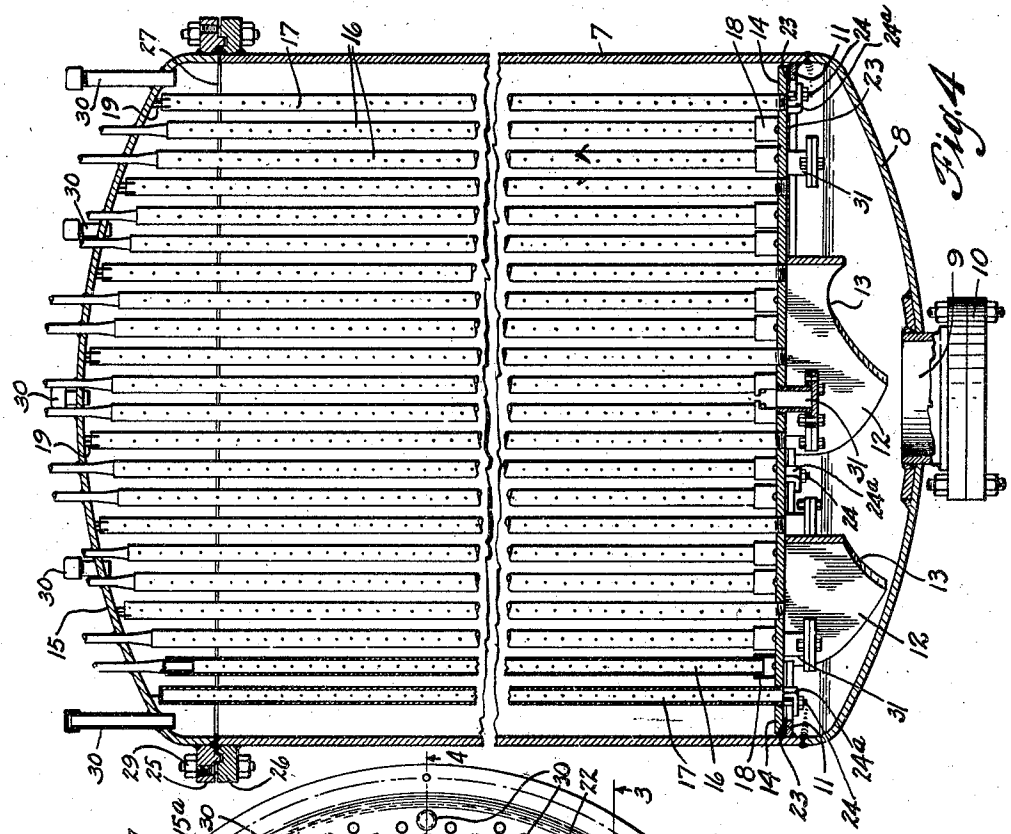

Fig. 4

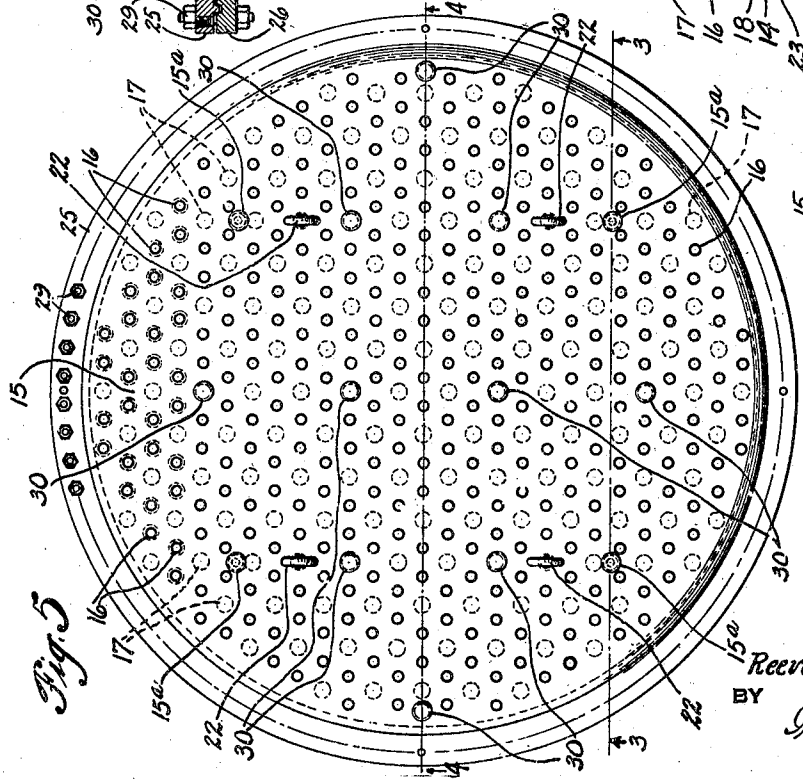

Fig. 5

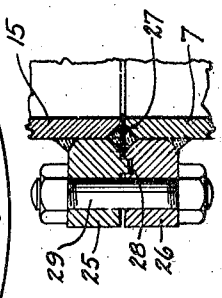

Fig. 6

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UNITED STATES PATENT OFFICE

2,045,596

REACTION APPARATUS AND ASSEMBLY OF SAME

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Application January 14, 1933, Serial No. 651,718

17 Claims. (Cl. 23—288)

This invention relates to apparatus for effecting chemical reactions and for controlling reaction temperatures. It is especially important in connection with the use of contact masses whether inert, reactive or possessing catalytic activity. It presents a practical solution of the structural features and mechanics of assembly of a converter having both inlet and outlet conduits embedded in the contact mass after the manner disclosed in the copending application of Eugene J. Houdry, Serial No. 611,362, filed May 14, 1932.

One object of the invention is to facilitate the assembly and disassembly of a converter of the described type. Another object is to simplify the structure. Another object is to secure and to maintain fluid-tight and vapor-tight joints. Still another object is to provide for convenient insertion and removal of the contact mass. Still other objects will be apparent from the detailed description which follows.

The invention involves the assembly of all conduits into a compact bundle which is inserted into the converter and removed therefrom as a unit. By preference the bundle depends from a detachable top or cover for the converter and some or all of the conduits extend through this cover plate and are attached thereto in a fluid-tight manner. A lower plate, intended to form a false bottom for the converter and to support the contact mass, is at the base of the bundle and may have the outlet pipes of the bundle mounted thereon in a fluid-tight manner to discharge therethrough. Each plate provides guides for the conduits mounted on the other, and suitable means such as rods secure the plates together when the bundle is inserted or removed from the converter. After insertion, the plates are individually secured to the converter in a fluid-tight manner and the rods are removed, the ports for the latter in the cover plate being utilized if desired to charge the converter at least partly with the contact mass. The lower plate provides discharge outlets for the contact mass into a chamber therebeneath in the converter and web supports or partitions in this chamber arranged to prevent sagging or warping of the lower plate are arched or otherwise apertured for the withdrawal of the mass as when the conduit bundle is to be removed.

In order to illustrate the invention a concrete embodiment which at present is considered the preferred form is shown in the accompanying drawings, in which:

Fig. 1 is a vertical sectional view through the converter case on the line 1—1 of Fig. 2;

Fig. 2 is a transverse sectional view of the case on the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view substantially on the line 3—3 of Fig. 5, showing the tube bundle and lower false bottom in assembled relation with the cover plate prior to insertion within the converter case;

Fig. 4 is a vertical central sectional view through the completely assembled converter substantially on the line 4—4 of Figs. 2 and 5, the contact mass being omitted;

Fig. 5 is a top plan view of Fig. 4; and

Fig. 6 is an enlarged fragmentary detail sectional view showing the joint between the cover and the case.

The converter case herein disclosed for the purpose of illustrating the invention is cylindrical in form and of a height in excess of its diameter. Case 7 has a closed lower end 8 integral therewith, with a central opening or conduit 9 which may be sealed by a closure 10 having a threaded aperture for the attachment of an inlet or outlet pipe. Conduit 9 is of sufficient size to serve as a manhole for purposes later to be described. Just above the tapered closed bottom 8, a ring 11 is welded or otherwise secured to the inner periphery of case 7 for the purpose of supporting a lower plate or false bottom 14 (Figs. 3 and 4), on which the contact mass will rest. To further support this plate, vertical webs 12 are provided, symmetrically disposed in parallel relation on opposite sides of manhole conduit 9. Each of these webs is apertured, as by an arched opening 13, to give access from manhole conduit 9 to the entire area of bottom 8. A cover plate 15 (Figs. 3–6) is arranged to close the top of case 7 in a fluid-tight manner, as will be later described.

Two series of apertured conduits 16 and 17, respectively, are adapted to be assembled in the form of a conduit bundle for insertion as a unit into the converter case, the two series of conduits being uniformly arranged in spaced parallel interprojecting disposition after the manner disclosed in the aforesaid copending Houdry application, Serial No. 611,362, so as to be embedded in the contact mass, eventually to be inserted within the converter case 7. By preference, the bundle is suspended from cover plate 15, and includes the lower plate or false bottom 14. In the form shown, the series of conduits 16 are secured in apertures therefor in cover plate 15, to depend therefrom, while conduits 17

of the other series are mounted in suitable apertures in lower plate 14 and extend upwardly therefrom, each plate having suitable means for guiding and positioning the conduits mounted on the other plate, such as disclosed in the copending application of Eugene J. Houdry and myself, Serial No. 640,198, filed October 29, 1932.

The procedure of assembly of the tube bundle is as follows. The dished cover plate 15 and the lower false bottom plate 14 are supported temporarily in parallel planes in properly spaced relation. Now starting from any convenient point on the periphery of the two plates, the conduits of the two series are mounted and made fast as follows: Conduits 16, with guide sleeves 18 slid over the closed ends, have their open ends inserted in the apertures therefor in cover plate 15. The closed end of the conduit is swung into perpendicular position with plate 14, and held in position while sleeve 18 is spot welded or otherwise secured to plate 14. The conduit is then pulled upwardly through the aperture in cover 15, to allow sufficient space for expansion and contraction, and the neck of the conduit is welded in a fluid-tight manner to cover plate 15. On the other hand, the lower or open ends of conduits 17 are screwed into threaded apertures in lower plate 14; the conduits are lined up and held in perpendicular position, while positioning means, such as prongs 19 for the closed end of the tubes, are welded or otherwise secured to cover plate 15. The mounting of the conduits is continued progressively across the plates in such a manner that no spaces for conduits are left inaccessible. After all the conduits have been installed, a suitable number of rods 20 (Fig. 3) are inserted through sleeved apertures 15*a* and 14*a*, respectively, in plates 15 and 14, and nuts 21 are applied to the opposite ends of the rods. Four such rods are ordinarily sufficient, and their positions are indicated at 15*a* in Fig. 5. These rods serve to maintain the assembly of the bundle, and to suspend lower plate 14 from cover plate 15, when the aforementioned temporary supports for these plates are withdrawn just prior to the insertion of the bundle within case 7.

The assembled bundle may now be raised by means of eye-bolts 22 (Fig. 5), and swung over the open end of case 7, whereupon it is carefully lowered therewithin until cover 15 rests upon the upper end of the case. The nuts 21 on the lower end of rods 22 are then loosened, or the rods are unscrewed if nuts 21 are welded to the lower side of plate 14, until the plate rests upon ring 11 and webs 12, a gasket 23 of asbestos or other suitable packing material having been inserted between ring 11 and plate 14. Plate 14 is then secured to ring 11 in any suitable manner, as by clamps 24*a* (Fig. 4), which may be applied to studs 24 therefor projecting from the under face of plate 14.

To effect a fluid-tight joint between cover plate 15 and the top of case 7, both may have apertured rings or flanges 25 and 26 welded thereto. A gasket 27 is applied between the case and cover, and may be retained in place by suitable interlocking means, such as an annular tongue and groove construction 28 (Figs. 4 and 6) in flanges 25 and 26. Bolts 29 extending through aligned apertures in the flanges 25 and 26 secure cover 15 in place. Care is taken, or suitable provision made, that plates 14 and 15 be not displaced relative to each other when rigidly secured in place in case 7. Rods 20 are now withdrawn through the sleeved openings 15*a* in cover plate 15, and these openings, together with additional ports having short conduits 30 in cover plate 15 are used to charge case 7 above lower plate 14 with the contact mass, after which the charging conduits are capped or otherwise closed in a fluid-tight manner.

If the converter is to be disassembled for inspection or repair, the procedure is to remove manhole cover 10 from manhole conduit 9, to give access to the lower face of bottom plate 14, from which extend a plurality of short discharge conduits 31 for the contact mass. The caps or closures on these conduits are removed, and the contact mass is taken out of the converter through manhole conduit 9. The arched openings or apertures 13 in webs 12 provide outlets for the portions of the chamber under plate 14 defined by webs 12. After the contact mass is removed, rods 20 are reinserted through sleeved openings 15*a* therefor in plate 15 and secured to or beneath lower plate 14, whereupon, after removal of clamps 24 and bolts 29, the conduit bundle (Fig. 3) may be hoisted out of case 7.

The procedure of assembly of the conduit bundle may be varied. For example, the tubes 16 may be screwed into threaded openings in cover plate 15, while conduits 18 are welded in the openings therefor in bottom plate 14, or both series of conduits may be screwed, welded, or otherwise secured in place. The guide and positioning means for the free ends of the tubes may be any of the forms disclosed in the aforesaid copending application, Serial No. 640,198, and may be applied to plates 14 and 15 before the mounting of the conduits. While the converter case is herein shown as mounted in a vertical position, it may be equally well mounted and operated in a horizontal position.

I claim as my invention:

1. The method of assembling a catalytic converter having a detachable cover and false bottom with fluid conduits embedded in the contact mass which comprises, mounting the conduits between the cover and the false bottom to form a bundle, inserting the bundle as a unit into the converter, securing the false bottom and the cover individually to the converter in a fluid-tight manner and in a definite registering relation, and filling the spaces between said false bottom and said cover and around the conduits with the contact material.

2. The method of assembling a catalytic converter having an inner supporting plate and a detachable cover with fluid conduits embedded in the contact mass which comprises, suspending the plate from the cover, mounting the conduits between said plate and cover to form a bundle, inserting the bundle as a unit in the converter, securing the plate and the cover individually to the converter in a fluid-tight manner and in a definite relation, and filling the space between said plate and said cover with the contact material.

3. The method of assembling a catalytic converter having an inner supporting plate and a detachable cover with fluid conduits embedded in the contact mass which comprises, suspending the plate from the cover, mounting the conduits partly on said plate and partly on said cover to extend therebetween and to form a bundle, inserting the bundle as a unit in the converter, securing the plate and the cover individually to the converter in a fluid-tight manner and in a definite relation, and filling the space between

said plate and said cover with the contact material.

4. The method of assembling a catalytic converter having an inner supporting plate and a detachable cover with fluid conduits embedded in the contact mass which comprises, suspending the plate from the cover by removable rods extending through holes in the cover, mounting the conduits partly on said plate and partly on said cover to extend therebetween and to form a bundle, inserting the bundle as a unit into the converter, removing the rods, securing the plate and the cover individually to the converter in a fluid-tight manner, and using the holes for the rods to feed the contact material into the space between the plate and the cover.

5. In apparatus for effecting chemical reactions, a converter case open at one end and having an outlet in the opposite end, a support for a contact mass insertable and removable through the open end of said case, means on the interior of said case for maintaining said support adjacent to but spaced from said outlet, apertured conduits extending from one side of said support to be embedded in the contact mass, and means on the other side of said support accessible through said outlet and the lower portion of said case for detachably securing said support in place.

6. In apparatus for effecting chemical reactions, a converter case open at one end and having a central outlet in its opposite end, an apertured plate insertable and removable through the open end of said case for supporting a contact mass, means within said case for supporting said plate both peripherally and transversely and in spaced relation to said outlet, apertured conduits mounted in certain of the apertures of said plate and extending from one side thereof to be embedded in the contact mass, and means accessible through said outlet and the lower portion of said case for securing said plate in place and for removing a contact mass supported by said plate.

7. In apparatus for effecting chemical reactions, a converter case open at one end and having an outlet in the opposite end, a support for a contact mass insertable and removable through the open end of said case, means on the interior of said case including vertical transverse webs for maintaining said support adjacent to but spaced from said outlet, said webs having openings therethrough, apertured conduits extending from one side of said support to be embedded in the contact mass, and means accessible through said outlet and through the openings in said webs for detachably securing said support in place.

8. In apparatus for effecting chemical reactions, a converter case open at one end and having a central outlet in its opposite end, an apertured plate insertable and removable through the open end of said case for supporting a contact mass, means within said case for supporting said plate both peripherally and transversely and in spaced relation to said outlet comprising a flange on said case and vertical arched webs disposed on both sides of said central outlet, apertured conduits mounted in certain of the apertures of said plate and extending from one side thereof to be embedded in the contact mass, and means accessible through said outlet and said arched webs for securing said plate in place and for removing a contact mass supported by said plate.

9. In apparatus for effecting chemical reactions, a converter case having two apertured plates, means supporting one of said plates at the bottom of said case, means securing the other plate to said case to form a cover therefor, apertured conduits mounted in the apertures of each plate and extending toward the other plate with their free ends terminating near the latter, guide and positioning means on each plate for the free ends of the conduits mounted on the other plate, and means in said plates for filling the space between said plates and around said conduits with contact material and for emptying such contact material.

10. In apparatus for effecting chemical reactions, a converter case having an open end and a tube bundle adapted to be lowered into said open end to complete the assembly of the converter, said bundle comprising upper and lower plates, perforated conduits mounted between said plates, means for securing said upper and lower plates individually to said case to form an outer cover and a false bottom respectively for said case, and means for filling the space between said plates and around said conduits with contact material after the tube bundle is in place and for removing such material prior to removal of said bundle from said case.

11. In apparatus for effecting chemical reactions, a converter case having an open end and a tube bundle adapted to be lowered into said open end to complete the assembly of the converter, said bundle comprising upper and lower plates, perforated conduits mounted between said plates, means for securing said upper and lower plates individually to said case to form an outer cover and a false bottom respectively for said case, and means for filling the space between said plates and around said conduits with contact material after the tube bundle is in place and for removing such material prior to removal of said bundle from said case.

12. In apparatus for effecting chemical reactions, a converter case having an open end and a tube bundle adapted to be lowered into said open end to complete the assembly of the converter, said bundle comprising upper and lower plates, perforated conduits mounted between said plates, means maintaining said tube bundle in assembled relation while it is being inserted in said case, means in said case permitting the detachment of said last named means, means for securing said upper and lower plates individually to said case to form an outer cover and a false bottom respectively for said case, and means for filling the space between said plates and around said conduits with contact material after the tube bundle is in place and for removing such material prior to removal of said bundle from said case.

13. In apparatus for effecting chemical reactions, a converter case having an open end and a tube bundle adapted to be lowered into said open end to complete the assembly of the converter, said bundle comprising upper and lower plates, perforated conduits mounted between said plates, removable members interconnecting said plates to maintain said tube bundle in assembled relation while it is being inserted in said case, means in said case permitting the detachment of said members, means for independently securing said plates to said case, the upper plate to form an outer cover for the case and the lower plate to form a false bottom within the case, means for filling the space between said plates with contact material through said upper plate, and means for removing such contact material

through said lower plate and through the bottom of said case.

14. A tube bundle for insertion in a converter case comprising upper and lower apertured plates, means suspending said lower plate from said upper plate, and conduits mounted in the apertures of each of said plates to form independent series, the conduit of each series extending toward the other plate in uniformly spaced relation, said means being withdrawable through said upper plate after the bundle is inserted in the case.

15. A tube bundle for insertion in a converter case comprising upper and lower apertured plates, rods suspending said lower plate from and in spaced relation to said upper plate, two independent series of apertured conduits, each series mounted in the apertures of one of said plates to extend toward the other of said plates, said upper plate having ports accommodating said rods and through which the latter are withdrawn after the bundle is inserted in the case.

16. A tube bundle for insertion in a converter case comprising upper and lower apertured plates, rods suspending said lower plate from and in spaced relation to said upper plate, a series of conduits mounted in the apertures of each of said plates to extend toward the other of said plates, said rods being withdrawn after said bundle is inserted in the case, and ports for charging and emptying the spaces between said plates and around said conduits, said ports being in said upper and lower plates respectively, the said ports in said upper plate serving for the insertion and removal of said rods.

17. A tube bundle for completing the assembly of a catalytic converter case comprising upper and lower apertured plates, the upper of said plates forming a cover for the case, conduits mounted in the apertures of each of said plates and extending in uniform relation toward but out of contact with the other of said plates, guide means on each plate for the free ends of the conduits mounted on the other of said plates, and removable means for suspending said lower plate from said upper plate and for retaining the bundle in assembled relation.

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