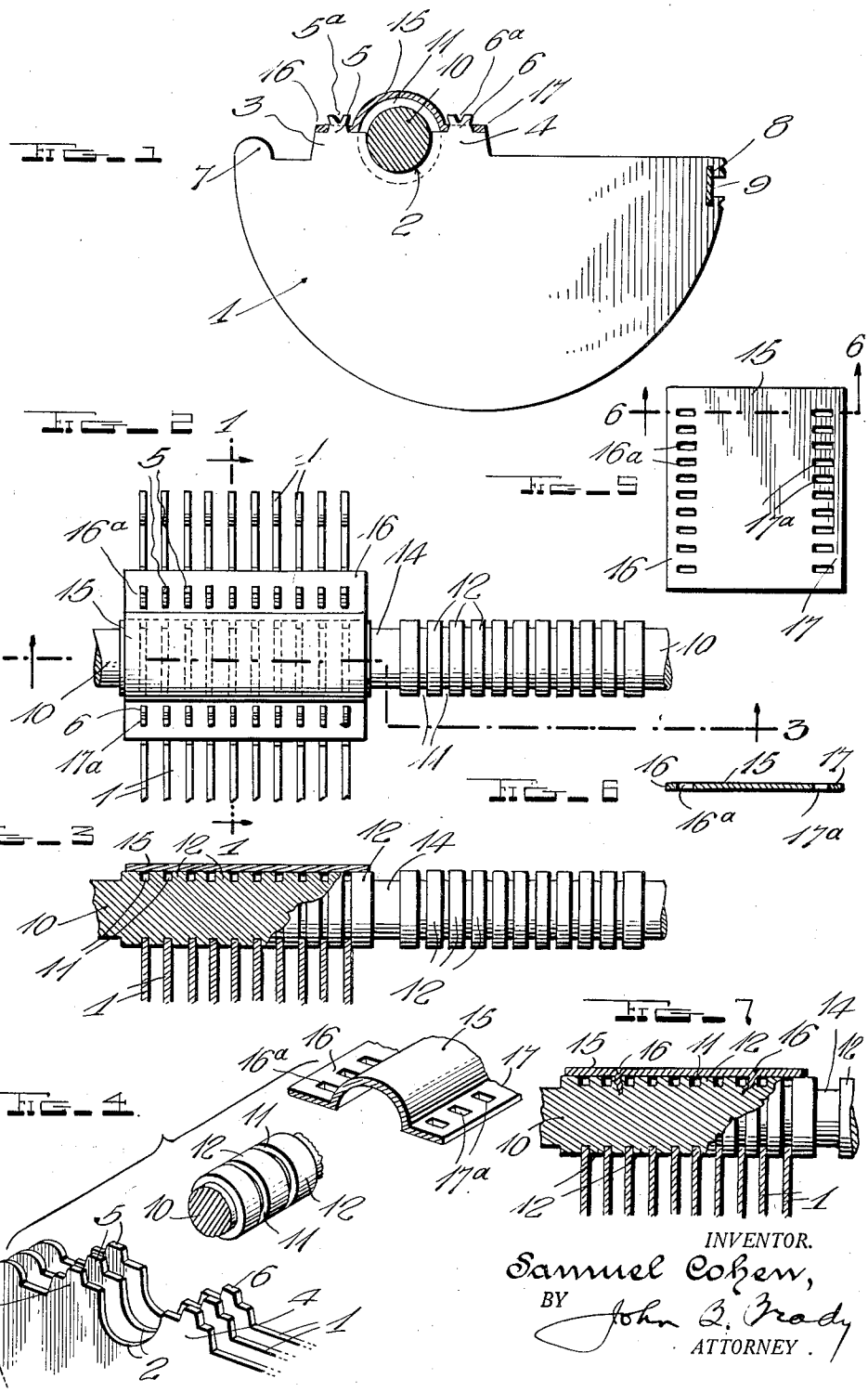
Dec. 19, 1933. S. COHEN 1,939,876

MOUNTING FOR ROTOR PLATES OF MULTIPLE VARIABLE CONDENSERS

Filed Dec. 6, 1932 2 Sheets-Sheet 1



INVENTOR.
Samuel Cohen,
BY John L. Brady
ATTORNEY.

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FIG. 8

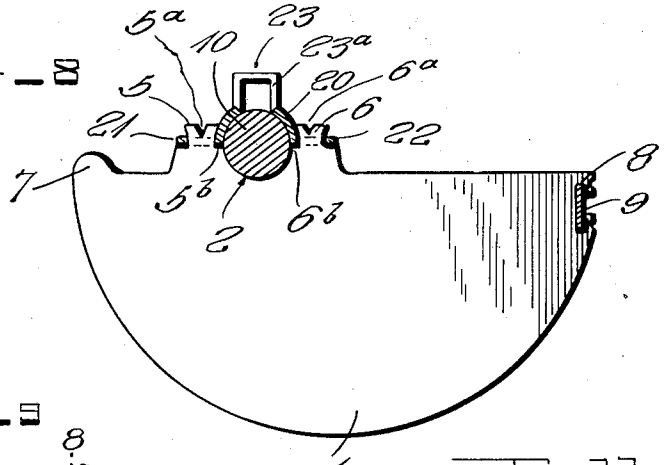


FIG. 9

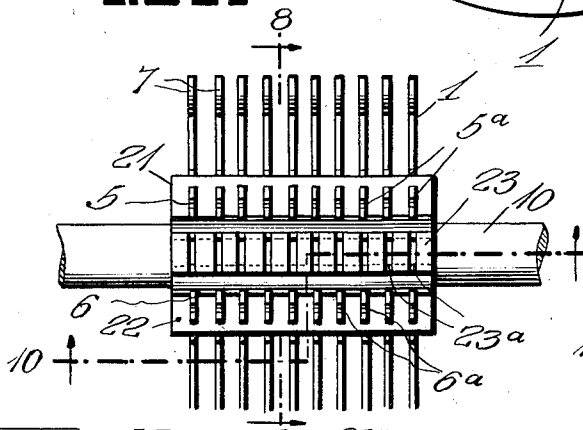


FIG. 12

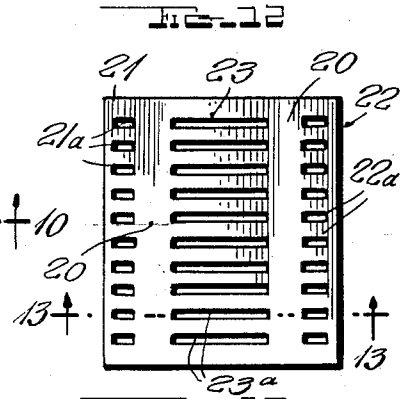


FIG. 10

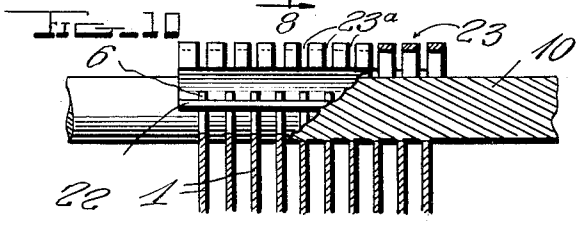


FIG. 13

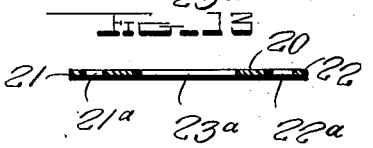


FIG. 11

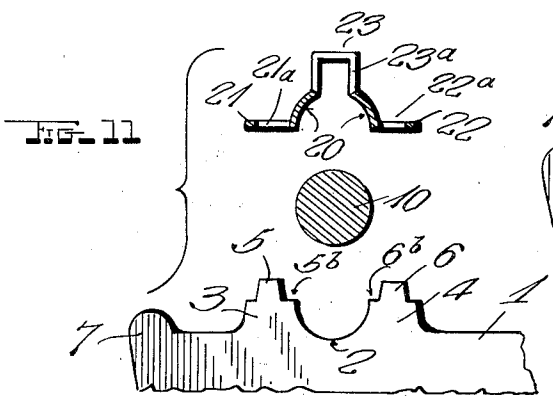
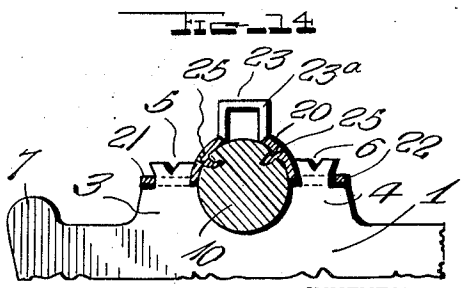


FIG. 14



INVENTOR.
Samuel Cohen,
BY
John B. Brady
ATTORNEY.

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MOUNTING FOR ROTOR PLATES OF MULTIPLE VARIABLE CONDENSERS

Samuel Cohen, Brooklyn, N. Y., assignor to General Instrument Corporation, New York, N. Y., a corporation of New York

Application December 6, 1932. Serial No. 646,009

10 Claims. (Cl. 175—41.5)

My invention relates broadly to variable electrical condensers and more particularly to a construction of rotor unit for variable electrical condensers.

One of the objects of my invention is to provide a simplified construction of rotor unit for variable electrical condensers which may be manufactured inexpensively on a quantity production basis.

Another object of my invention is to provide a method of mounting the rotor plates of a variable condenser which insures the uniform spacing of the rotor plates and the maintenance of such spacing throughout the operative life of the condenser.

Still another object of my invention is to provide a construction of rotor unit for variable condensers in which the rotor plates are secured to the rotor shaft by means of a special form of comb which embraces the rotor shaft and is secured to lugs extending from the rotor plates on opposite sides of the rotor shaft.

A further object of my invention is to provide a special construction of comb adapted to embrace one portion of a rotor shaft for securing the rotor plates in predetermined spacial relation with respect to another portion of the rotor shaft.

A still further object of my invention is to provide a method of and construction for mounting the rotor plates of a variable condenser with respect to a rotor shaft in which the rotor unit is welded to the rotor shaft.

Other and further objects of my invention reside in the construction of and method for mounting rotor plates of a multiple unit variable condenser as set forth in the specification hereinafter following and illustrated in the accompanying drawings, wherein:

Figure 1 is an elevational view of one of the rotor plates of a variable condenser showing the rotor shaft and plate securing means in cross section; Fig. 2 is a plan view of the plate securing means in position on the rotor shaft, the plates which are mounted with respect to the shaft being broken away at one side thereof; Fig. 3 is an elevational view of the rotor shaft illustrated in Fig. 2, with part of the shaft, rotor plates and plate securing means broken away and illustrated in section on line 3—3 of Fig. 2; Fig. 4 is a perspective view of the parts constituting one of the rotor units, the rotor plates being illustrated as a group spaced away from a section of the rotor shaft which is in turn spaced away from a portion of the comb which embraces the shaft; Fig. 5 is a plan view of the blank which is shaped to constitute the comb, the blank being illustrated on a reduced scale to illustrate the general contour thereof before the comb is formed therefrom; Fig. 6 is a cross sectional view taken through the blank illustrated in Fig. 5 on line 6—6 of Fig. 5; Fig. 7 is a side elevation with parts broken away and shown in longitudinal section illustrating the comb spot welded to the rotor shaft; Fig. 8 is a transverse, vertical sectional view taken on line 8—8 of Fig. 9 showing a modified form of my improved condenser construction; Fig. 9 is a top plan view; Fig. 10 is a longitudinal sectional view taken substantially on lines 10—10 of Fig. 9; Fig. 11 is a sectional view showing the various units comprising the improved condenser in transverse section and all of the parts arranged in juxtaposition to each other; Fig. 12 is a plan view of the blank of the comb shown in Figs. 8–11; Fig. 13 is a transverse vertical sectional view taken on line 13—13 of Fig. 12; and Fig. 14 is a transverse vertical section showing the rotor plates secured to the comb and the latter spot welded to the rotor shaft.

My invention is directed to a method of forming rotor units for variable condensers by which such units may be constructed inexpensively on a quantity production basis. Heretofore in the art it has been proposed to assemble rotor plates of a variable condenser by means of a rod and washer construction which is a time consuming and expensive process. It has been proposed to mount rotor plates at spaced grooves formed in a bushing, which bushing is secured to a rotor shaft by set screws. This process requires substantial time in assembly and is relatively expensive. It has also been proposed to cast the rotor shaft about the edges of the rotor plates, which process is both impractical on a quantity basis and involves substantial expense in production process. It has heretofore been proposed to mount the edges of the rotor plates in grooves formed in the rotor shaft and then expand the material of the rotor shaft to secure the rotor plates in position. This has been an unsatisfactory mechanical process for quantity production.

My invention departs radically from all prior practices and establishes an inexpensive method of mounting rotor plates with respect to a rotor shaft in such form as will insure the precision spacing of the rotor plates and will insure the maintenance of such spacial relation throughout the operative life of the variable condenser. I have shown two embodiments of my invention but it will be understood that the disclosures

herein are to be regarded in the illustrative sense and not in the limiting sense. In one form of my invention I provide a multiplicity of uniformly spaced grooves in the rotor shaft. The rotor plates are each shaped at their edges to fit into the grooves and conform with the shape of the grooves disposed in the rotor shaft. The rotor plates are provided with lugs projecting therefrom on opposite sides of the rotor shaft. A special form of comb is shaped to embrace the rotor shaft and the grooves formed therein. The comb is provided with a multiplicity of slots through which the lugs on the rotor plates extend. These lugs are clinched over the slots under such pressure that the rotor plates are mechanically bound to the rotor shaft in a rigid manner. The rotor units thus formed may be spot welded to the rotor shaft, although in many instances the frictional grip between the rotor shaft and the comb is so great that spot welding can be eliminated. In another form of my invention I may eliminate the plurality of grooves formed in the rotor shaft and heretofore referred to. In this arrangement the edges of the rotor plates are recessed so that the rotor plates accurately conform at the recesses to the contour of the rotor shaft. The special construction of comb employed in this arrangement has a portion which directly conforms to the contour of the shaft and is provided with slotted portions on opposite sides of the shaft through which lugs projecting from opposite sides of the recesses in the rotor plates project and are clinched for securing the rotor plates in accurate spaced relation.

Referring to the drawings in more detail, Fig. 1 shows the rotor plate in elevation as indicated by reference character 1. The rotor plates are provided with recesses 2 at the diametrical edge thereof. The recessed portion of the rotor plate 1 is provided with projecting portions on opposite sides of the recessed portion as represented at 3 and 4. The projections 3 and 4 are each provided with lugs 5 and 6 extending therefrom as shown. The rotor plate 1 is provided at one extremity with a projecting lug portion 7 and at the opposite extremity with a bracing strip 9 set within aligned grooves 8 provided in the edges of the rotor plate. The rotor shaft is illustrated at 10. As shown more clearly in Figs. 2 and 3, the rotor shaft is provided with groups of grooved portions. The groups of grooved portions in shaft 10 are shown spaced one from the other by the relatively wide annular groove 14. The grooved portions of the shaft each have annular grooves 11 formed therein spaced by intermediate portions 12. Intermediate portions 12 are of a uniform size insuring the accurate and uniform spacing of the rotor plates constituting the rotor unit. The grooves 11 are of a uniform depth and receive the recessed edge 2 of the rotor plate 1 as illustrated in Fig. 1.

I provide a special form of comb comprising a plate having an intermediate cylindrical shaped portion 15 and laterally extending portions 16 and 17. The comb is provided with a multiplicity of aligned slots 16*a* and 17*a* on opposite sides of the cylindrical portion 15. The lugs 5 and 6 project through the slots 16*a* and 17*a* and are clinched under pressure as represented by the notches 5*a* and 6*a* to secure the comb in intimate bonded relation with the rotor shaft. The cylindrical portion 15 of the comb is drawn tightly against the intermediate portions 12 of the rotor shaft 10 while the recesses 2 of rotor plate 1 are drawn tightly within the grooves 11 in the rotor shaft 10.

As shown in Figs. 5 and 6, the comb is formed from a flat plate which has the aligned row of apertures 16*a* and 17*a* in the extreme outer portions 16 and 17 thereof punched along parallel axes on opposite sides of the center of the plate and adjacent the opposite remote edges of the plate. In the form of my invention illustrated in Figs. 1–7, I have shown a plurality of spaced grooves formed in the rotor shaft. I may secure the unit in position by a welding process by spot-welding the comb 15 to the intermediate portions 12 between the grooves 11 as represented at 16 in Fig. 7.

In the form of my invention illustrated in Figs. 8—14, I have shown these grooves eliminated and the rotor plates directly secured against the rotor shaft and maintained in spaced relation by a modified form of comb. In this arrangement, the recesses 2 provided in the edges of the rotor plate has a similar arrangement of projections 3 and 4 on each side thereof and a similar arrangement of lugs 5 and 6 connected therewith as heretofore described in connection with the form of the invention shown in Figs. 1–7. However, in the modified arrangement, the lugs 5 and 6 are offset from the opposite sides of shaft 10 only by the distances 5*b* and 6*b* equal to the thickness of the comb 20. In the prior construction, lugs 5 and 6 were disposed on opposite sides of recesses 2 and spaced therefrom for distances equal not only to the thickness of the comb 15 but also to the depth of the groove 11. Inasmuch as in the modified construction, the comb 20 directly conforms to the contour of the shaft 10, the lugs 5 and 6 are only spaced at opposite sides of recesses 2 for distances equal to the thickness of the comb 20.

The form of comb employed in the modified construction of Figs. 8–14 is illustrated in its original blank form in Figs. 12–13. The central portion of the blank is shown at 23 having lateral extensions 21 and 22 thereon. These lateral extensions are provided with aligned slots 21*a* and 22*a* for receiving lugs 5 and 6 of rotor plate 1. The central portion 23 of the blank is provided with laterally extending slots 23*a* aligned with the slots 21*a* and 22*a*. The comb is pressed to shape in the form illustrated clearly in Fig. 11 in which the central portion 23 is left upstanding to provide a tool engaging means during the assembly process. That is to say, the projecting central portion 23 provides a convenient means for securing the comb in position for the assembly of the rotor plates with respect thereto on the opposite side of the shaft. The laterally extending flanges 21 and 22 in the comb 20 provides securing means for the lugs 5 and 6 on the rotor plate 1. The comb is set directly against the surface of shaft 1 while the recessed edges 2 of the rotor plates 1 are set directly against the opposite surface of rotor shaft 10, enabling lugs 5 and 6 to be passed through slots 21*a* and 22*a* in comb 20 and clinched thereover as represented at 5*a* and 6*a* for rigidly securing the rotor plates 1 in uniformly spaced planes normal to the axes of shaft 10. The comb may be maintained in intimate contact with the surface of shaft 10 by virtue of the pressure which is developed by the clinching of lugs 5 and 6 or the comb may be welded to shaft 10 as represented at 25 in Fig. 14.

I have found the rotor assembly of my invention as described herein highly practical in its construction and adaptable to quantity produc-

tion processes at minimum expense. The assembled rotor has been found to be electrically efficient in its operation. While I have described the rotor structure of my invention in one of its preferred embodiments, I desire that it be understood that modifications may be made and that I intend no limitations upon my invention other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a rotor unit for variable condensers, a rotor shaft, a multiplicity of rotor plates, each of said rotor plates having a semi-circular recess in one edge thereof and having projections formed on said plates and extending on opposite sides of said rotor shaft, a lug extending from each of said projections, and a comb conforming to the contour of said rotor shaft and projecting on opposite sides thereof in a plane substantially aligned with a diametrical line through said shaft and in engagement with the lugs on said rotor plates for maintaining said rotor plates in rigid spacial relation in planes normal to the axis of said rotor shaft.

2. A rotor unit for variable condensers comprising a rotor shaft, a multiplicity of rotor plates each having a recess in one edge thereof conforming to the contour of said rotor shaft and embracing said rotor shaft, projections on said rotor plates extending on opposite sides of said rotor shaft, lugs extending from said projections, a comb having a central portion and slotted edge portions, said central portion being shaped to conform with the peripheral surface of said rotor shaft and said slotted portions engaging said lugs for securing said rotor plates in uniform spacial relation in planes normal to the axis of said rotor shaft.

3. In a rotor unit for variable condensers, a rotor shaft, a plurality of rotor plates disposed in spaced relation, each of said rotor plates having a recess formed in one edge thereof and embracing said rotor shaft, projections on each of said rotor plates on opposite sides of the recess therein, lugs extending from said projections, a comb comprising a plate extending around said shaft in a position opposite the engagement of the recess in each of said plates with said shaft and having lateral projections thereon, said lateral projections having aligned slots adjacent each edge thereof for receiving the lugs on said rotor plates, said lugs being clinched over the lateral extensions of said comb for securing and maintaining said rotor plates in uniform spaced relation in planes normal to the axis of said rotor shaft.

4. In a rotor unit for variable condensers, a rotor shaft, a plurality of rotor plates disposed in spaced relation, each of said rotor plates having a recess formed in one edge thereof and embracing said rotor shaft, projections on each of said rotor plates on opposite sides of the recess therein, lugs extending from said projections, a comb comprising a plate extending around said shaft in a position opposite the engagement of the recess in each of said plates with said shaft and having lateral projections thereon, said lateral projections having aligned slots adjacent each edge thereof for receiving the lugs on said rotor plates, said lugs being clinched over the lateral extensions of said comb for securing and maintaining said rotor plates in uniform spaced relation in planes normal to the axis of said rotor shaft, and a welded connection between said comb and said rotor shaft.

5. In a rotor unit for variable condensers, a rotor shaft, a plurality of rotor plates disposed in spaced relation, each of said rotor plates having a recess formed in one edge thereof and embracing said rotor shaft, projections on each of said rotor plates on opposite sides of the recess therein, lugs extending from said projections, a comb comprising a plate extending around said shaft in a position opposite the engagement of the recess in each of said plates with said shaft and having lateral projections thereon, said lateral projections having aligned slots adjacent each edge thereof for receiving the lugs on said rotor plates, said lugs being clinched over the lateral extensions of said comb for securing and maintaining said rotor plates in uniform spaced relation in planes normal to the axis of said rotor shaft, and a tool engaging portion formed centrally of said comb.

6. In a rotor unit for variable condensers, a rotor shaft, a plurality of rotor plates disposed in spaced relation, each of said rotor plates having a recess formed in one edge thereof and embracing said rotor shaft, projections on each of said rotor plates on opposite sides of the recess therein, lugs extending from said projections, a comb comprising a plate extending around said shaft in a position opposite the engagement of the recess in each of said plates with said shaft and having lateral projections thereon, said lateral projections having aligned slots adjacent each edge thereof for receiving the lugs on said rotor plates, said lugs being clinched over the lateral extensions of said comb for securing and maintaining said rotor plates in uniform spaced relation in planes normal to the axis of said rotor shaft, and a laterally slotted tool engaging portion formed centrally of said comb.

7. In a rotor unit for variable condensers, a rotor shaft, a plurality of rotor plates disposed in spaced relation, each of said rotor plates having a recess formed in one edge thereof and embracing said rotor shaft, projections on each of said rotor plates on opposite sides of the recess therein, lugs extending from said projections, a comb comprising a plate extending around said shaft in a position opposite the engagement of the recess in each of said plates with said shaft and having lateral projections thereon, said lateral projections having aligned slots adjacent each edge thereof for receiving the lugs on said rotor plates, said lugs being clinched over the lateral extensions of said comb for securing and maintaining said rotor plates in uniform spaced relation in planes normal to the axis of said rotor shaft, and an angularly disposed offset projection connected with the central portion of said comb diametrically opposite the center of the recess in said rotor plate and forming a tool engaging member for said comb.

8. A rotor unit for variable condensers comprising a rotor shaft, said rotor shaft including a multiplicity of uniformly spaced annular grooves, a plurality of rotor plates each having a semi-circular shaped recess in one edge thereof projecting into the annular grooves in said shaft, and a strap device extending around one side of said rotor shaft and in intimate contact therewith and engaging the edges of said rotor plates on opposite sides of the recess therein in a position substantially aligned with a diametrical line through said shaft for effecting a rigid connection between said rotor plates and said rotor shaft and main-

taining said rotor plates in planes normal to the axis of said shaft.

9. A rotor unit for variable condensers comprising a rotor shaft, a multiplicity of rotor plates each having a semi-circular recess in one side thereof and having projections on opposite sides of said recess and lugs extending from said projections, said rotor shaft having uniformly spaced annular grooves therein, each adapted to receive the recessed edge of a rotor plate, a bonding member extending around the opposite side of said shaft, said bonding member having laterally extending portions slotted to receive the lugs extending from the projections on said plates, said lugs being clinched over the slots in said bonding member for maintaining said rotor plates in spaced relation in planes normal to the axis in said rotor shaft.

10. A rotor unit for variable condensers comprising a rotor shaft, a multiplicity of rotor plates each having a semi-circular recess in one side thereof and having projections on opposite sides of said recess and lugs extending from said projections, said rotor shaft having uniformly spaced annular grooves therein each adapted to receive the recessed edge of a rotor plate, a semi-cylindrical plate having diametrically projecting flanges thereon, said semi-circular plate being secured in intimate contact with the portion of said rotor shaft opposite the portion into which the recessed edges of said rotor plates extend, the diametrically projecting flanges on said semi-cylindrical plate being slotted for the passage of the lugs on said rotor plates therethrough, the lugs on said rotor plates being clinched over said slots for securing said rotor plates in planes normal to the axis of said rotor shaft.

SAMUEL COHEN.