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ELECTRICAL RECTIFYING APPARATUS

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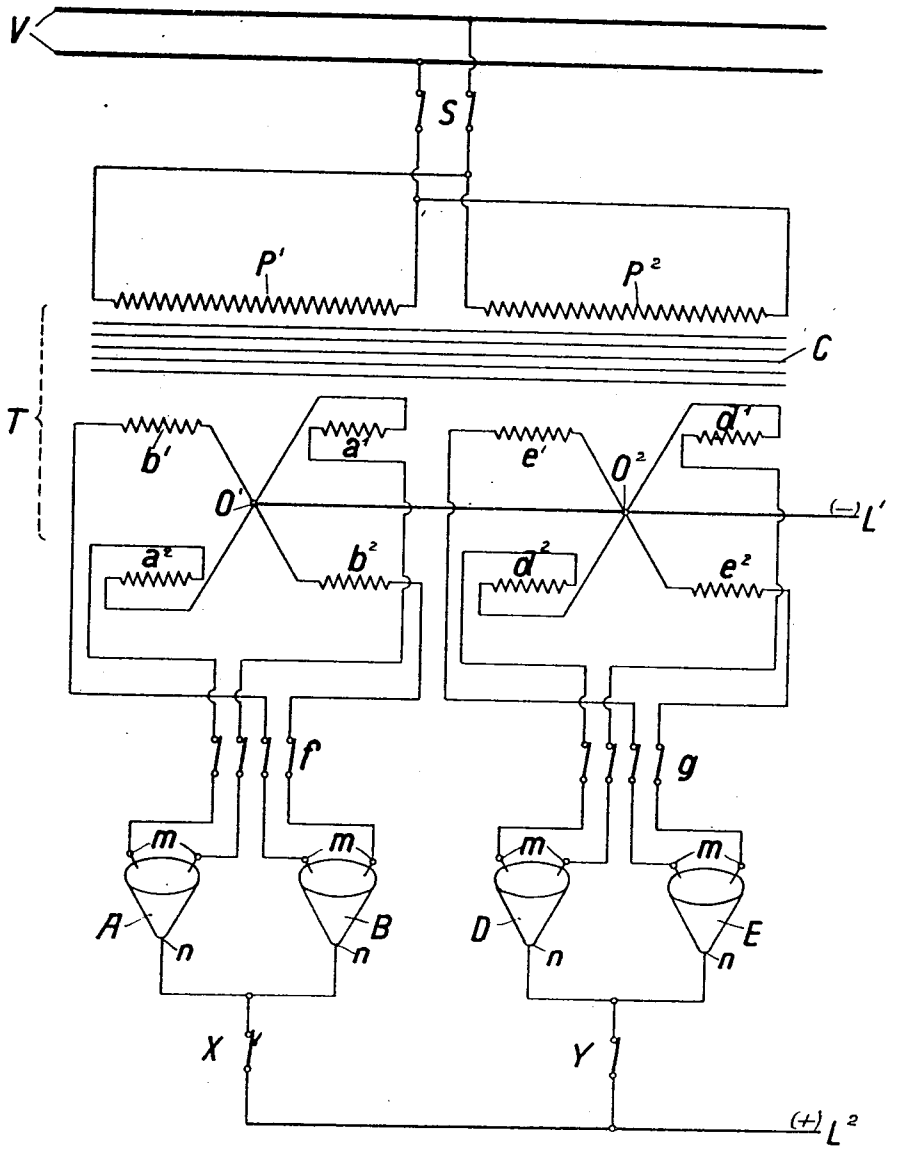

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UNITED STATES PATENT OFFICE.

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ELECTRICAL RECTIFYING APPARATUS.

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This invention relates to apparatus for the rectification of alternating to direct current and pertains particularly to rectifiers of the mercury vapour type. It is concerned with the distribution of the impressed current among a plurality of rectifiers and a plurality of groups of rectifiers in such fashion as to enable them to function properly when operating in parallel.

The general object of the invention is the provision of an arrangement of apparatus whereby there will be an equal distribution of impressed current among the respective rectifiers of associated groups, and at the same time permit the cutting out of one or more of the groups without affecting the voltage of the remaining group or groups, for the ultimate purpose of maintaining uniformity of voltage in the output of the installation while permitting a desired variation in its current output.

Another object is the simplification and reduction in cost of apparatus for the operation of a plurality of groups of rectifiers, in an installation wherein it may be desirable to vary the current output to meet varying demands.

Other and further objects will be indicated or pointed out hereinafter or obvious to one skilled in the art upon an understanding of the invention.

In the drawing forming a part of this specification I show diagrammatically one arrangement of apparatus embodying the invention, but the same is presented for illustration only and is not to be accorded any interpretation having the effect of limiting the claims short of the true and most comprehensive scope of the invention in the art.

The drawing is a diagrammatic illustration of an installation comprising two groups of mercury vapour rectifiers arranged for operation in parallel.

For the purpose of best utilizing the impressed energy and obtaining uniformity in the output of asymmetric rectifiers it is customary to use a plurality of them energized from respective secondary windings of a transformer and delivering their output to the same line. In order that they may function properly it is necessary that they be supplied with current equally. It is apparent that an arrangement which would give an equal distribution of current when all of the rectifiers were working would be thrown off balance by the cutting out of some of the rectifiers, with the result that there would be a substantial drop of voltage in those remaining in operation. In order to avoid this without complication or duplication of apparatus, I provide an arrangement such as illustrated by that shown in the drawing. Here are illustrated two groups of mercury vapour rectifiers, one group comprising the two rectifiers designated A and B respectively, and the other group comprising those designated D and E respectively. The respective rectifiers have the anodes m and cathodes n, the cathodes of the first group being connected to the positive ontput line L^2 through the switch X, and the cathodes of the second group being likewise connected to that line through the switch Y. Both groups of rectifiers are energized from a transformer T having the core C. This transformer is provided with two primary windings p^1 and p^2 which are connected in parallel through the switch S to the alternating current lines V. The transformer includes a secondary winding for the rectifier A having the sections a^1 and a^2 connected to respective anodes, and a secondary winding for the rectifier B having the sections b^1 and b^2 for the respective anodes. These windings are arranged so that the sections which take current simultaneously are uniformly distributed over the whole primary winding p^1 so as to fully compensate the same. Likewise, the transformer includes a secondary winding d^1 and d^2 for the rectifier D, and a secondary winding e^1 and e^2 for the rectifier E, each of said windings being arranged so that the simultaneously energized sections are uniformly distributed over the whole of the primary winding P^2. The connections of the secondary windings for the anodes of the first group are through the double switch f, and those to the anodes of the second group through the double switch g. The middle points O^1 and O^2 of all of the secondary windings are connected to the negative wire L^1 of the direct current system. It will be seen, therefore, that the secondaries of each group are so arranged that all the winding sections which carry current simultaneously are uniformly distributed over the whole length of their associated primary

windings, with the result that the primary ampere turns are fully compensated, with the exception of the comparatively small fraction required to cover magnetization and losses. As a result, there is obtained a uniform distribution of current between the rectifiers of the respective groups, since, if one rectifier begins to take a smaller current, the primary ampere turns of the transformer no longer will be fully compensated by the corresponding secondary winding and a leakage field will be induced in the transformer. This will have the effect of reducing the voltage on the fully loaded rectifier of the group, while the voltage on the one taking the reduced current will be raised. The construction permits any group or groups of rectifiers to be cut in or cut out of service without affecting the operation of those remaining or disturbing the uniform distribution of current among the rectifiers of the active group. For example, if the switch f is opened, the current, except for a small fraction, ceases to flow in the primary winding P^1, while primary winding P^2 still carries its full load current, and the windings d^1 and d^2 and e^1 and e^2 continue to supply rectifiers D and E without interruption or disturbance. Thus, with a single transformer I am able to supply a plurality of groups of rectifiers and permit variation in the quantity output of the installation as desired, by the cutting in or cutting out of the groups selectively, while maintaining the desired equal distribution of current to the respective rectifiers and the desired uniformity of output voltage.

What I claim is:

1. Rectifying apparatus comprising, in combination, a plurality of groups of rectifiers, a transformer common to and supplying said groups, said transformer including a plurality of parallel primary windings and secondary windings for the corresponding input electrodes of the respective rectifiers, each of said secondary windings being uniformly distributed over its associated primary winding.

2. Rectifying apparatus comprising, in combination, a plurality of groups of rectifiers, a transformer common to and supplying said groups, said transformer including a plurality of parallel primary windings arranged side by side and secondary windings for the corresponding input electrodes of the respective rectifiers, the sections of said secondary windings which carry current simultaneously being uniformly distributed over their associated primary windings.

3. Rectifying apparatus comprising, in combination, a plurality of groups of rectifiers, an output line supplied by said rectifiers in common, means for disconnecting individual groups from said line, a transformer common to and supplying the rectifiers, said transformer comprising parallel primary windings for the respective rectifiers and secondary windings having sections for current of different polarity, the sections of the secondary windings which carry current simultaneously being uniformly distributed over their associated primary windings and compensating same.

4. Rectifying apparatus, comprising, in combination, a plurality of groups of rectifiers, the D. C. electrodes of the rectifiers in respective groups being connected, an output line supplied by said groups in common, means for disconnecting respective groups from said line, a transformer common to and supplying said groups of rectifiers, said transformer comprising parallel primary windings, one for each group, and secondary windings connected to corresponding electrodes of the respective rectifiers, the simultaneously active secondary windings of each group compensating the primary winding of such group, and means for disconnecting the rectifiers of respective groups from their secondary windings.

5. Rectifying apparatus comprising, in combination, a plurality of groups of rectifiers each having a plurality of anodes, an output line supplied by said rectifiers in common, and a transformer common to and supplying said groups of rectifiers, said transformer comprising a primary and a secondary winding for each group, each of said secondary windings being divided into sections connected to and energizing respective anodes of the associated group, the simultaneously energized secondary sections compensating the associated primary windings.

In testimony whereof I have hereunto subscribed my name at Zurich, Switzerland, on the 4th day of March, A. D. 1926.

JOHANNES KÜBLER.