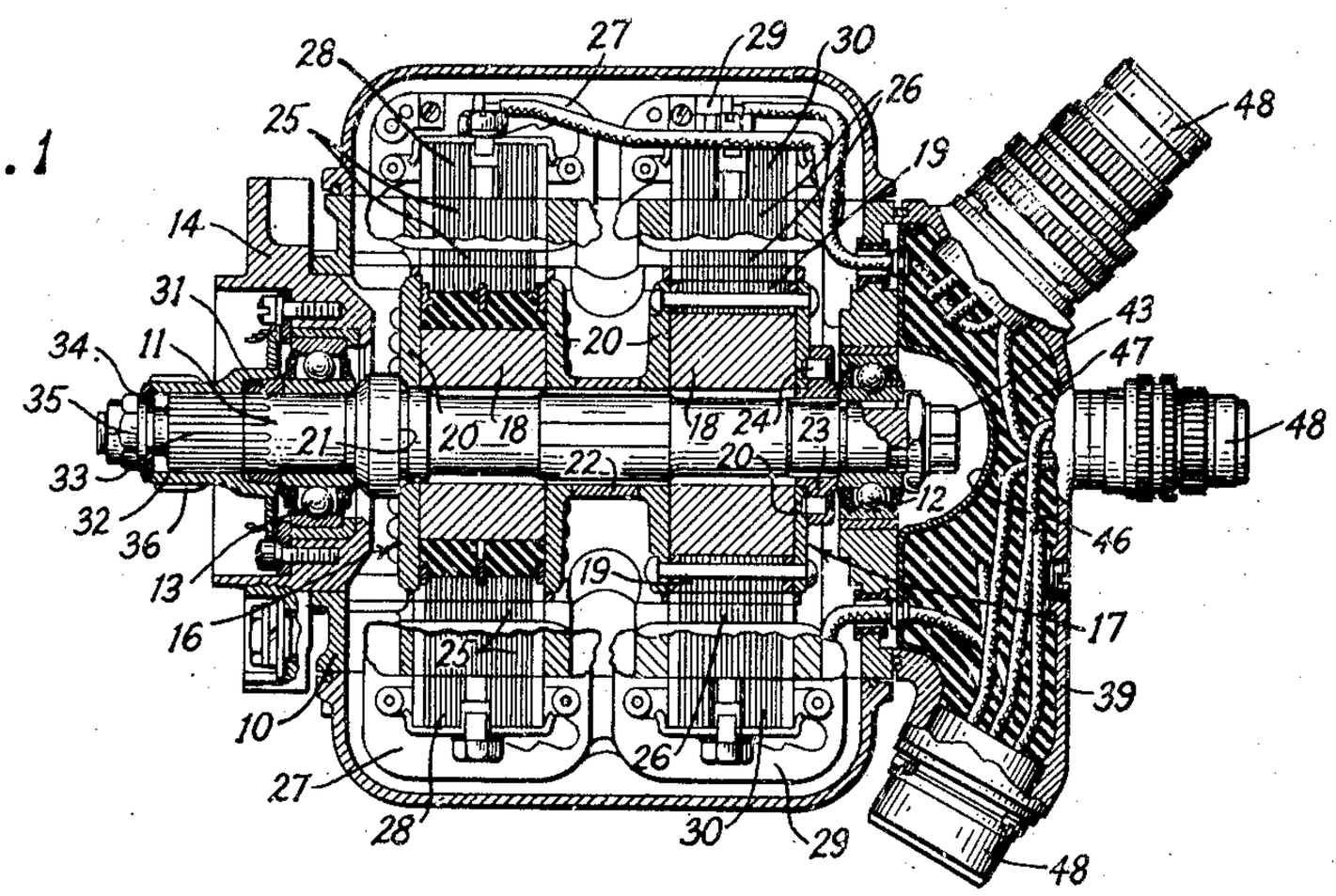
Oct. 4, 1949. R. M. PURDY 2,483,667

MAGNETO

Filed April 24, 1944

Fig. 1



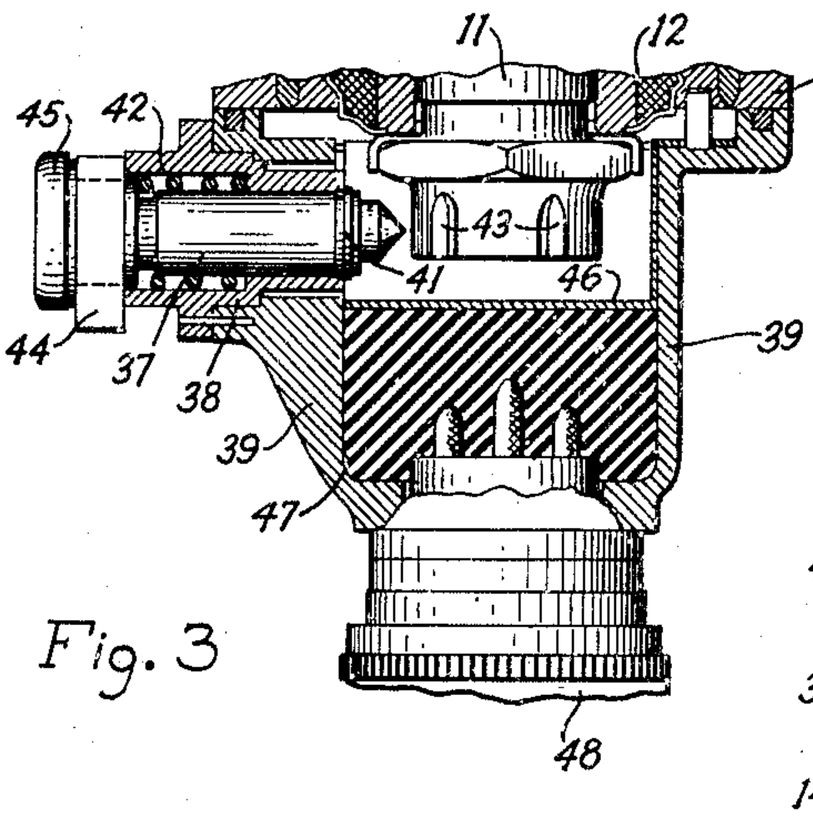




Fig. 3

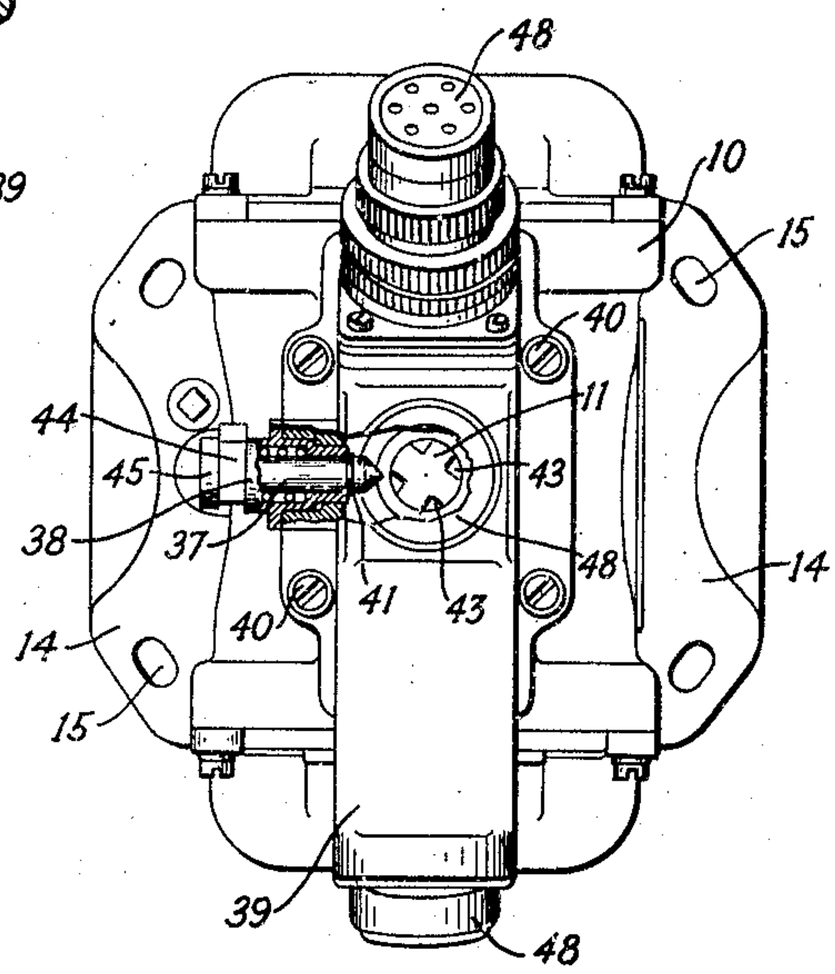



Fig. 2

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## MAGNETO

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12 Claims. (Cl. 171—209)

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This invention relates to ignition apparatus and more particularly to means for generating electrical energy of a character adapted to satisfy the requirements of the ignition system of an internal combustion engine, or the like.

One of the objects of the present invention is to provide a novel magneto generator which will produce desired electrical impulses in rapid timed succession without unduly taxing or overloading any of the parts thereof.

Another object of the invention is to provide novel apparatus of the above character which is so constructed as to facilitate the timing thereof in relation to the engine on which the same is installed.

Still another object is to provide novel means in combination with a magneto generator whereby proper mounting thereof on an internal combustion engine is facilitated.

A further object of the invention is to provide a magneto generator embodying novel means for coupling and securing the same to an internal combustion engine whereby proper timing of the engine and magneto may be insured with a minimum of space in which to adjust the position of the magneto structure.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a side elevation view, mostly in section and with parts broken away, illustrating one form of magneto generator embodying the present invention;

Fig. 2 is an end elevation of said magneto generator, as viewed from the right in Fig. 1 and with parts broken away to show novel means for positioning the magneto rotor for timing purposes; and

Fig. 3 is a detail sectional view, with parts broken away, illustrating said novel means on a larger scale.

Only a single embodiment of the invention is illustrated, by way of example, in the accompanying drawings in the form of a magneto generator adapted for use on a dual ignition high

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speed engine having a large number of cylinders. As shown, said embodiment comprises a main casing member 10 having suitable laminated stator poles embedded therein in accordance with the well-known practice in this art. Rotatable shaft 11 is journalled in a bearing 12 mounted in one end wall of said casing member and a bearing 13 in a flanged end plate 14, which is suitably secured in an opening in the other end wall of said casing member. If desired, a suitable oil seal, such as the one illustrated in copending application Serial No. 444,203, filed May 23, 1942, now Patent No. 2,392,998, may be mounted in end plate 14 adjacent bearing 13 to prevent the flow of oil into the magneto casing from the engine crankcase.

As best seen in Fig. 2, the flange or end plate 14 is provided with four arcuate slots 15 through which threaded bolts may extend for adjustably securing the apparatus to the casing of an engine. The arcuity of slots 15 and the positions thereof with respect to shaft 11 are such as to permit angular adjustment of casing 10, 14 about the axis of rotation of the shaft. The length of the slots is preferably such as to permit an angular adjustment of approximately three degrees.

For the purpose of producing electrical impulses in rapid succession without overtaxing the ignition coils and circuit breakers and for otherwise enhancing the operating efficiency of the ignition system, of which the illustrated apparatus forms a part, two independent magnetic rotors or flux distributors 16 and 17 are mounted on and rigidly secured to shaft 11 for rotation therewith. The rotors 16 and 17 are preferably substantially identical and, as shown, each includes a permanent four pole magnet 18 with the poles thereof arranged circumferentially. Each pole has a laminated pole shoe 19 associated therewith and held in proper relation thereto by non-magnetic end plates 20, 20 which also support the magnet and pole shoes in spaced relation to shaft 11. Rotors 16 and 17 are connected to shaft 11 for rotation therewith through end plates 20 which are keyed or otherwise suitably connected with said shaft. The axial position of the rotors is determined by a shoulder 21, or the like, on shaft 11, a spacer sleeve 22 and a nut 23 threaded onto shaft 11 and locked against rotation thereon by a pin 24, or other suitable means. The rotors may, for example, be constructed and mounted on the shaft in the manner disclosed in Tognola Patent No. 2,255,477. For reasons to appear hereafter, rotor 16 is preferably mounted on shaft 11 with its poles in stag-

gered relation with respect to the poles of rotor 17. In the present embodiment, therefore, one rotor is angularly offset 45 degrees with respect to the other.

Rotors 16 and 17 are operatively associated in a manner well-known in the art with diametrically disposed pairs of stator poles 25 and 26, respectively, which may be embedded in the cast casing 10, as heretofore pointed out. A coil 27 having a laminated core 28 is operatively magnetically connected with each pair of stator poles 25, 25 and a coil 29 having a laminated core 30 is operatively magnetically connected with each pair of stator poles 26, 26. Thus, during rotation of shaft 11, rotor 16 will be effective to simultaneously energize coils 27, 27, the energy induced in said coils reaching a peak or maximum four times during each revolution of the shaft. Coils 29, 29 will likewise be similarly simultaneously engaged and energized by rotor 17, but, with respect to time and by reason of the staggered relation of the rotors, the energy peaks in coils 29 will occur between the energy peaks in coils 27. It will thus be seen that eight sets of two simultaneous sparks may be produced at equal intervals during each revolution of the shaft by connecting the coils 27, 29 with suitable breaker mechanisms and sparking devices in a manner well-known in the art. If desired, the timing of the energy peaks in coils 27, with respect to the energy peaks in coils 29, may be varied by changing either the angular relationship of the rotors 16 and 17 or the relationship of the respective stators associated therewith.

Novel means are provided for drivably connecting shaft 11 to an operating member of an engine (not shown) for rotation thereby, said connecting means having a novel relationship to the remaining magneto structure so that a minimum of space is required for adjusting the magneto and the engine. As shown, said means preferably but not necessarily comprises a tapered split sleeve 31 freely mounted on shaft 11 adjacent bearing 13 and adapted to be pressed into frictional driving engagement with the shaft by the internally-tapered enlarged end of a second sleeve 32. The other end of the latter sleeve is provided with equally spaced internal splines which mesh with splines 33 on shaft 11 to provide a positive driving connection. Sleeve 32 may be held against axial movement on shaft 11 by a washer 34 and a nut 35 which has threaded engagement with the shaft. When sleeve 32 is forced to the right, as viewed in the drawings, by nut 35 the same is effective to contract split sleeve 31 into frictional driving engagement with shaft 11, thereby relieving splines 33 of all or a substantial part of the load.

The outer surface of sleeve 32 is also provided with a plurality of equally spaced splines or teeth 36 for operative engagement with an internally splined member or gear driven by the engine. The number of splines either on the interior or exterior surface of sleeve 32 is so chosen that it is not divisible by the number of poles on the magnetic rotors, i. e., the number of splines is so chosen that it is not a multiple of four in the present instance. In the illustrated structure, the number of splines employed is preferably one greater than some number which is divisible by four, such as thirty-three, for example. Thus, for purposes of timing the magneto with respect to the engine when the magneto is being mounted thereon, the angular distance between corresponding faces of successive splines may, in effect, be reduced by 75 per cent by choosing the most advantageous rotor position, i. e., the maximum angular discrepancy may be readily reduced to less than 25 per cent of the pitch of said splines. For example, if thirty-three splines 36 are employed, an adjustment of slightly less than 11 degrees may be effected by moving sleeve 32 a distance of one spline relative to the engine member, rotating the entire magneto unit through the angular distance between successive splines 36 and then re-engaging said sleeve with the engine member. Since the four pole rotor 16, for example, has four equally spaced E-gap or firing positions, as is well understood in the art, and since the number of splines 36, for example, is not divisible by four, movement of the rotor through 90 degrees from one firing position to the next and relative to the engine member with which sleeve 32 meshes will render it necessary to rotate the entire magneto unit an angular distance equal to one-fourth the angular distance between said splines before sleeve 32 and the engine member may be re-engaged. Accordingly, by choosing the proper one of the four firing positions of one of the rotors when mounting the magneto structure on the engine, one of the engine cylinders being in firing position, the maximum timing discrepancy between the engine and magneto is reduced to a relatively small angle. Accurate timing may then be attained by effecting a small angular adjustment of casing 10, 14 and, hence, stators 25 and 26 around shaft 11 and rotors 16, 17 relative to the engine. This latter adjustment is permitted by arcuate slots 15 in the securing flange of end plate 14. Since the maximum extent of this final adjustment may be reduced to a relatively small angle, it will be seen that the space required for the magneto may be likewise reduced. In the structure assumed above wherein the pitch of splines 36 is less than 11 degrees, the angular extent of slots 15 may be reduced to as little as 3 degrees and any final adjustment to be effected by bodily shifting the magneto casing around rotor 11 will be less than three degrees.

Novel means are also provided for quickly ascertaining the firing positions of one of the rotors 16 or 17 and for holding the same in any E-gap or firing position against the tendency of the permanent magnets to turn the rotor from such position. In the form shown, said means comprises a plunger 37 slidably mounted in a sleeve or cylinder 38 which is threaded into an opening in an end cover 39 for casing 10. Cover 39 may be secured to the casing by any suitable means, such as screws 40 (Fig. 2). Outward movement of said plunger, i. e., movement to the left as viewed in the drawings, is limited by some suitable means, such as a split snap ring 41, that engages a groove in plunger 37 and the inner end of cylinder 38. The plunger is normally held in its outermost position by spring 42. The inner end of the plunger is conical or wedge shaped for engagement with V-shaped slots 43 cut into the periphery of a projecting end of shaft 11. Four of these slots are provided, one for each pole of a rotor, said slots being so positioned on the shaft that when one of them is engaged by the inner end of plunger 37, one of the rotors 16 or 17, as per pre-selection, will be in one of its four firing positions. By pressing plunger 37 inwardly, the selected one of the rotors may be readily and quickly positioned in one of its firing positions and held in such position while the magneto is meshed with and securely mounted on an engine.

The angular relationship of the walls of slots **43** is such as to make it relatively easy to hold the rotor in a firing position by manually pressing on plunger **37** and yet be adapted to force the plunger out of the slot without sheering the end of it when the force of the engine is accidentally applied to shaft **11** when the plunger is engaged with the shaft. In order to prevent any accidental pressing of plunger **37**, a removable snap ring or clip **44** may be inserted around the plunger between the enlarged head **45** thereof and the outer end of cylinder or barrel **38**.

The electrical conductors which pass through cover **39** for connecting coils **27** and **29** to suitable circuit breakers, distributors, switches and the like, are protected from shaft **11** and plunger **37** by a channel shaped plate **46** which extends transversely across the channel shaped cover **39** and is secured to housing **10**, or said cover. The wire accommodating space in cover **39** may but need not necessarily be filled with a suitable insulating material **47** and the necessary electrical connections to these conductors may, if desired, be made through one or more sockets **48** of suitable plug and socket connectors, such as the "Cannon" plug type.

When mounting the above-described magneto on an engine, a selected one of the engine pistons is placed in its desired firing position, i. e., the position which it is in when the combustible charge in the same cylinder is ignited during engine operation. The rotor which fires the spark plugs in the cylinder in which said piston operates is then placed and held in one of its firing positions by means of plunger **37** and a slot **43**, and sleeve **32** is meshed with the engine member which drives it. If the securing bolts or studs on the engine do not pass through or near the center of slots **15**, the magneto is withdrawn and the next successive firing position of the rotor is chosen. When the rotor firing position is found which will cause the securing bolts on the engine to pass nearest the centers of slots **15**, the magneto may be secured in position on the engine casing by tightening the securing nuts or studs. If the mounting bolts or studs are thus caused to pass through arcuate slots **15** near the centers thereof, ample leeway is provided for further adjustment in either direction when operating conditions require it, such further adjustment being effected by loosening the securing studs or nuts and angularly adjusting casing **10** around shaft **11**.

Although only a single embodiment of the invention has been illustrated and described, it is to be expressly understood that the same is not limited thereto. For example, the novel means for drivably connecting the magneto to an engine may be used in other types of magnetos and either with or without the novel rotor positioning means. Additionally, either one or both of the rotors may have one stator and coil associated therewith and the coils may have either single or transformer windings, depending upon the particular ignition system in which the magneto is employed. The rotor magnets may also have more or less than four poles and the same may be axially magnetized with the pole shoes mounted thereon in any of many ways well known in the art. Various other changes, such as in the design and arrangement of parts illustrated may also be made without departing from the spirit and scope of the invention, as will now be readily apparent to those skilled in the art. For a definition of the limits of the invention, reference is had primarily to the appended claims.



What is claimed is:

1. A magneto generator comprising a housing, a shaft rotatably journalled in said housing, a mounting flange on said housing, said flange having elongated arcuate slots therein with the center of curvature thereof coincident with the axis of rotation of said shaft for receiving mounting bolts, two pairs of axially spaced stator poles in said housing, a pair of magnetic rotors on said shaft adapted to cooperate with said pairs of stator poles, said rotors having circumferentially spaced pole shoes and being secured to said shaft, an ignition coil associated with each pair of said stator poles, splined means on one end of said shaft for operatively coupling the latter with a driving member of an engine, the number of splines on said splined means being indivisible by the number of pole shoes on one of said rotors, a plunger slidably mounted in said housing and adapted to be moved into any one of a plurality of recesses on said shaft whereby one of said rotors may be held in any one of its "E" gap positions by said plunger, and resilient means for normally holding said plunger out of engagement with said shaft.

2. A magneto generator comprising a housing, a shaft rotatably journalled in said housing, means for mounting said housing on a support for angular adjustment about the axis of rotation of said shaft, a pair of stator poles in said housing, a magnetic rotor secured to said shaft, said rotor having a plurality of circumferentially arranged pole shoes adapted to cooperate with said stator poles, an ignition coil having a core joining said stator poles, means for coupling said shaft with a driving member including a splined member mounted on one end of said shaft, the number of splines on said member being several times greater than but indivisible by the number of pole shoes on said rotor, and manually operable means on said housing adapted to be moved into engagement with said shaft for holding said rotor in any one of several preselected positions relative to said stator poles.

3. In a magneto generator, a housing, means including a rotor journalled in said housing for generating electrical energy, a plunger slidably mounted on said housing and adapted to engage any one of a plurality of equally spaced recesses on the periphery of a portion of said rotor for holding the latter in preselected positions relative to said housing, and means for operatively connecting said rotor to driving means therefor including a plurality of equally spaced splines of uniform width on said rotor, the number of said splines being indivisible by the number of said recesses.

4. In a magneto generator, a housing, a flux distributing rotor journalled in said housing, means for mounting said housing on a support for limited angular adjustment about the axis of rotation of said rotor, means including a plurality of splines on said rotor for coupling the latter to a driving means therefor, and manually operable means on said housing and selectively engageable at the will of an operator with a recess in said rotor for holding said rotor in a preselected position relative to said housing.

5. In a magneto generator, a housing, an ignition coil, means including a magnetic flux distributing rotor journalled in said housing for periodically inducing current flow in said coil, and a plunger slidably mounted on said housing and

adapted to be engaged with spaced recesses on said rotor for holding the latter against rotation in said housing in any one of several preselected positions.

6. In a magneto generator, a housing, a coil, means including a magnetic flux distributing rotor for inducing a plurality of electrical impulses in said coil during each revolution of said rotor in normal operation, and means mounted on said housing and engageable at the will of an operator with any of a plurality of recesses in said rotor for holding the latter in preselected positions relative to said housing against the tendency of magnetism to move said rotor from said positions.

7. In apparatus of the class described, a housing, a magnetic flux distributing rotor journalled in said housing and having a plurality of circumferentially arranged pole shoes, means including a plurality of equally spaced splines of uniform width on said rotor for coupling the latter to driving means therefor, the number of said splines being one more or less than several times the number of said pole shoes, and manually operable means slidably mounted on said housing, said rotor having a plurality of circumferentially spaced recesses thereon for engagement by said last-named means whereby said rotor may be held in preselected positions relative to said housing, the number of said recesses being equal to the number of said pole shoes.

8. In a magneto generator, a housing, a magnetic flux distributor rotatably journalled in said housing, said rotor having a plurality of circumferentially arranged pole shoes, an element slidably mounted on said housing and adapted to be moved into engagement with said rotor for holding the latter in any one of several preselected positions relative to said housing, and resilient means for normally holding said element out of engagement with said rotor.

9. In a magneto generator, a casing, means inculding a flux distributing rotor journalled in said casing for generating electrical energy, said rotor having a portion of the shaft thereof extending through a wall of the casing, cover means removably secured to said wall, said means being divided into a chamber for the extending end of said shaft and a chamber for housing cables connected with said current generating means, and a plunger slidably mounted on said cover means and adapted to be moved into engagement with circumferentially spaced recesses in the extending portion of said shaft whereby said rotor may be held in preselected positions relative to said casing.

10. In apparatus of the class described, a casing, means including a flux distributing rotor journalled in said casing for generating electrical energy, said rotor having a portion of said shaft thereof extending through a wall of the casing, means secured to said wall for housing the extending portion of said shaft, and a plunger slidably mounted on said last-named means and adapted to be moved into engagement with circumferentially spaced grooves in said extending portion of the shaft whereby said rotor may be held in preselected positions relative to said casing.



11. In apparatus of the class described, a casing, means including a flux distributing rotor journalled in said casing for generating electrical energy, said rotor having an end portion of the shaft thereof extending through a wall of said casing, cover means secured to said wall to thereby form a chamber for the extending end of said shaft, and means slidably mounted on said cover means and adapted to be moved into engagement with at least one recess in the extending end portion of said shaft whereby said rotor may be held in at least one preselected position relative to said casing.

12. In apparatus of the class described, a casing means including a flux distributing rotor journalled in said casing for generating electrical energy, said rotor having an end portion of the shaft thereof extending through a wall of said casing, cover means secured to said wall to thereby form a chamber for the extending end of said shaft and a chamber for cables connected with said current generating means, means slidably mounted on said cover means and adapted to be moved into engagement with at least one recess in the extending end portion of said shaft whereby said rotor may be held in at least one preselected position relative to said casing, at least one socket of a multiple plug and socket connector mounted on said cover means and connected with said cables, and an insulating material filling said second-named chamber around said cables.

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