Nov. 26, 1935. H. J. LOFTIS 2,021,941

GENERATOR VOLTAGE REGULATOR

Filed Nov. 17, 1933

Fig. 1

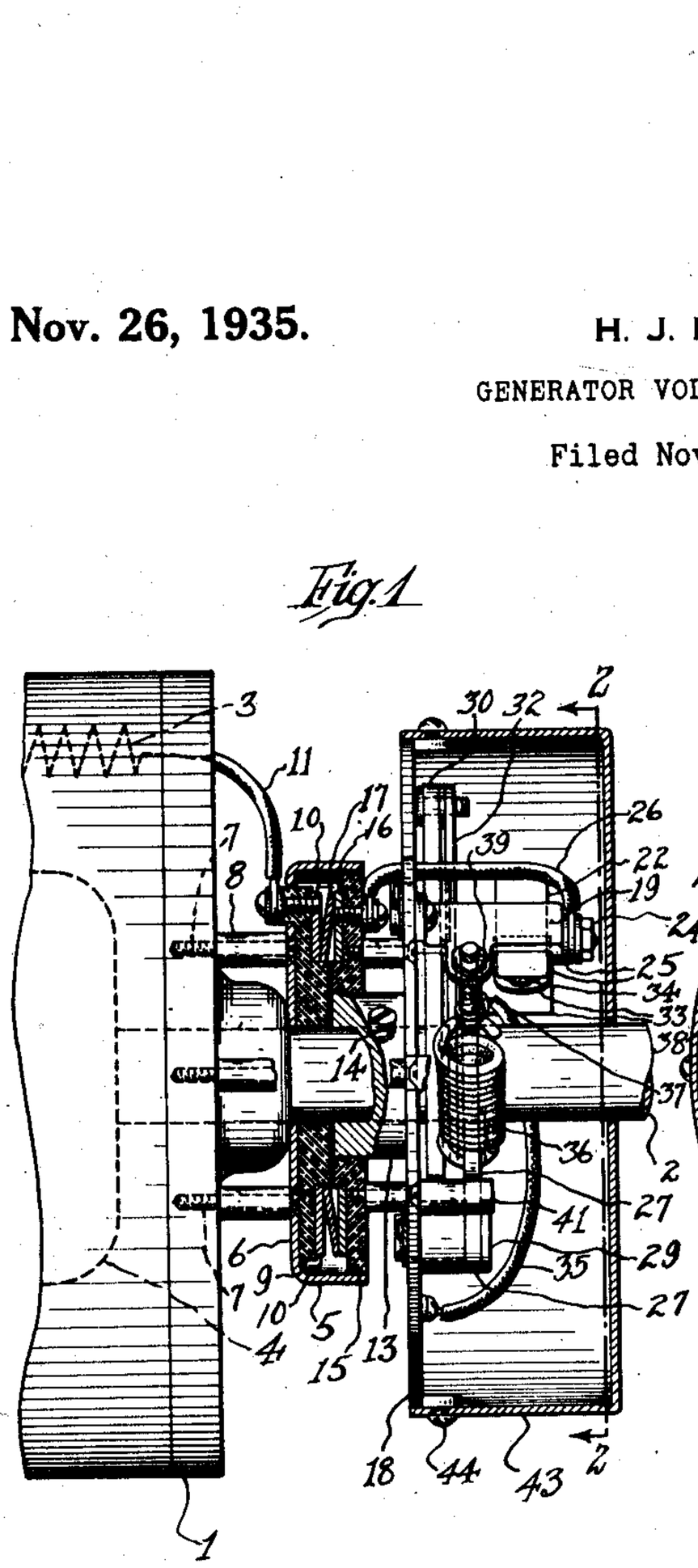


Fig. 2

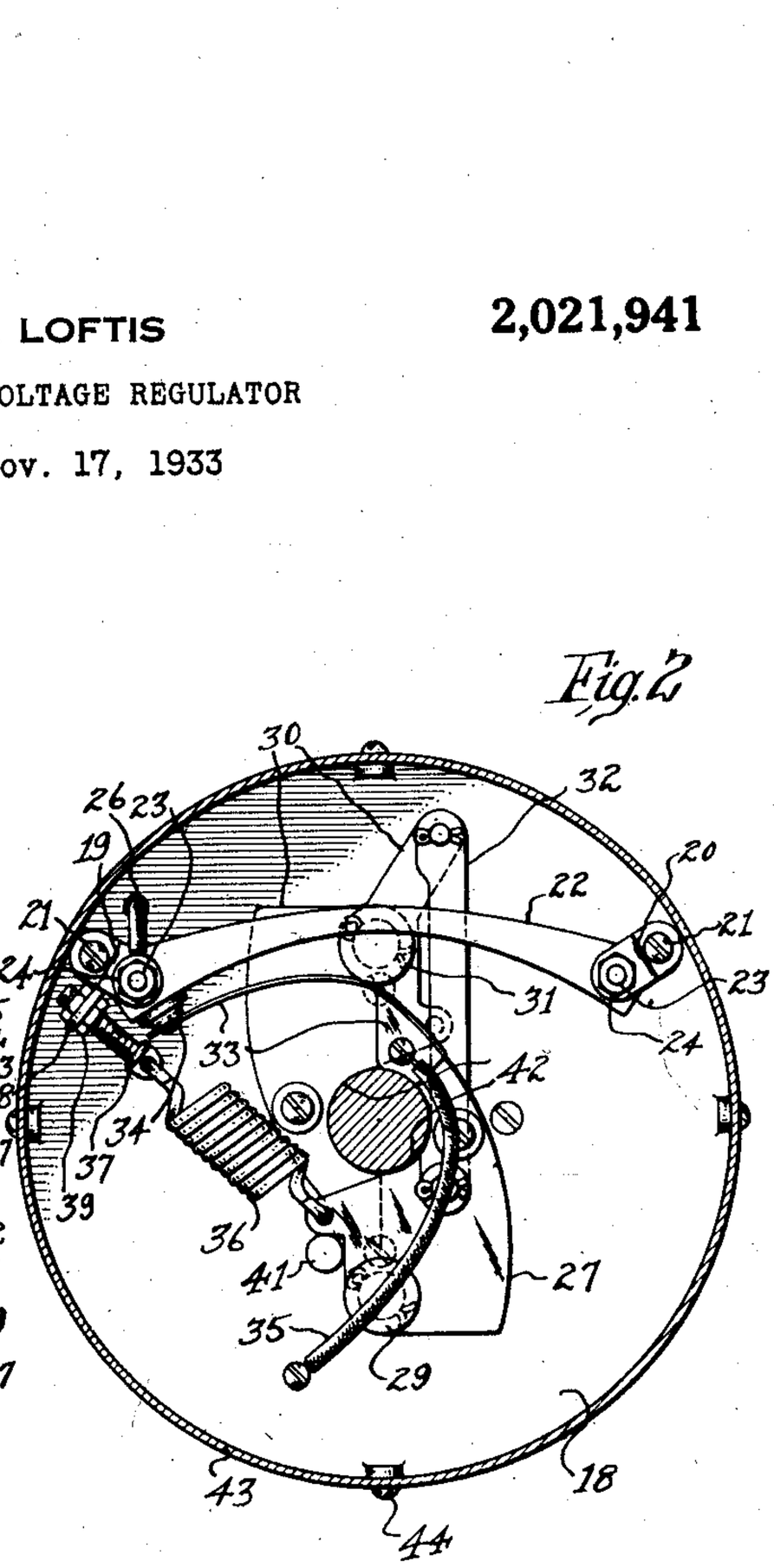
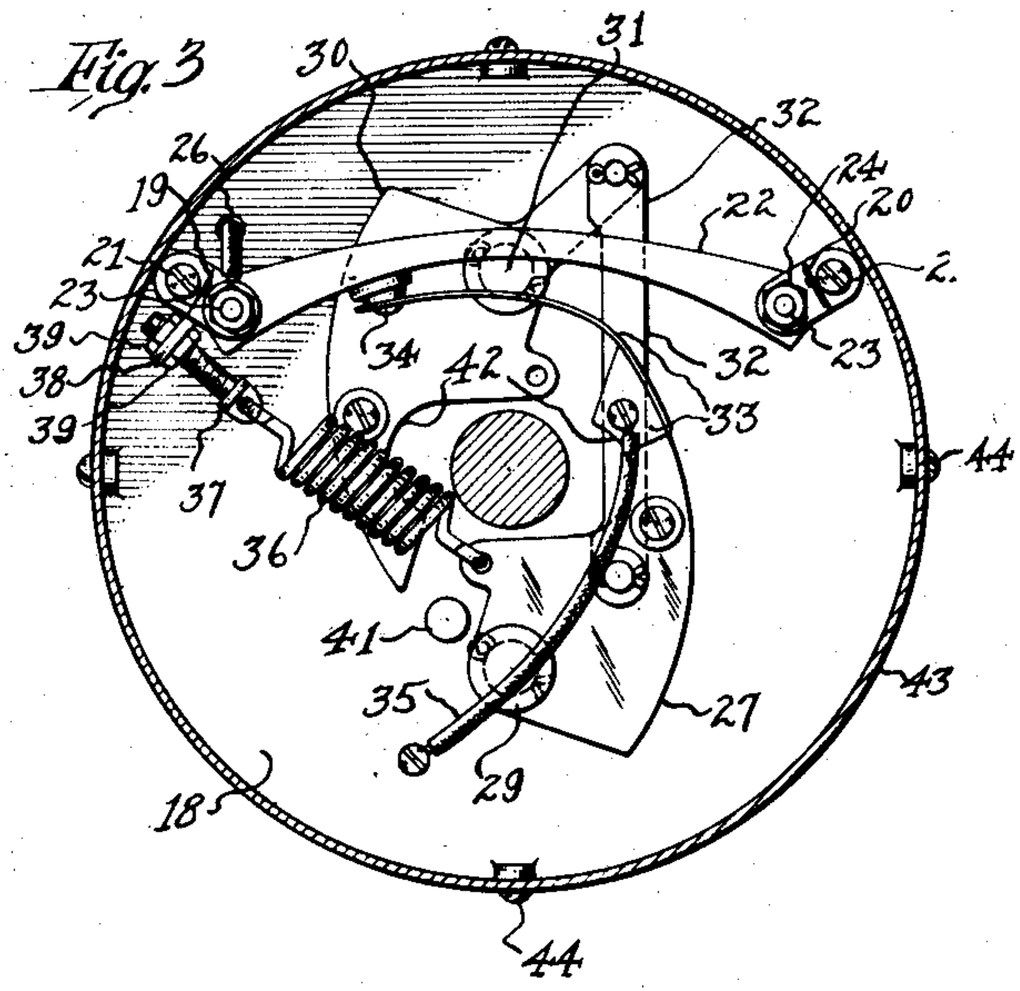


Fig. 3



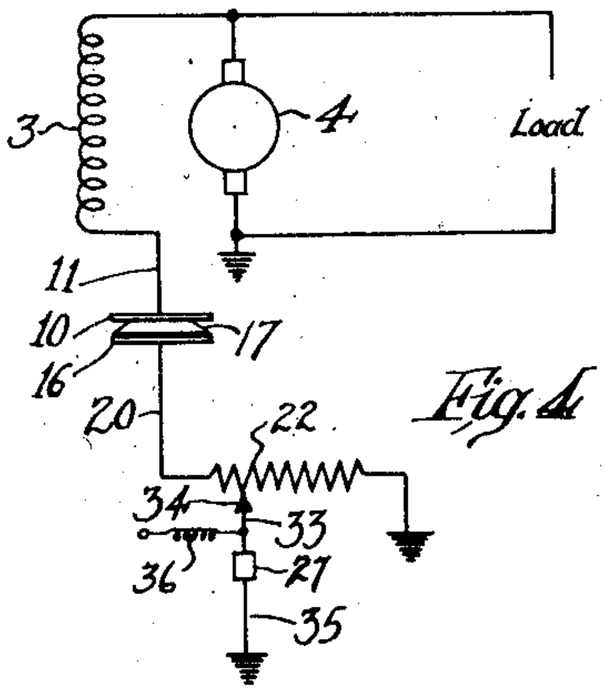


Fig. 4

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GENERATOR VOLTAGE REGULATOR

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2 Claims. (Cl. 171—229)

This invention relates, generally, to the regution of the output voltage of generators and especially automobile type generators, and the invention has reference, more particularly, to a novel generator voltage regulator adapted to maintain the output voltage of generators substantially constant.

The output voltage of automobile generators usually varies within wide limits due to the greatly varying speed of the automobile engine in use. This fluctuation of the generator output voltage is highly objectionable and injurious not only because it tends to cause oxidation of the distributor contacts resulting in poor engine operation, but also because the varying voltage applied to the storage battery, lamps, etc., greatly shortens the life of such equipment.

The principal object of the present invention is to provide a novel generator voltage regulator that is adapted to maintain the generator output voltage substantially constant regardless of speed variations of the automotive engine.

Another object of the present invention lies in the provision of a novel generator voltage regulator having resistor means responsive to the speed of the engine for varying the generator excitation to compensate for engine speed variations, thereby obtaining constant generator voltage output.

Still another object of the present invention is to provide a novel generator voltage regulator of the above character that is of simple rugged construction and has an extremely long life in use, the said regulator being adapted to be easily and quickly applied to generators.

Other objects of this invention, not at this time more particularly enumerated, will be clearly understood from the following detailed description of the same.

The invention is clearly illustrated in the accompanying drawing, in which:

Fig. 1 is a fragmentary view with parts broken away of an automobile generator equipped with the novel voltage regulator of this invention.

Fig. 2 is a sectional view taken along line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is a view similar to Fig. 2, but illustrates the operation of the regulator upon an increase in speed of the engine, and

Fig. 4 is a wiring diagram illustrating a typical circuit involved.

Similar characters of reference are employed in said views, to indicate corresponding parts.

Referring now to the said drawing, the reference numeral 1 designates a generator, as of the automotive type, having a generator shaft 2 driven from the automobile engine by a belt or other suitable means (not shown). The shunt field winding 3 and the generator armature 4 are shown diagrammatically in dotted lines in Fig. 1.

According to the preferred construction, a cylindrical slip ring housing 5, open at one end and closed at its other end 6 is attached to the casing of generator 1 in concentric relation to generator shaft 2 by means of screws 7 and spacing collars 8. The closed end 6 of housing 5 has a central aperture through which the shaft 2 projects. A disc 9 of insulation material is mounted in fixed position in housing 5 adjoining the end 6 of this housing. A suitable slip ring 10 is carried by disc 9 in concentric relation to shaft 2 and this slip ring is electrically connected to a lead 11 which in turn is electrically connected to the negative side of the field winding 3.

A collar 13 is fixed on generator shaft 2 as by a set screw 14 and this collar projects somewhat into the open end of housing 5. The portion of collar 13 projecting into housing 5 has an insulating disc 15 fixed thereon, which disc carries a metallic slip ring 16 that is similar and opposed to slip ring 10. A spring contact washer 17 is interposed between slip rings 10 and 16 and engages these slip rings so that in use current will pass from the stationary ring 10 through contact washer 17 to rotating ring 16.

A metallic disc 18 is fixed on collar 13 and carries two annularly spaced posts 19 and 20 which are attached to disc 18 as by screws 21. A curved or bow shaped resistor 22 extends between the posts 19 and 20 and has its ends supported by these posts. The resistor 22 is illustrated as a rigid molded unit consisting, for example, of electrically conducting and non-conducting materials, such as carbon, feldspar and mica, together with a condensation product serving as a binder. The ends of the resistor unit 22 may be attached to posts 19 and 20 in any desired manner, for example, these ends are illustrated as having studs 23 moulded therein, which studs extend through holes in posts 19 and 20 and are secured to these posts by nuts 24. The end of resistor 22 attached to post 19 is insulated from this post as by the use of insulating washers 25. The slip ring 16 is electrically connected to a lead 26 which in turn is electrically connected to stud 23 at post 19.

A fly-weght 27 is turnably mounted on a stud 28 projecting from disc 18 at one side of shaft 2. Another fly-weight 30 is turnably mounted on a stud 31 also projecting from disc 18 but at the

other side of shaft 2. A link 32 extends between fly-weights 27 and 30 and has its ends pivotally connected to these fly-weights, thereby causing these fly-weights to function together in use. Fly-weight 27 has a spring contact arm 33 secured thereto, which contact arm urges a movable contact member 34 into engagement with the resistor 22. Contact member 34 is illustrated as a mercury contact such as disclosed in my Patent #1,908,908, but it is to be understood that any type of movable contact or brush may be used. Spring contact arm 33 is shown grounded upon the disc 18 by a lead 35.

A coil tension spring 36 has one end connected to the fly-weight 27 and its other end connected to an eye-bolt 37. The shank of eye-bolt 37 extends through an aperture in a bracket 38 that is provided on post 19. Nuts 39 threaded on eye-bolt 37 and engaging bracket 38 provide for the adjustment of the tension of spring 36. Spring 36 tends to turn or pull the fly-weight 27 and hence also the fly-weight 30 inwardly toward the shaft 2. A stop pin 41 projecting from disc 18, serves to limit the inward turning movement of fly-weights 27 and 30 under the action of spring 36. These fly-weights have cut out portions 42 for conforming to and accommodating the shaft 2 when these fly-weights are fully retracted as shown in Fig. 2, in which position the fly-weight 27 engages stop pin 41. A cover member 43 encloses the resistor 22, fly-weights 27 and 30 and associated parts and is attached to the periphery of disc 18 as by screws 44.

In use, current for exciting field winding 3 is supplied from armature 4, (see Fig. 4) such exciting current passing from the positive terminal of armature 4 through field winding 3, through lead 11, slip rings 10 and 16, and lead 26 to resistor 22. This current leaves resistor 22 by way of movable contact 34, contact arm 33, and lead 35 to ground, the negative side of the generator being also grounded.

As the speed of the engine and hence that of shaft 2 increases, the fly-weights 27 and 30 move outwardly more and more against the tension spring 36 owing to the action of centrifugal force. This outward movement of the fly-weights causes contact arm 33 to move outwardly also, so that contact 34 is moved along resistor 22 from terminal post 19 toward terminal post 20, as especially shown in Fig. 3. Thus, more and more of the resistor 22 is included in the circuit of field winding 3 as the engine increases its speed. Thus, the current in the field winding is reduced with increase in speed so that the resulting E. M. F. generated by the generator remains substantially constant regardless of speed, or in other words the exciting flux is substantially inversely proportional to the speed of the generator. The magnitude of the ohmic resistances necessary to include in the field winding circuit to maintain constant output voltage at various speeds may be determined by actual tests, if desired, and the resistor 22 made up of suitable sections having proportions of conducting and insulating materials so as to give the desired resistances throughout the range of speed of the engine. In other words, the resistor 22 is made up of resistance sections having ohmic resistances varying to match the characteristics of the generator to the end that a constant output voltage is obtained regardless of speed.

Although my novel device has been disclosed in connection with the regulation of generator voltage, the principles of the same may be utilized in other developments such, for example, as electric speedometers, motor-speed regulators and starting devices for split phase motors.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, as defined by the following claims, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrated and not in a limiting sense.

I claim:—

1. In a device of the character described for controlling the output voltage of a generator having an armature and field winding, a bow shaped resistor mounted for rotation with the armature shaft of the generator, fly-weight mechanism also mounted for rotation with the armature shaft of the generator, a contact member carried by said fly-weight mechanism and engaging said resistor, means for connecting said contact member and one end of said resistor in the circuit of the generator field winding, said fly-weight mechanism acting, with increase in speed of the generator armature, to move said contact member over said resistor to thereby increase the resistance in the generator field winding circuit.

2. In a device of the character described for controlling the output voltage of a generator having an armature and field winding, a bow shaped resistor mounted for rotation with the armature shaft of the generator, fly-weight mechanism also mounted for rotation with the armature shaft of the generator, spring means for urging said fly-weight mechanism inwardly toward the armature shaft, a contact member resiliently carried by said fly-weight mechanism and engaging said resistor, said contact member and one end of said resistor being connected in the generator field winding circuit, said fly-weight mechanism acting, with increase in speed of the generator armature, to move outwardly under the action of centrifugal force against the tension of said spring means, thereby moving said contact member over said resistor and increasing the resistance of the field winding circuit to maintain a substantially constant generator output voltage.

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