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ELECTRICAL IMPULSE GENERATOR

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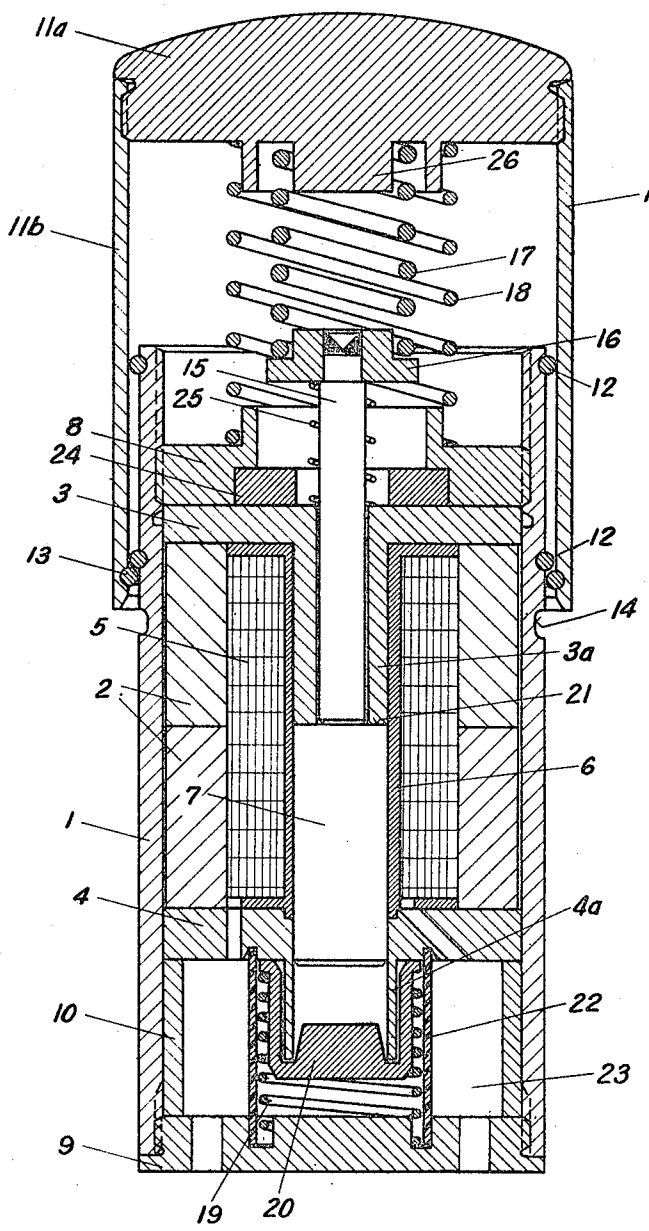

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ELECTRICAL IMPULSE GENERATOR

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3 Claims. (Cl. 310—14)

ABSTRACT OF THE DISCLOSURE

An electrical impulse generator in which a housing contains a magnetic support together with an induction coil in the support with a movable armature. An actuating cap fits over the housing and is moveable relative to the armature and an energy store is located in the cap.

The invention relates to an electrical impulse generator, in particular for igniting the propellant or explosive charge in a projectile, in which on movement of an armature by means of an energy store a permanent-magnet circuit is opened and an electrical impulse is produced in an induction coil, and which has an actuating member in the form of a cap engaged over the front end of the housing of the electrical impulse generator. An example of such a generator is found in British patent specification No. 913,896.

The present invention concerns a further improvement to an electrical impulse generator of that form in which, by simplification of the construction, easier and thus more economic manufacture is made possible together with greater reliability of operation.

An electrical impulse generator according to the present invention is characterised by the fact that the energy store is arranged within the cap-like actuating member and acts by way of a plunger on the armature, which consists, in a known manner, of a cylindrical piston. This construction allows the generator to be assembled from turned and moulded parts which are comparatively simple and cheap to produce, thus rendering manufacture particularly economic.

As a subsidiary feature of the invention, means (stop, pins or similar) are provided on the actuating member, which in the end position of the actuating member ensure the discharge of the energy store and thus the opening of the permanent magnet circuit by mechanical means. An electrical impulse is even produced with certainty, therefore, if the energy store should fail, as is quite possible.

By way of example only, an embodiment of the invention will now be described in greater detail with reference to the accompanying single figure of the drawing which is in section through the embodiment.

The housing **1** of the electrical pulse generator consists substantially of a tube into which a thread is cut at both ends in order to fix the individual components of the electrical impulse generator. Inside the housing **1** is arranged an annular permanent magnet **2**, with its pole surface in contact with soft iron pole plates **3** and **4**. Inside the annular magnet **2** is situated an induction coil **5** wound on a former **6** made of non-magnetic material. The upper pole plate **3** has a tubular extension **3***a* which projects into the former **6** for about half the length of the latter. In the free space in the former an armature **7** in the form of a cylindrical piston is arranged so that it is longitudinally displaceable and fits with its end face against the annular surface of the extension **3***a* of the pole plate **3** forming a surface **21**. The pole plates **3** and **4**—and thus the annular magnet **2** and the induction coil **5**—are held in the housing **1** between an annular disc **8** screwed into the housing and a distance piece **10** held in place by a cover disc **9** also screwed into the housing. The lower pole plate **4** has a tubular extension **4***a* which projects into the space formed by the distance piece **10** and serves to guide the armature **7**.

The housing **1** is closed, at its upper end, by a cap-like actuating member **11** which consists of a pressure plate **11***a*, which is guided on the housing **1** by means of a tubular extension **11***b* of the plate. Movement of member **11** which is described later is helped by two circlips **12** fitted externally on the housing **1**. A further circlip **13** is positioned on the lower end of the tubular section **11***b* and prevents the cap being lifted off the housing. A recess **14** is provided on the housing **1** to enable this circlip to be fitted.

Into the free space between the upper annular disc **8** and the pressure plate **11***a* projects a plunger **15** made of non-magnetic material, and guided for movement by the extension **3***a* of the pole plate **3**. The plunger **15** rests on the armature **7**. At its upper end, the plunger carries a spring disc **16** between which and the pressure plate **11***a* is arranged an energy store in the form of a spiral spring **17**. In addition, a further spiral spring **18** serving as a return spring is compressed between the annular disc **8** and the pressure plate **11***a*.

When the actuating member **11** is depressed, the force of the spiral spring **17** acts, by way of the plunger **15**, on the armature **7** and the spiral spring **17** is compressed until the force stored in the spring exceeds the magnetic holding force of the armature **7** at the annular surface **21** of the extension **3***a*, whereupon the armature pulls away. The intensity of the magnetic flux is suddenly altered by the resulting air gap and an electric impulse is induced in the induction coil **5**. The armature accelerates downward, to return again quickly into its initial position, so that the plunger **15** with spring disc **16** is also returned to its initial position.

The return spring **18** also guides the actuating member **11** back into its rest position. In this way, electrical impulses of constant strength are produced in quick succession.

In order to protect the housing, during operation of the electrical impulse generator, from hard knocks and jolts, which might lead to damage and distortion of the armature, a buffer cap **20** made of resilient material and supported against a buffer spring **19** is provided in the space provided by the distance piece **10**. The armature which is accelerating downwards after pulling away from the gap surface **21** is thereby brought resiliently to rest.

The buffer spring **19** and buffer cap **20** are covered over by a plastic tube **22** which separates them from the surrounding space **23** which contains the leads to and from the induction coil and is also filled with an insulating and sealing mass. In addition, for the resilient stopping of the spring disc **16**, a buffer disc **24** is provided which is held by the annular disc **8**. A further spring **25** initiates and ensures the return of the spring disc **16** with plunger **15**. The spring **25** is supported against the upper pole plate **3** and is dimensioned so that its pre-loading is equal to or slightly less than that of the energy store spring **17**. This also ensures that the plunger, in the rest position, fits on the armature **7** without loading it by means of the pre-loading of the energy store spring **17**.

Almost complete reliability of operation of the electrical impulse generator just described is achieved in the event of failure of the energy store spring **17** due to weakening or breakage. In that event, when the pressure plate is actuated, a pin **26** provided on the latter meets the spring disc **16**, thereby pushing the armature away from the gap surface **21** by way of the plunger **15**. The

pin **26** does not normally meet the spring disc when the electrical impulse generator is actuated as described previously. The compression spring **17** acting as an energy store is for this purpose so dimensioned that the travel of the spring until the holding force of the magnet is reached is less than the distance between the pin **26** and the spring disc **16**.

We claim:

1. An electrical impulse generator comprising in combination a housing containing a normally-closed magnetic circuit, an induction coil located within the magnetic circuit, a movable armature forming part of said magnetic circuit, an actuating cap fitted over said housing and movable relatively to said armature, an energy store located in the actuating cap and operable on movement of said actuating cap and an actuating plunger linking said energy store to said armature whereby initial movement of the actuating cap first stores energy in said energy store until the force existing between the actuating cap and the armature is equal to the magnetic force between the armature and the magnetic circuit when further movement of the actuating cap separates the armature from the magnetic circuit, the energy stored in said energy store serving to accelerate the armature away from the magnetic circuit, and a return device for the actuating cap located within the latter.

2. An electrical impulse generator comprising in combination a housing containing a normally-closed magnetic circuit, an induction coil located within the magnetic circuit, a movable armature forming part of said magnetic circuit, an actuating cap fitted over said housing and movable relatively to said armature, an energy store located in the actuating cap and operable on movement of said actuating cap and an actuating plunger linking said energy store to said armature whereby initial movement of the actuating cap first stores energy in said energy store until the force existing between the actuating cap and the armature is equal to the magnetic force between the armature and the magnetic circuit when further movement of the actuating cap separates the armature from the magnetic circuit, the energy stored in said energy store serving to accelerate the armature away from the magnetic circuit, and a projection on said actuating cap, which ensures release of energy stored in said energy store and mechanical separation of said armature and said magnetic circuit.

3. An electrical impulse generator comprising in combination a housing containing a normally-closed magnetic circuit, an induction coil located within the magnetic circuit, a movable armature forming part of said magnetic circuit, an actuating cap fitted over said housing and movable relatively to said armature, an energy store located in the actuating cap and operable on movement of said actuating cap and an actuating plunger linking said energy store to said armature whereby initial movement of the actuating cap first stores energy in said energy store until the force existing between the actuating cap and the armature is equal to the magnetic force between the armature and the magnetic circuit when further movement of the actuating cap separates the armature from the magnetic circuit, the energy stored in said energy store serving to accelerate the armature away from the magnetic circuit, and resilient means acting on said armature in a sense opposite to that in which said energy store acts on said armature to relieve the latter, when in its initial position, of the effect of the energy store.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,398,302 August 20, 1968

Hans-Dieter Harnau et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, lines 4 to 6, "assignors to Essex Wire Corporation, Fort Wayne, Ind., a corporation of Michigan" should read -- assignors to Firma Rheinmetall G.m.b.H., Dusseldorf, Germany --.

Signed and sealed this 10th day of March 1970.

(SEAL)

Attest:

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Attesting Officer

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Commissioner of Patents