

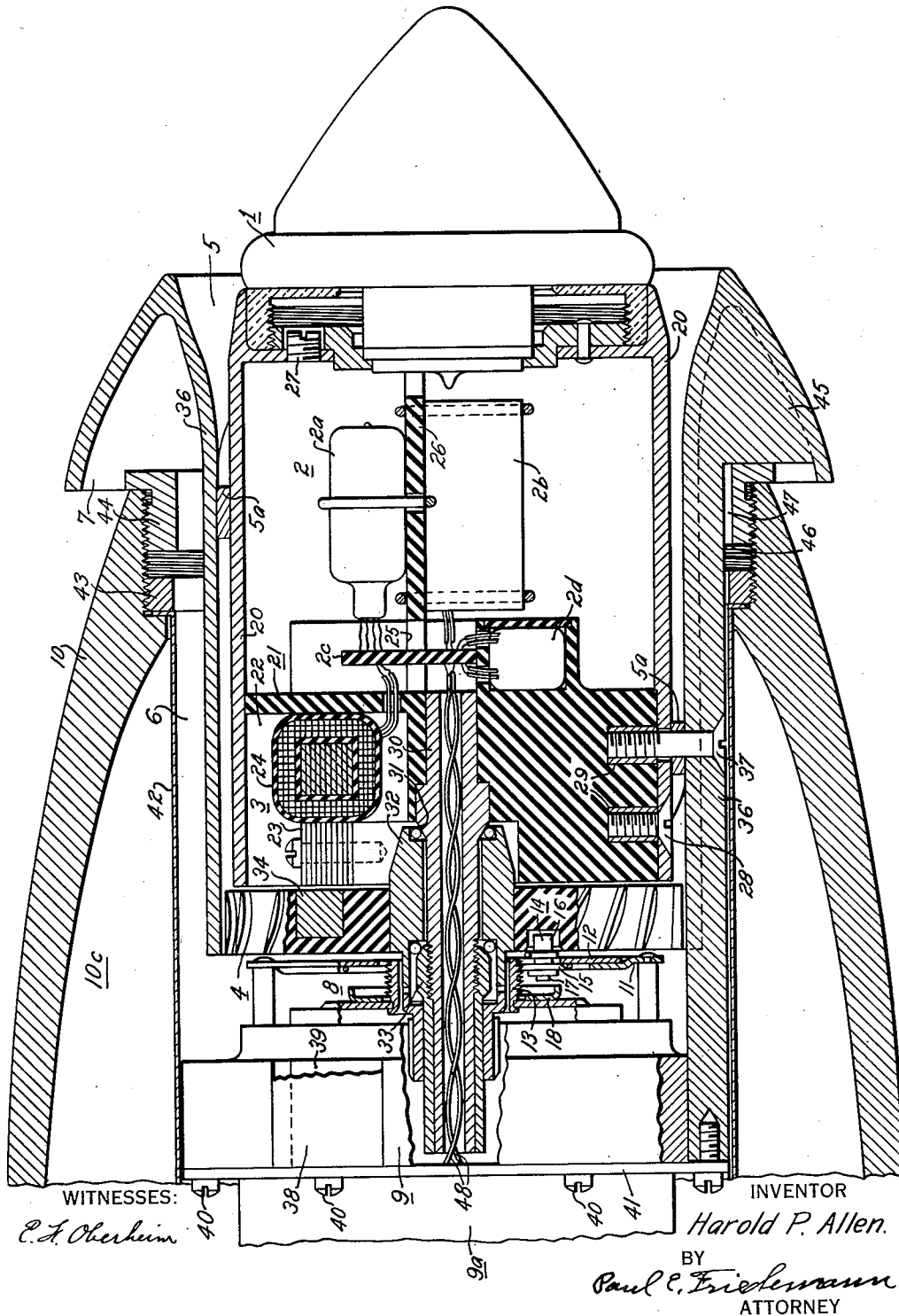
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FUSE

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FUSE

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mesne assignments, to the United States of
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4 Claims. (Cl. 102—70.2)

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This invention relates generally to ordnance devices and more particularly to a proximity type of ordnance fuse.

In certain of its aspects, this invention is related to the copending application of E. K. Clark, Serial Nos. 597,575 and 597,576, both filed on the same date as this application, the former entitled Mechanical Device, now Patent No. 2,484,206, and the latter entitled Arming System.

One object of this invention is to provide a proximity type of ordnance fuse which is easily assembled.

Another object of this invention is to provide an ordnance fuse of the character mentioned which is comprised of simple, easily manufactured elements.

A further object of this invention is to provide an ordnance fuse for attachment to a projectile which is assembled as a complete operating unit and which is attached, for example, to said projectile as by threaded engagement therewith.

A still further object of this invention is to provide a fuse of the character referred to, which is simple to test.

Other objects and advantages will become apparent upon a study of the following specification when considered in conjunction with the accompanying drawing, in which the single figure thereof illustrates the ordnance fuse of this invention.

A photoelectric controlled type of proximity fuse is illustrated in the drawing. In general, this fuse includes a photoelectric head 1, an amplifier 2 electrically related to the photoelectric head, and responsive thereto, a generator 3 for supplying electrical energy to the electrical system of the fuse, an air operated turbine 4 also forming the generator rotor, driven by the air stream flowing the direction of the arrows through passages 5, 6 and 7, an arming mechanism 8 for restraining the turbine except under operating conditions of the fuse, and a gear reduction unit and arming contact assembly in the housing section 9 operated by the turbine 4 which establishes energizing circuits for a heater buried in a powder charge, the assembly being generally known as a squib, and which forms part of a powder train located in the housing section 9a for detonating the projectile charge. The squib and powder train as well as details of the gear reduction unit and arming contact assembly are not shown in the interest of simplicity. This entire fuse assembly is mounted as a unit in the nose of a projectile 10.

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A fuse of the type described is particularly adapted for attachment to certain rocket types of projectiles which have high values of acceleration and which operate at high speeds. Upon movement of the projectile through the atmosphere, air is taken into the fuse through the passage 5. The volume transfer of this air through the spiral intake passages 5 is due to the laminar impact of air across the bell-shaped opening thereof. The resulting air stream has a velocity component in the direction of turbine rotation effected by the spiral ribs fragmentarily shown at 5a and impinges on the turbine blades causing the turbine to rotate. Beyond the turbine the air stream reverses its flow through the passage 6, moving towards the front of the projectile where it again reverses its direction and is exhausted into the atmosphere from the exhaust passage 7 at the rear of the Venturi tip. A large pressure differential exists between the entrance and exhaust passages because of the air impact and compression at the entrance passage 5 and the air deflection at the Venturi tip forming the exhaust passage 7.

Rotation of the turbine is controlled by the acceleration responsive arming mechanism 8. When the rocket is launched the propulsive reaction of the burning fuel on the rocket produces accelerating forces which in a specific instance are about 1100 ft./sec./sec. The arming mechanism 8 includes a spring biased inertia assembly 11 (the spring biasing not being shown) which is supported in the housing section 9 and therein spring biased to the right to frictionally engage a disc 12, in turn engaging a threaded member 13 and the turbine 4, through the medium of pins 14 mounted thereon, which pins have knife-edged discs 15 engaging the threaded member 13 and projections 16 inserted in recesses in the turbine. The reaction of the inertia member in the vicinity of the acceleration value mentioned moves the inertia member to the left as viewed in the drawing, breaking its frictional engagement with disc 12 and permitting turbine operation. Disc 12 is driven in rotation with the turbine and operated towards the left by means of the discs 15 which follow the lead of the threads of threaded member 13 until projections 17 of pins 14 enter cup 18 at which time the projections 16 are free of the turbine which thereafter rotates freely. The knife-edged discs are adapted to ratchet over the threads they engage and should the accelerating force drop off before projections 17 are inside the cup 18, inertia assembly 11 drives the disc 12 to the right to the

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position shown. A more detailed description of this arrangement appears in the above-mentioned copending application of E. K. Clark, Serial No. 597,576, only sufficient description being presented here that its function may be understood.

The electrical output of the generator 3 is applied to the electrical system and the photoelectric head 1 becomes active. After a certain number of turbine rotations, the arming contacts (not shown) but which are controlled by the gear reduction unit 9, close and connect the heater (also not shown) to the electrical system. When preset objective proximity is reached the photoelectric head control of the amplifier and associated trigger circuit, in most cases including a thyratron triggered by the amplifier output, causes an electrical discharge into the heater, igniting the powder train which explodes the projectile.

The foregoing brief explanation of the general construction and particularly the function may be of assistance in better understanding this invention in its specific teachings.

Metal housing 20 forms the inner wall of passage 5 and carries the photoelectric head 1, the amplifier 2 and the stator support 21 of the generator 3. Stator support 21 is a molding, preferably of a high strength plastic, having three equally circumferentially spaced recesses, one of which appears at 22, which are of suitable configuration to receive the stator laminations 23 and coil 24 associated therewith. In other suitable recesses or grooves 25 of the stator support, an insulating panel 26, which carries the amplifier units, is secured. The physical characteristics of panel 26 are such as to provide mounting thereof directly in the grooves 25. The support afforded by the grooves 25 maintains the panel 26 in vertical relation with reference to the transverse face of the stator support until potting compound is poured into the hole sealed by plug 27 and secures the amplifier unit in position. Stator support 21 is secured within the housing 20 by means of screws 28 which pass through the housing wall and thread into the inserts 29 in the stator support.

The various elements of the amplifier unit such as the tube 2a and the member 2b which may consist of an assembly of resistors, condensers, etc. forming part of the amplifier circuits and a filter in the supply circuits therefor, are simply wired to the panel 26 to secure them during assembly. The tube 2a is placed upon its side, that is, with its axis longitudinally of the fuse and therefore in line with the accelerating forces, since, in this direction its internal circuit elements have the greatest strength. No attempt is made to illustrate the various connections of the fuse elements; all circuits having been terminated in a terminal board 2c. It will be understood however that the generator 3 supplies all electrical power to the fuse system, that for the plate supply of tube 2a being rectified in a rectifier 2d carried in a recess in the amplifier side of the stator support 21 and thereafter filtered in the mentioned filter circuits.

Stator support 21 also carries a tubular shaft 30 having a conical bearing surface 31 formed thereon. The hub 32 of the turbine rotor 4 has suitable bearing races formed in each extremity thereof. At the right-hand end of the rotor hub, the ball bearings ride upon the conical surface 31. A conical bearing 33 threads onto the free extremity of the shaft 30 and secures the turbine

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rotor 4 in proper rotational position. Permanent magnet inserts 34, of which there are three in number distributed in the turbine to match the stator laminations 23, provide the energizing flux for the generator 3.

Cylindrical member 36 is concentrically secured about the cylindrical housing 20 by means of a plurality of circumferentially distributed screws, one of which appears at 37, which pass through webs 38 on the outer surface of the cylindrical member 36, through ribs 5a and wall of housing 20 and thread into other inserts 29 in the stator support. Extensions of the webs 38, which extend towards the rear of the projectile, are received in recesses 39 in member 9 and secured thereto by a plurality of screws 40 which pass through the ring 41 and alternately threadedly engage the webs 38 and the member 9. A thin tubular cuplike liner 42 is secured within the projectile body 10 by means of its flanged extremity which is clamped between the projectile body and threaded ring 43. This liner provides a moisture-proof seal for the high explosive placed in the projectile cavity 10c and provides a smooth surface over which the fuse unit may slide when installed therein. The fuse powder train when ignited bursts the liner and blasts into the high explosive. The fuse unit is secured within the projectile by threaded engagement of ring 44 with the projectile nose. This ring 44 is carried upon the webs 38 and abuts the radial extensions 45 thereof at the Venturi tip. It is secured in position, once in place, by upsetting of the extremities 46 of keys 47 on the web surfaces which are received by complementary keyways in the ring 44. All wires, such as 48, which are utilized for functional purposes of the unit and which in the instant cases are utilized to energize the above-mentioned heater located in the housing section designated 9a, are connected between the various electrical components of the fuse system through the hollow generator shaft 30.

Units of the type hereinbefore described must be thoroughly tested before final assembly. It is a simple matter to test the amplifier unit since its output leads extend through the hollow shaft 30 and are easily accessible prior to assembly of the housing section 9 to the web extensions 38.

The turbine 4 revolves at extremely high speed when the projectile is in flight and consequently its bearings have a very short life. In view of this fact the generator may not readily be tested once assembled without somewhat damaging the bearings. This construction provides for testing of the generator with a separate testing rotor which may be slipped over the end of the hollow shaft 30 and driven from some suitable external power source. With this arrangement the entire unit assembled within the cylindrical housing 20 may be tested with power delivered thereto by the generator.

The foregoing disclosure and the showing made in the drawing are merely illustrative of the principles of this invention and are not to be considered in a limiting sense. The only limitations are to be determined by the scope of the appended claims.

I claim as my invention:

1. In a projectile, a body portion adapted to contain electroresponsive detonating means, a shell section secured in spaced relation within said body portion and having an open forward end provided with a rearwardly flared skirt portion disposed in spaced relation with the external

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surface of said projectile, said shell section forming a passage from within said projectile and terminating externally of the projectile adjacent said rearwardly flared skirt portion, a nose portion carrying photoelectric control means, a hollow cylindrical housing adapted to be fitted into said shell section in spaced relation therewith to form a passage communicating with said first mentioned passage and for supporting said nose portion adjacent the open end of said shell section, a stator member secured in said housing, an electrical amplifier assembly mounted on said stator member adjacent said photoelectric means in the nose portion, a hollow shaft secured in said stator member and having a passage for containing wires leading from said amplifier assembly to said detonating means in the body of the projectile, an electrical generator assembly including an air operated rotor element journaled on said shaft in the path defined by said passages to be operated by air flowing therethrough upon movement of said projectile through the atmosphere for supplying electrical energy to said amplifier assembly, said housing and elements carried thereby being insertable into said shell section as a unit.

2. In an electrical fuse assembly for a projectile having a body portion, the combination of detonating means, within said body portion, an electrical generator, an air driven rotor for operating the generator, an amplifier assembly adapted to be energized thereby for firing said detonating means, a photoelectric control device for controlling response of said detonating means to the energy output of said amplifier assembly, a cylindrical housing adapted to be fitted into the leading end of said projectile, a stator block member secured in said housing for supporting said electrical generator and said amplifier assembly, a hollow shaft mounted in said stator block for supporting said rotor at one end of said housing in cooperative relation with said generator, means for securing said photoelectric control device in closing relation with the other end of said housing, means including wires disposed within said hollow shaft for electrically relating said amplifier assembly to said detonating means, and means for securing said housing together with said control device, amplifier assembly, and generator as a unit within said projectile.

3. In an ordnance device for attachment to a projectile the combination of, a cylindrical member, a photoelectric head disposed in one extremity of said cylindrical member, a generator having a stator assembly and a rotor, means securing said stator assembly in the remaining extremity of said cylindrical member, an amplifier, means securing said amplifier to said stator assembly, a tubular shaft carried by said stator assembly, said rotor member being mounted in bearings in said tubular shaft in proximity with said stator assembly, permanent magnet members forming part of said rotor member for producing magnetic fluxes linking said stator assembly, a second cylindrical member, means supporting said second cylindrical member concentrically

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about said first-mentioned cylindrical member, a plurality of blade elements disposed about the periphery of said rotor, said second cylindrical member forming a shroud about said blade elements, a threaded ring member secured in concentric spaced relation about said second cylindrical member adapted for threaded engagement with the nose of a projectile, said second cylindrical member having a venturi-like tip extending from the extremity thereof adjacent said photoelectric head and adapted for disposal in concentric spaced relation with a portion of said projectile, mechanical arming mechanism operable in response to the acceleration of said projectile when fired, means electrically connecting said generator to said amplifier, and means responsive to rotative movements of said rotor for controlling the operation of said fuse.

4. In an ordnance device for attachment to the nose of a projectile, the combination of, a shell section adapted for insertion into the nose of said projectile in spaced relation thereto and having a venturi-like tip disposed in spaced relation to an external portion of the nose of said projectile, a housing disposed in spaced relation with said shell section within said shell section, a photoelectric device disposed in the extremity of said housing adjacent the nose of said projectile, a stator support secured in the opposite extremity of said housing, a generator comprising a plurality of permanent magnet elements and an electromagnetic assembly, means securing the electromagnetic assembly to said stator support, a tubular shaft carried by said stator support, a rotor member journaled on said shaft, said permanent magnet elements being carried by said rotor member in proximity to said electromagnetic assembly, a plurality of blades on said rotor member, said blades being disposed adjacent the extremities of said shell section and said housing adjacent the end of said housing carrying said stator support, a housing having an arming unit disposed therein, extensions in said shell section extending axially of said fuse assembly away from the nose portion thereof secured to said housing said tubular shaft extending through said housing, detonating means beyond said housing from said fuse assembly, an amplifier supported by said stator support, and circuit means electrically connecting said generator, said amplifier, said photoelectric head and said detonating means, portions of said circuit means extending through said tubular shaft.

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