July 21, 1959 J. ROSSELET 2,895,419

SAFETY ARMING MECHANISM FOR FUSES

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FIG.1

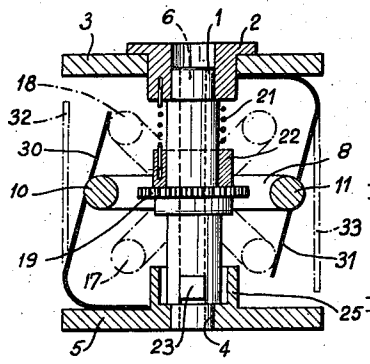


FIG.3

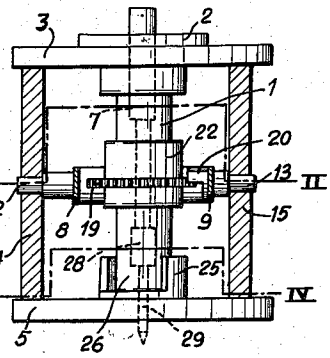


FIG.2

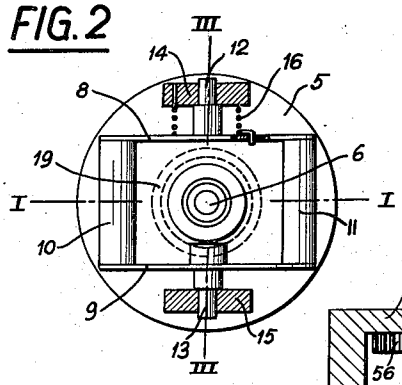


FIG.4

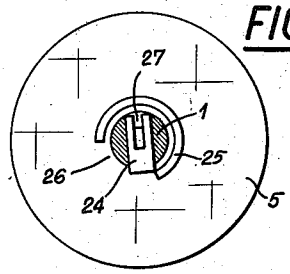
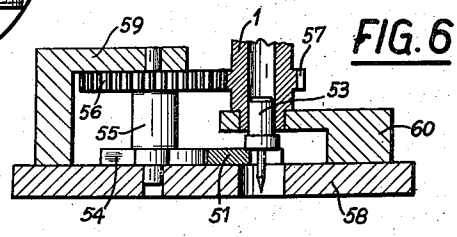


FIG.6



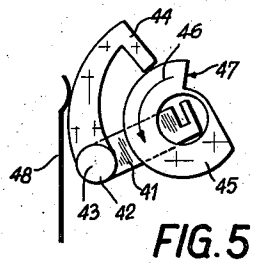


FIG.5

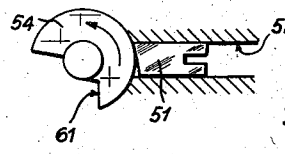


FIG.7

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SAFETY ARMING MECHANISM FOR FUSES

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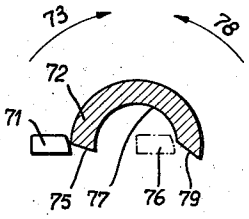

FIG. 8

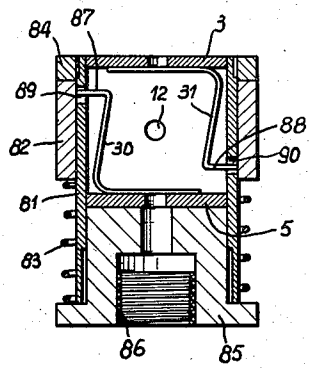

FIG. 10

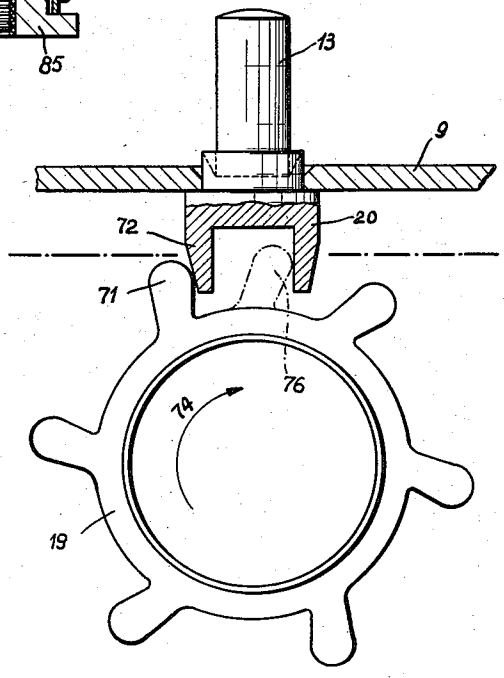

FIG. 9

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July 21, 1959 J. ROSSELET 2,895,419

SAFETY ARMING MECHANISM FOR FUSES

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FIG.11

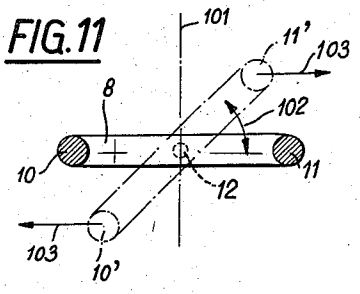
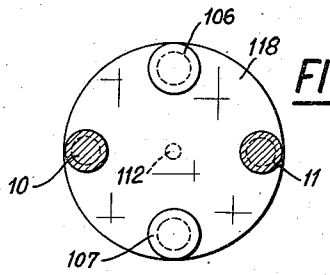


FIG.14



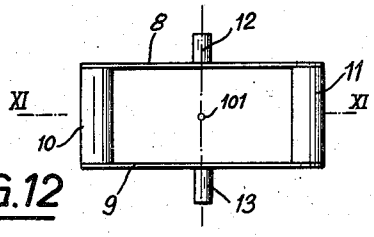


FIG.12

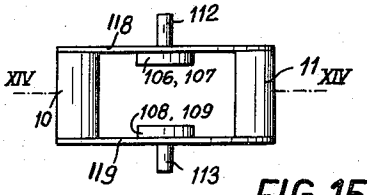
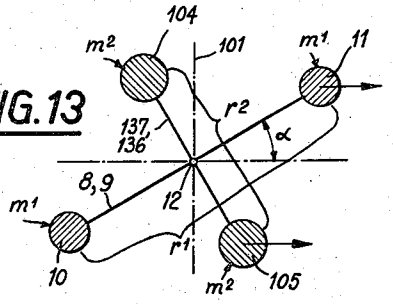


FIG.15

FIG.13



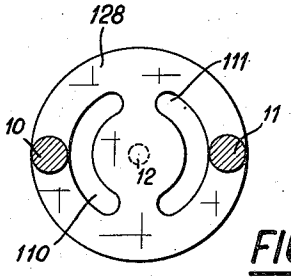


FIG.16

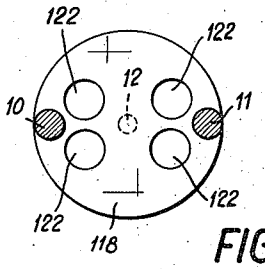


FIG.17

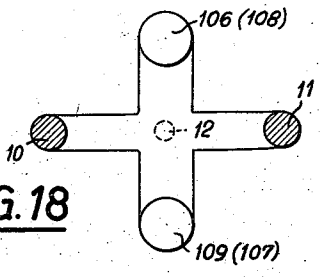


FIG.18

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SAFETY ARMING MECHANISM FOR FUSES

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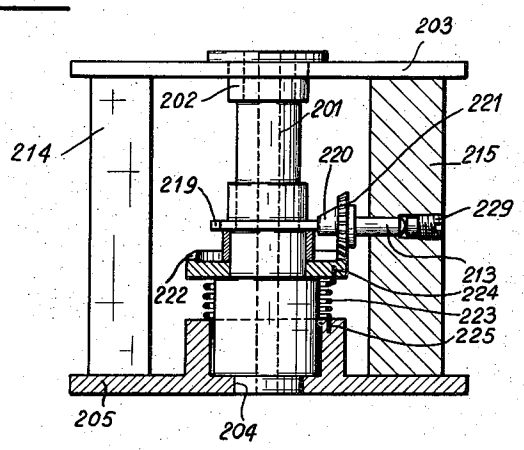
FIG. 19



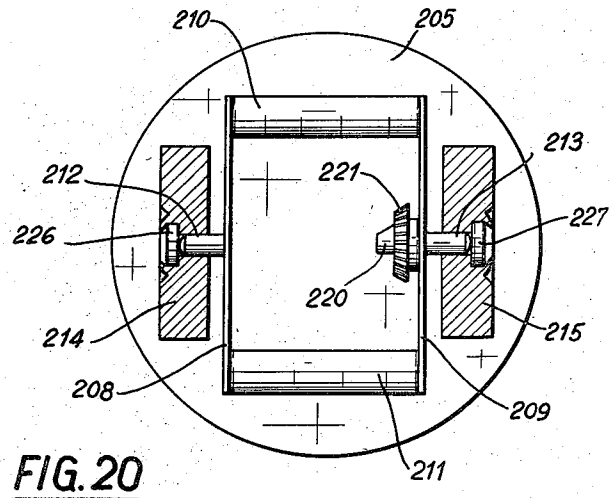


FIG. 20

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Attorney

July 21, 1959 J. ROSSELET 2,895,419

SAFETY ARMING MECHANISM FOR FUSES

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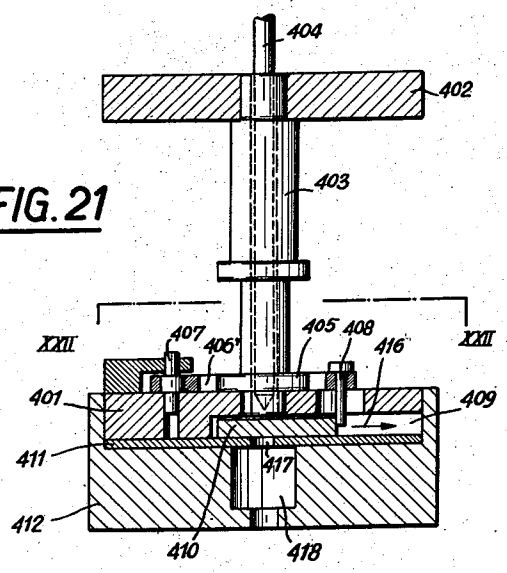
FIG. 21



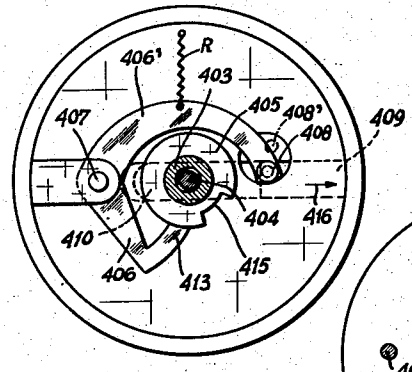
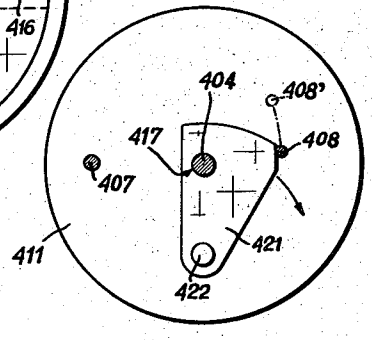


FIG. 22

FIG. 23



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Attorney

July 21, 1959 J. ROSSELET 2,895,419

SAFETY ARMING MECHANISM FOR FUSES

Filed June 7, 1955 7 Sheets-Sheet 6

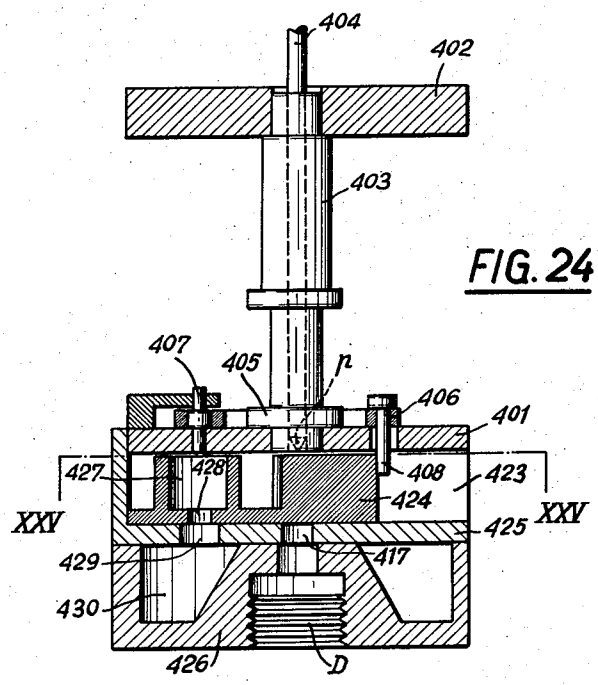
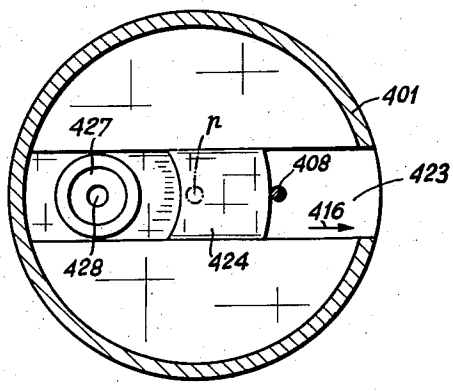


FIG. 24

FIG. 25



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Attorney

July 21, 1959 J. ROSSELET 2,895,419

SAFETY ARMING MECHANISM FOR FUSES

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FIG. 26

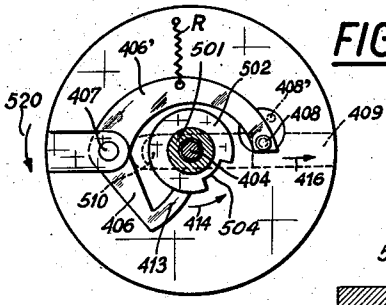


FIG. 27

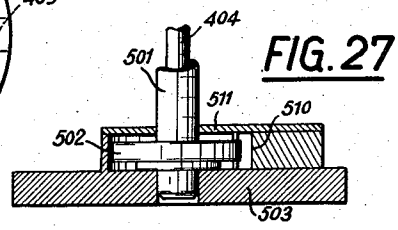


FIG. 28

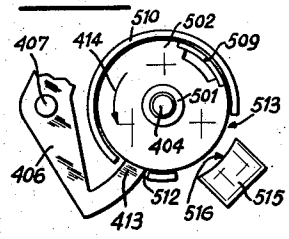


FIG. 29

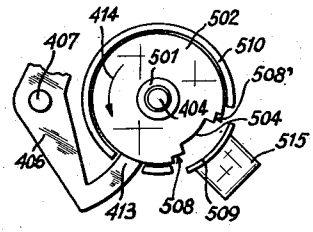


FIG. 30

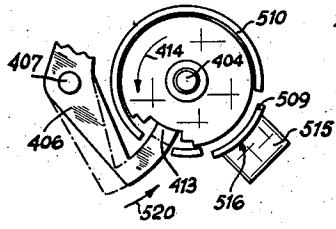
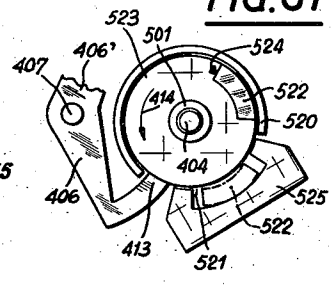


FIG. 31



Inventor:
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Attorney

United States Patent Office

2,895,419

Patented July 21, 1959

2,895,419

SAFETY ARMING MECHANISM FOR FUSES

Jean Rosselet, Geneva, Switzerland

Application June 7, 1955, Serial No. 513,836

Claims priority, application Switzerland June 8, 1954

11 Claims. (Cl. 102—71)

My invention has for its object a safety arming mechanism for the fuses of missiles, such as percussion fuses, self-destroying fuses, time fuses, said mechanism being adapted to provide a delay in the arming of the fuse so as to provide safety over a predetermined path; the chief feature of my invention consists in that I provide a central spindle arranged axially of the fuse and urged by a driving spring which is set when held in its inoperative position so as to produce the rotation of the central spindle when released while a rocking weight subjected to the action of a further spring is adapted to execute permanent oscillations round an axis perpendicular to the axis of the fuse and an escape mechanism constituted by an escape wheel rigid with the central spindle and a cylinder rigid with the rocking weight is adapted to maintain the undamped oscillations of the rocking weight and to adjust thus the speed of rotation of the central spindle. Furthermore, the central spindle controls a striker bolt to hold the striker in its inoperative position and to release said striker when the central spindle has executed a predetermined rotation corresponding to a predetermined number of oscillations of the rocking weight, the central spindle being provided with an axial bore for the passage of the striker therethrough.

I have illustrated by way of example in accompanying drawings various embodiments of the improved mechanism according to my invention. In said drawings:

Figs. 1 to 10 relate to a first embodiment and two detail modifications and more specifically:

Fig. 1 is an axial cross-section of a mechanism through line I—I of Fig. 2.

Fig. 2 is a simplified horizontal cross-section of the mechanism through line II—II of Fig. 3.

Fig. 3 is a side view of the mechanism, partly sectional through line III—III of Fig. 2.

Fig. 4 is a partial horizontal cross-section through line IV—IV of Fig. 3.

Fig. 5 illustrates a portion of the same mechanism in accordance with a modification.

Fig. 6 is an axial cross-section of said portion of the mechanism in another modification thereof.

Fig. 7 is a transverse cross-section of the portion of mechanism shown in Fig. 6.

Figs. 8 and 9 illustrate an escape mechanism forming part of the safety arming mechanism.

Fig. 10 is a partial axial cross-section through a modified arming mechanism.

Figs. 11 to 18 relate to a second embodiment, wherein the arms radially carried by the rocking weight carry auxiliary weights distributed in a balanced manner so that the action on said masses of centrifugal force arising under the action of the rotation of the missiles compensate each other. More specifically:

Figs. 11 and 12 illustrate the action of centrifugal force on a nonbalanced weight.

Fig. 13 illustrates the action of centrifugal force on a compound balanced rocking weight.

Figs. 14 to 18 illustrate different embodiments of the arms forming part of the rocking weight.

Figs. 19 and 20 relate to a third embodiment and to a modification wherein the rocking weight adapted to execute undamped oscillations round a diametrical axis perpendicular to the axis of the fuse includes a toothed wheel meshing with a further toothed wheel coaxial with the central spindle on which it is mounted. More specifically, Fig. 19 is an axial cross-section of said third embodiment while Fig. 20 illustrates in plan view and perpendicularly to the central spindle a detail modification thereof.

Figs. 21 to 25 relate to a fourth embodiment and to two modifications thereof, wherein the striker bolt located underneath the tip of the striker moves in a plane perpendicular to the central spindle. More specifically:

Fig. 21 is a partial axial cross-section of a mechanism incorporating such a striker bolt.

Fig. 22 is a plan view of the mechanism illustrated in Fig. 21.

Fig. 23 is a plan view of a first modification.

Figs. 24 and 25 are respectively a partial axial cross-section and a plan view of the same mechanism according to the second modification.

Figs. 26 to 31 relate to a fifth embodiment together with a modification of the latter. In said figures:

Fig. 26 illustrates partly and diagrammatically, in a plane perpendicular to the central spindle, a mechanism for locking the striker.

Fig. 27 is a partial axial cross-section of said embodiment of which Figs. 20 to 30 illustrate the cam system in various positions in a plane perpendicular to the central spindle.

Fig. 31 is a simplified view of a modification in a plane perpendicular to the central spindle.

Turning to Figs. 1 to 4, the safety arming mechanism illustrated includes a central spindle 1 extending along the axis of the fuse which has not been illustrated; said spindle is guided in an upper bearing 2 centrally fitted inside an upper plate 3 and in a lower bearing 4 rigid with the lower plate 5. The central spindle is provided with an axial bore 6 for the passage therethrough of a striker 7. (Fig. 3.)

I have illustrated in Fig. 2 a rocking weight including two arms 8 and 9 located to either side of the central spindle 1 and rigidly interconnected by two transverse stays 10 and 11. The arm 8 is rigid with a spindle 12 pivotally carried inside a bearing 14; the arm 9 is rigid with a spindle 13 pivotally carried inside a bearing 15. The common axis of the two spindles 12 and 13 extends diametrically across the axis of the central spindle 1 and perpendicularly thereto. This system 8—13 forms a rocking weight subjected to the action of a spring 16 constituted by a coil spring arranged coaxially with reference to the spindle 12 and inserted between the arm 8 and the bearing 14.

The rocking weight may execute angular oscillations round the axis of the spindles 12 and 13 and occupy two extreme positions of a predetermined amplitude, illustrated in Fig. 1 by the locations 17 and 18 of the stay 10 to either side of the neutral position assumed by said stay 10.

An escape mechanism forming a mechanical connection between the central spindle and the rocking weight includes an escape wheel 19 rigid with the central spindle 1 and a cylindrical member 20 or more accurately speaking a cylindrical sector rigid with the spindle 13. This escape mechanism will be described hereinafter.

The central spindle 1 is urged into rotation by a driving spring 21 constituted by a coil spring coaxial with the central spindle 1 and one end of which is secured to the

upper bearing 2 and the lower end of which is rigid with a ferrule 22 rigid with the central spindle 1.

The driving spring 21, which is set when in its inoperative position through rotation of the upper bearing 2 during the mounting of the mechanism, urges as stated the central spindle 1 into rotation.

The central spindle 1 is provided with a diametrical recess 23 extending perpendicularly to the axis of said shaft and in said recess is housed a striker bolt 24 held when the fuse is inoperative inside said recess 23 by a member 25 in the shape of a cylindrical sector coaxial with the central spindle 1 and rigid with the lower plate 5. Said sector 25 is provided with a port 26 engageable by the bolt 24 when the central spindle has executed a predetermined angular shifting away from its striker-locking position illustrated in Fig. 4.

The bolt 24 is constituted by a bar provided with a longitudinal slot 27. When the bolt is operative, the collar 28 on the striker 7 engages the bolt 24 the slot in which provides a free passage for the tip 29 of the striker 7.

The rocking weight is held against rocking before the firing of the missile by two stops 30 and 31 constituted by two spring blades rigidly secured respectively to the upper plate 2 and to the lower plate 5.

I have illustrated in Figs. 8 and 9 an escape mechanism including an escape wheel 19 rigid with the central spindle 1 which is not illustrated in said figures, and which cooperates with a cylindrical sector 20 rigid with one end of the spindle 13 riveted or otherwise secured to the arm 9 of the rocking weight. The escape wheel 19 is provided with six teeth of which one is illustrated as engaging the outer surface 72 of the cylindrical sector 20.

The operation of this escape mechanism is as follows: when the tooth 71 engages the outer surface 72 of the cylinder 20, the escape wheel 19 is stopped. The oscillations of the rocking weight constrain the cylindrical sector to rock in the direction of the arrow 73 and thus to release said tooth 71 (Fig. 8); the escape wheel progresses through one half-pitch in the direction of the arrow 74 and the tooth 71 enters the position 76 shown in dotted lines in Fig. 9. As it passes underneath the input edge 75 of the cylinder 20, the tooth 71 imparts an impulse to the cylindrical sector 20, said impulse serving for the maintenance of the oscillations of the rocking weight. The escape wheel 19 is again stopped as the tooth 71 which has entered the position illustrated at 76 in Figs. 8 and 9 engages the inner surface 77 of the cylindrical sector 20. During the return movement of the cylinder in the direction of the arrow 78 of Fig. 8, the escape wheel 19 progresses through one half pitch underneath the output edge 79 of the cylindrical sector 20 whereby it gives a further impulse to the cylinder 20, which impulse serves again for the maintenance of the oscillations of the rocking weight. The escape wheel 19 is now again stopped by the tooth of the escape wheel following the tooth 71 which next tooth engages the outer surface 72 of the cylinder 20. The same operations are repeated with each successive tooth of the escape wheel 19 which maintains the oscillations of the rocking weight while the rocking weight adjusts the speed of rotation of the escape wheel to the desired value.

The frequency of the oscillations is defined by the characteristic properties of the spring 16 and by the magnitude of the momentum of inertia of the rocking weight.

The operation of the safety arming means described hereinabove is as follows: I will first suppose that said mechanism is fitted in a gyratory fuse having its nose directed upwardly. When the fuse is inoperative, the rocking weight is held in its inoperative position 18 by the locking springs 30 and 31. The escape mechanism 19—20 also locks the central spindle in its inoperative position. The striker bolt 24 is held inside its recess 23 by the cylindrical sector 25.

After the shot has been fired, centrifugal force constrains the locking springs 30 and 31 to open outwardly and to enter the positions shown in dotted lines at 32 and 33 in Fig. 1. This releases the rocking weight which may thus execute undamped oscillations between its extreme positions 18 and 17, said oscillations providing for the rotation of the central spindle 1 under the action of the driving spring 21.

After a predetermined number of oscillations corresponding also to a predetermined rotation of the central spindle 1, the striker bolt 24 registers with the opening 26 in the cylindrical sector 25. Said bolt is urged outwardly by centrifugal force and engages said opening 26: it passes thus out of its recess 23 and releases the striker 7 which is ready to execute its striking movement through a rearward axial movement; this means the fuse is now armed.

The frequency of oscillation of the rocking weight being thus defined, the release of the bolt is executed after a predetermined number of oscillations, starting from the firing of the shot and consequently the arming of the fuse is obtained after a predetermined period which forms the delay brought to the arming of the fuse on its path. A delay of the magnitude of 0.1 second is readily obtainable and provides safety on a path the length of which is about 80 meters for a missle with a muzzle velocity of 800 m. per second.

I have illustrated in Fig. 5 a modification of the striker bolt constituted by a lever 41 rigid with an arm 42 pivotally secured at 43 and provided with a nose 44 cooperating with a cam 45 rigid with the central spindle 1, which latter revolves in the direction of the arrow 46.

The nose 44 is submitted to the action of a spring 48, said spring being illustrated diagrammatically as urging said nose against the cam 45.

The operation of said striker bolt is as follows:

When the fuse is inoperative, the lever 41 which is supposed to be mounted over the rear end of the central spindle 1, closes the central perforation 6 in said central spindle 1 so as to lock the striker against movement.

After a predetermined angular shifting of the central spindle 1 and of the cam 45 thereon, the nose 44 drops into the receding section 47 of the cam 45 and the lever 41 rocking round the pivot 43 uncovers the axial perforation 6 in the central spindle 1 so as to allow the striker to operate.

I have illustrated in Figs. 6 and 7 a further modification of the central spindle and striker bolt: said bolt 51 is guided radially inside a slideway 52 so as to lock the striker 53; said bolt is controlled by a cam 54 rigid with a spindle 55 parallel with the central spindle 1 and carrying a toothed wheel 56 meshing with a pinion 57 rigid with the central spindle 1. The spindle 55 is revolubly carried between a plate 58 and a bridge-piece 59. The lower bearing of the central spindle is constituted by a further bridge-piece 60.

The operation of last mentioned modification is as follows: when inoperative, the bolt 51 is held in its locking position by the cam 54. After a predetermined rotation of the cam 54 and a corresponding rotation of the central spindle 1, the bolt 51 is shifted radially by a cooperating spring and engages the receding section 61 of the cam 54 so as to release the striker 53. The speed reducer constituted by the wheel 56 and pinion 57 inserted between the central spindle and the cam 54 allows the central spindle and the escape wheel to execute an angular shifting longer than one complete revolution and to increase the number of oscillations required before the release of the bolt whereby an increased safety on the path of the missile is obtained.

I have illustrated in Fig. 10 a section of a safety mechanism including a lower plate 5 and an upper plate 3 rigid with a cylindrical casing 81 serving as a guide for a bolt 82 adapted to move axially over the cylindrical casing 81 and held in its striker locking position

by a coil spring 83 which urges it against a stop 84 rigid with said casing 81. A plug 85 screwed into the casing 81 is provided with a tapping 86 inside which may be screwed a detonator and primer system.

I have shown at 12 the bearing provided for a rocking weight which is not illustrated and which is held in its inoperative position by two springs 30 and 31 the free ends of which, 87 and 88, engage respectively ports 89 and 90 in the cylindrical casing 81 and bear against the bolt 82 which operates through inertia. The operation of the arrangement described is as follows:

At the firing of a shot, the inertia-actuated bolt 82 is urged downwardly and uncovers the ports 89 and 90 whereby the springs 30 and 31 are released and open so as to allow the rocking weight to oscillate freely; the nose 88 of the spring 31 which moves then outwardly of the cylindrical casing 81 prevents the bolt 82 from returning into its inoperative position. The mechanism for locking the rocking weight as just described is provided for missiles which assume in their flight no gyratory movement or only a small gyratory movement.

I have illustrated in Figs. 11 and 12 a rocking weight adapted to execute oscillatory movements round the axis of the two spindles 12 and 13 extending in a direction perpendicular to the axis of the fuse 101. The rocking weight includes again two arms 8 and 9 rigidly interconnected by two stays 10 and 11.

In Fig. 11 is shown in dotted lines the location of the arm 8 in a rocked position of an irrelevant amplitude 102. In this position the stays 10 and 11 are subjected each to a centrifugal force 103 producing a torque which urges the arm 8 back into its neutral position of equilibrium shown in solid lines. Centrifugal force opposes thus the undamped oscillations of the rocking weight provided with the stays 10 and 11 round the common axis of the pivots 12 and 13. To cut out this serious drawback, I associate with the first compound rocking weight 8—9—10—11 a second compound rocking weight including heavy stays 104 and 105 which are interconnected by arms 136 and 137 located in a common plane perpendicular to that containing the arms 8—9 as readily apparent from inspection of Fig. 13.

In said Fig. 13, a first compound rocking weight includes two stays 10 and 11 which are balanced by the two stays 104 and 105 of the second compound weight, which are pivotally secured at 112 to a diametrical axis perpendicular to the axis 101 of the fuse. The two stays 104 and 105 of the second weight are positioned in a plane perpendicular to that of the stays 10 and 11 of the first weight.

By reason of this arrangement, and by a suitable selection of the masses m_1—m_2 and of the lever arms r_1—r_2 defining the torques, it is possible to provide for a compensation between the torques produced by centrigugal force on the two rocking weights to wit, 8—9—10—11, to which the magnitudes m_1—r_1 have been allotted on the one hand and 104—105—136—137 on the other hand, to which the magnitudes m_2—r_2 have been allotted.

Calculation shows as a matter of fact that in this case the centrifugal torques of opposite directions compensate each other, since there is obtained for any amplitude of oscillation α of the rocking weight a resulting torque $C=m_1r_1 \cos \alpha \sin \alpha - m_2r_2, \sin \alpha \cos \alpha = 0$. The weights of the stays 104 and 105 balance thus the weights of the stays 10 and 11.

I have illustrated in Figs. 14 and 15 a rocking weight including two discs 118 and 119 revolubly mounted at 112 and 113 and interconnected by two stays 10 and 11 which are balanced as far as centrifugal force is concerned by four masses 106, 107, 108, and 109 which are located in a diametrical plane of the discs perpendicular to the plane of the stays 10 and 11.

The stays 10 and 11 may also be balanced as illustrated in Fig. 16 by means of discs 128 provided with two apertures 110 and 111 arranged symmetrically with reference to a plane extending perpendicularly to the plane containing the stays 10 and 11 and symmetrically between said stays.

The weight of the stays 10 and 11 may also be balanced by means of circular openings 122 provided in such discs 118 forming part of the compound rocking weight as illustrated in Fig. 17.

The shape of the arms of the rocking weight may also be that illustrated in Fig. 18, to wit, a cross-shaped member revolubly carried by a spindle 12 and associated with stays 10 and 11 and balancing weights 106 to 109 similar to those illustrated in Fig. 15.

I have illustrated partly in Fig. 19 safety means for a fuse arming mechanism including a central spindle 201 extending axially of the fuse and guided inside an upper bearing 202 centrally fitted in an upper plate 203 and inside a lower bearing 204 formed in a lower plate 205. The two plates 203 and 205 are held in position by two uprights 214 and 215.

The central spindle 201 carries a toothed escape wheel 219 cooperating with a cylinder 220 adapted to rock to either side of a neutral position round a diametrical axis perpendicular to the axis of the fuse i.e. round the axis of the spindle 213 which bears against an attachment screw 229. A pinion 221 rigid with said spindle 213 meshes with a toothed wheel 222 revolubly mounted on the central spindle 201.

The operation of the mechanism just described is similar to that of the mechanism described with reference to Figs. 1 to 9. The cylinder 220 executes undamped oscillations round the spindle 213 so as to carry along with it through the pinion 221 the toothed wheel 222 which executes in its turn oscillations round the central spindle 201.

In the example illustrated, the spring serving for the maintenance of the oscillations is constituted by a coil spring 223 coaxial with the central spindle 201 and secured through one end 224 to the pinion 222 and through its other end to the lower plate 205.

In the example illustrated, the weight oscillating with reference to the spindle 213 has its centre of gravity outside the axis of the fuse and centrifugal force urges said mass towards the bearing constituted by the attachment screw 229.

I have illustrated in Fig. 20 a section of a mechanism similar to that of Fig. 19, wherein the rocking weight oscillating round a diametrically located spindle perpendicular to the axis of the fuse has its centre of gravity on said axis of the fuse.

Said mechanism includes again a lower plate 205 associated with two uprights 214 and 215 which serve as bearings for the two pivots, 212 and 213, of a rocking weight including two arms 208 and 209 rigid with two stays 210 and 211, while a cylinder 220 controls as precedingly a toothed wheel 222 similar to the wheel 222 illustrated in Fig. 19. The elementary weights forming said compound rocking weight should be selected in a manner such that the centre of gravity of the oscillating mass lies on the axis of the fuse.

The two pivots or spindles 212 and 213 engage two small discs or the like members 226 and 227 serving as step bearings for them and fitted in the uprights 214 and 215.

The toothed pinion 221 meshing with the toothed wheel 222 and said toothed wheel 222 are both provided preferably with bevel teeth.

In the examples selected for the illustration of a fourth embodiment, I have shown in Figs. 21 to 22 a mechanism including a lower plate 401, and an upper plate 402 serving as a bearing for a central spindle 403, provided with an axial bore for the passage of a striker 404 rigid when inoperative with the actual fuse which is not illustrated and which is located above the mechanism.

The central spindle 403 carries a cam 405 cooperating

with a lever 406 pivotally secured at 407 and including a terminal bolt-locking projection 408.

The lower plate 401 is provided with a diametrical recess 409 for the striker bolt 410 extending underneath the tip of the striker 404 and held inside said recess by a perforated plate 411 fitted inside a primer carrier 412. When the mechanism is inoperative as shown in Fig. 22, the nose 413 on the lever 406 engages the periphery of the cam 405 and the locking projection 408 rigid with the outer lever arm 406' holds the bolt 410 in its operative striker-locking position.

When the central spindle 403 and the cam 405 rigid therewith have executed a predetermined angular movement, the receding section 415 of the cam registers with the terminal nose 413 on the lever 406 which is thus engaged by said receding section. The lever 406 pivots consequently round the stud 407 and the projection 408 enters its second position 408' shown in dotted lines so as to release the bolt 410 which moves in the direction of the arrow 416 perpendicularly to the central spindle 403 so as to uncover the central perforation 417 in the plate 411. The striking of the primer 418 by the striker 404 is thus made possible through said perforation. The striker is now free to operate. The release of the bolt 410 and of the striker 404 is thus obtained only when the central spindle 403 has executed a predetermined rotation corresponding to the desired safety length on the path of the missile.

I have illustrated in Fig. 23 a bolt 421 for the striker pivotally secured at 422 and held in its locking position by the projection 408 for which it covers the central opening 417 in the plate 411, said perforation 417 being caused to register with the striker when the safety mechanism is released. In the case illustrated in Fig. 23, the bolt 421 is shifted through a rotation round an axis parallel with the central spindle. The remainder of the mechanism is the same as that illustrated in Figs. 21 and 22.

I have illustrated in Figs. 24 and 25 a mechanism similar to that described with reference to Figs. 21 and 22 and including a lower plate 401, an upper plate 402, a central spindle 403 and a striker 404. The central spindle 403 carries as precedingly a cam 405 cooperating with a lever 406 pivotally secured at 407 and including a bolt-locking projection 408. The lower plate 401 is provided with a diametrical housing for a striker-locking bolt 424 which held in said housing by a safety plate 425 underneath which is located a detonator carrier 426.

The bolt 424 is constituted by a recessed bar provided with a housing 427 for a primer, said housing communicating, before the arming of the fuse through the ports 428 and 429 with an annular housing 430 inside the detonator carrier 426.

The operation of the mechanism illustrated in Figs. 24 and 25 is similar to that described precedingly. Before the arming, the bolt is held in its locked position by the locking projection 408. The housing 427 for the primer and the primer inside same lie then outside the path of the striker 404 so that it is impossible for the striker 404 to be operative. The fortuitous bursting or ignition of the primer housed inside the recess 427 cannot be propagated through the central perforation 417 in the plate 425 towards the detonator D. In this embodiment the bolt holding the striker forms thus also a safety arrangement for the detonator. When the bolt 424 is released, it moves in the direction of the arrow 416 which brings the housing 427 for the primer into register with the tip *p* of the striker 404 and with the central perforation 417 communicating with the detonator D so that percussion is henceforward possible.

In the examples described, the centre of gravity of the bolts is eccentric with reference to the axis of the striker so as to allow the movement of the bolt under the action of centrifugal force in the desired direction. This movement may also be executed by means of a spring acting on the bolt. In the two examples selected for the illustration of the fifth embodiment of my invention, the tubular central spindle 501 of the arming mechanism of the fuse carries a cam 502 (Figs. 26 to 31), said spindle being revolubly carried in a lower plate 503.

In the example illustrated in Fig. 26, the lower plate 503 is provided as precedingly with a diametrical recess 409 for a bolt 510 located underneath the tip of a striker 404 shown cross-sectionally in Fig. 26. Said striker extends inside the central tubular spindle 501. Before the cocking, the nose 413 on the lever 406 engages the periphery of the cam 502 and the locking projection 408 carried by the outer arm 406' of said lever 406 locks the bolt 510 in its inoperative position. When the central spindle 501 and the cam 502 rigid therewith have executed a predetermined angular movement, the receding section 504 of the cam registers with the nose 413 on the lever 416 so that said nose engaging the receding section of the cam provides for a pivotal movement of the lever 406 round its pivot 407; the locking projection 408 enters thus the position 408' which releases the bolt so that the latter moves in the direction of the arrow 416 perpendicularly to the central spindle 403. This uncovers the central perforation in the plate located underneath the lower plate 503 so that the striker 404 is now free to strike the primer through said perforation.

In the first example (Figs. 26 to 30) of this fifth embodiment, the cam 502 is shown as provided with a receding section 504 for engagement with the nose 413 on the lever 406 pivotally secured at 407 (Figs. 28 and 29). To either side of said depressed section 504 the cam 502 is provided with two shoulders 508 and 508' adapted to be engaged by a cam plug 509 guided between said shoulders on the inside of a stationary ring 510 rigid with the lower plate 503. The cam plug 509 is axially guided inside the lower plate 503 and a spindle-holding plate 511 lying above the lower plate. To prevent any risk of wedging, the cam plug is free inside its housing constituted by the receding section 504–508 of the cam and its outer surface is cylindrical.

The stationary ring 510 is provided with two ports or openings of which one 512 allows the passage therethrough of the nose 413 on the lever 406 while the second port 513 serves for the radial outward shifting of the cam plug 509. The port 513 is formed beyond the port 512 in the direction of the arrow 414 illustrating the direction of rotation of the cam 502.

In radial register with said second port 513 is located an also stationary bearing block 515 the inner surface of which 516 has a cylindrical shape matching the outer surface of the cam plug 509. The operation of the mechanism described is as follows:

Fig. 28 illustrates the mechanism in its inoperative position for which the cam plug 509 is held in its cam engaging position by the stationary ring 510. When the cam has rotated through a predetermined angle in the direction of the arrow 414, the cam plug 509 enters a position registering with the nose 413 of the lever 406 and prevents the latter from being shifted inwardly with reference to the cam. When the cam has rotated through a further predetermined angle corresponding to a predetermined number of oscillations of the rocking weight forming part of the escape mechanism, said cam enters the position illustrated in Fig. 29. The cam plug 509 registering now with the second port 513 in the ring 510 is urged centrifugally away from the shoulders 508 and 508' on the cam 502 and engages the cooperating surface 516 on the bearing block 515.

The cam 502 continues then rotating and when it has entered the position illustrated in Fig. 30, it has its receding section 504 registering with the first port 512 and with the nose 413 on the lever 406; consequently, the

lever 406 urged by a spring R for instance (Fig. 26) pivots in the direction of the arrow 520 shown in Fig. 30 round the pin 407 and engages the receding section 504 in the cam 502. This pivotal movement of the lever 406 releases the striker bolt in the manner described with reference to Fig. 26.

The mechanism described hereinabove allows the cam 502 to execute a rotation through an angle longer than one revolution but less than two revolutions before it allows the lever 406 to rock. I obtain thus an arming mechanism with an increased safety on the path of the missile.

In the second example of the fifth embodiment of my invention, as illustrated in Fig. 31, the stationary ring 520 is provided with a single port 521 both for the inward movement of the nose 413 on the lever 406—406' and for the outward movement of the plug 522 for the cam 523. The receding section 524 in the cam 523 is not provided with any shoulder as in the case of the first example and it assumes the shape of a cylindrical sector matching the shape of the plug 522. The bearing block 525 is engaged by the plug 522 when the cam is in the position for which the outwardly shifted plug is shown in dot-and-dash lines in Fig. 31 i.e. when the cam 523 has executed a rotation by less than one complete revolution, starting from its inoperative position for which the receding section of the cam 524 lies on the right hand side of said cam, as illustrated in Fig. 31.

The operation of the modification shown in Fig. 31 is substantially the same as that described with reference to Figs. 27 to 30.

Generally speaking, the safety arming mechanism according to the fifth embodiment of my invention is characterized by the fact that the central spindle is provided with a cam cooperating with a lever controlling the locking and the release of the striker bolt, said cam being provided with a depressed or receding section closed against the entrance of the lever into it before operation and during a part of the rotation of the central spindle by a cam plug, while said cam is surrounded coaxially by a stationary ring provided with at least one port for the passage of the lever nose into the receding section of the cam and for the release of the cam plug. This mechanism is designed in a manner such that the cam plug is held in its cam-closing position by the stationary ring and that during the rotation of the central spindle said plug prevents first the nose on the lever from engaging said receding section of the cam, after which the plug moves away from the cam after it has passed underneath said nose through the passage afforded by the said port, whereby said cam is allowed to execute a rotation through an angle greater than one revolution before the lever is released and is allowed to pass through said port and to engage the receding section of the cam so as to release in its turn the striker bolt.

What I claim is:

1. In a fuse for a rotating missile, including a fuse body and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, a weight adapted to rock with reference to the fuse body around an axis crossing perpendicularly the axis of the central spindle to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism operatively connecting the rocking weight with the central spindle to provide for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radially directed channel and engaging transversely in its original position the bore in the central spindle to prevent the operative movement of the striker through said bore, said bolts being subjected to centrifugal force, means carried by the fuse body preventing radial movement of the bolt as long as the spindle is in its original starting position and during its rotary travel between said starting position and a predetermined angular setting, the bolt being urged outwardly centrifugally to release the striker as soon as the spindle has entered said predetermined angular setting, means locking in its original starting position the system including the rocking weight, escape mechanism and central spindle against rotation and means releasing the last-mentioned locking means upon firing of the missile.

2. In a fuse for a rotating missile, including a fuse body and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, a weight adapted to rock with reference to the fuse body around an axis crossing perpendicularly the axis of the central spindle to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism including an escape wheel rigid with the central spindle and a cylinder rigid with the rocking weight operatively connected with said escape wheel, to provide for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radial channel and engaging transversely in its original position the bore in the central spindle to prevent the operative movement of the striker through said bore, said bolt being subjected to centrifugal force, means carried by the fuse body preventing radial movement of the bolt as long as the spindle is in its original starting position and during its rotary travel between said starting position and a predetermined angular setting, the bolt being urged outwardly centrifugally to release the striker as soon as the spindle has entered said predetermined angular setting, means locking before operation the system including the rocking weight, escape mechanism and central spindle against rotation and means releasing the last-mentioned locking means upon firing of the missile.

3. In a fuse for a rotating missile, including a fuse body and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, a weight including two parallel arms, located symmetrically to either side of the central spindle and two parallel stays rigidly interconnecting said arms, a transverse spindle section rigid with each of said parallel arms and aligned along a common axis crossing perpendicularly the axis of the central spindle, the center of gravity of said weight lying on the axis of the central spindle, said weight being adapted to rock with reference to the body of the fuse round said common spindle axis to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism operatively connecting the rocking weight with the central spindle to provide for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radial channel and engaging transversely in its original position the bore in the central spindle to prevent the operative movement of the striker through said bore, said bolt being subjected to centrifugal force, means carried by the fuse body preventing radial movement of the bolt as long as the spindle is in its original starting position and during its rotary travel between said starting position and a predetermined angular setting, the bolt being urged outwardly centrif-

ugally to release the striker as soon as the spindle has entered said predetermined angular setting, means locking in its original starting position the system including the rocking weight, escape mechanism and central spindle against rotation and means releasing the last-mentioned locking means upon firing of the missile.

4. In a fuse for a rotating missile, including a fuse body and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore carried axially of the fuse to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, a weight including two parallel arms, located symmetrically to either side of the central spindle and two parallel stays rigidly interconnecting said arms, a transverse spindle section rigid with each of said parallel arms and aligned along a common axis crossing perpendicularly the axis of the central spindle, the center of gravity of said weight lying on the axis of the central spindle, said weight being adapted to rock with reference to the body of the fuse around said common spindle axis to either side of a position of non stable equilibrium, a coil spring mounted coaxially with reference to the aligned transverse spindles of the rocking weight and operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism including an escape wheel rigid with the central spindle and a cylinder rigid with the rocking weight and operatively connected with said escape wheel to provide for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radial channel and engaging transversely in its original position the bore in the central spindle to prevent the operative movement of the striker through said bore, said bolt being subjected to centrifugal force, means carried by the fuse body preventing radial movement of the bolt as long as the spindle is in its original starting position and during its rotary travel between said starting position and a predetermined angular setting, the bolt being urged outwardly centrifugally to release the striker as soon as the spindle has entered said predetermined angular setting, means locking in its original starting position the system including the rocking weight, escape mechanism and central spindle against rotation and means releasing the last-mentioned locking means upon firing of the missile.

5. In a fuse for a rotating missile, including a fuse body and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a coil spring arranged coaxially round the central spindle urging said central spindle into rotation, a weight adapted to rock with reference to the fuse body around an axis crossing perpendicularly the axis of the central spindle to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism operatively connecting the rocking weight with the central spindle to provide for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radial channel and engaging transversely in its original position the bore in the central spindle to prevent the operative movement of the striker through said bore, said bolt being subjected to centrifugal force, means carried by the fuse body preventing radial movement of the bolt as long as the spindle is in its original starting position and during its rotary travel between said starting position and a predetermined angular setting, the bolt being urged outwardly centrifugally to release the striker as soon as the spindle has entered said predetermined angular setting, means locking in its original starting position the system including the rocking weight, escape mechanism and central spindle against rotation and means releasing the last-mentioned locking means upon firing of the missile.

6. In a fuse for a rotating missile, including a fuse body and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, a weight adapted to rock with reference to the fuse body around an axis crossing perpendicularly the axis of the central spindle to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism operatively connecting the rocking weight with the central spindle to provide for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radial channel, said bolt including a slotted section engaging transversely in its original position the bore in the central spindle to hold the tip of the striker and to prevent operative movement of the latter, a slideway for the bolt extending radially of the spindle axis, said bolt being subjected to centrifugal force, means carried by the fuse body preventing radial movement of the bolt as long as the spindle is in its original starting position and during its rotary travel between said starting position and a predetermined angular setting, the bolt being urged outwardly centrifugally to release the striker as soon as the spindle has entered said predetermined angular setting, means locking in its original starting position the system including the rocking weight, escape mechanism and central spindle against rotation and means releasing the last mentioned locking means upon firing of the missile.

7. In a fuse for a rotating missile, including a fuse body and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, a weight including two parallel arms, located symmetrically to either side of the central spindle and two parallel stays rigidly interconnecting said arms, a transverse spindle section rigid with each of said parallel arms and aligned along a common axis crossing perpendicularly the axis of the central spindle, the center of gravity of said weight lying on the axis of the central spindle, said weight being adapted to rock with reference to the body of the fuse around said common spindle axis to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism operatively connecting the rocking weight with the central spindle to provide for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radially directed channel and engaging transversely in its original position the bore in the central spindle to prevent the operative movement of the striker through said bore, said bolt being subjected to centrifugal force, means carried by the fuse body preventing radial movement of the bolt as long as the spindle is in its original starting position and during its rotary travel between said starting position and a predetermined angular setting, the bolt being urged outwardly centrifugally to release the striker as soon as the spindle has entered said predetermined angular setting, and at least one blade spring carried by the fuse body frictionally engaging the rocking weight and adapted to release the latter under the action of centrifugal force upon firing of the missile.

8. In a fuse for a rotating missile, including a fuse body

and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, two bearings in the fuse body for the opposite ends of said spindle respectively, a ferrule rigid with the central spindle, a driving spring urging said central spindle into rotation, one end of the spring being secured to the outer bearing and the other end to said ferrule, a weight adapted to rock with reference to the fuse body around an axis crossing perpendicularly the axis of the central spindle to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism operatively connecting the rocking weight with the central spindle to provide for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radially directed channel and engaging transversely in its original position the bore in the central spindle to prevent the operative movement of the striker through said bore, said bolt being subjected to centrifugal force, means carried by the fuse body preventing radial movement of the bolt as long as the spindle is in its original starting position and during its rotary travel between said starting position and a predetermined angular setting, the bolt being urged outwardly centrifugally to release the striker as soon as the spindle has entered said predetermined angular setting, means locking in its original starting position the system including the rocking weight escape mechanism and central spindle against rotation and means releasing the last mentioned locking means upon firing of the missile.

9. In a fuse for a rotating missile, including a fuse body and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, a weight adapted to rock with reference to the fuse body around an axis crossing perpendicularly the axis of the central spindle to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism operatively connecting the rocking weight with the central spindle to proivde for constancy of the speed of rotation of the latter, a bolt slidably mounted in the radially directed channel and engaging transversely in its original position the bore in the central spindle to prevent the operative movement of the striker through said bore, said bolt being subject to centrifugal force, an arcuate member rigid with the fuse body extending in a plane perpendicular to the spindle axis on the outside of said spindle between radii passing through the locations of the radial channel at the starting of the spindle and a predetermined angular setting to be occupied subsequently by the latter, said arcuate member preventing outward movement of the centrifugally urged bolt until the spindle has passed beyond the last-mentioned angular setting, means locking in its original position the system including the rocking weight, escape mechanism and central spindle against rotation and means releasing the last-mentioned locking means upon firing of the missile.

10. In a missile fuse, including a fuse for a rotating missile and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, a weight adapted to rock with reference to the fuse body around an axis crossing perpendicularly the axis of the central spindle to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism operatively connecting the rocking weight with the central spindle to provide for constancy of the speed of rotation of the later, a cam rigid with the central spindle, a bolt extending transversely of the central spindle through its radially directed channel and adapted to be shifted along said channel out of an original position extending across the bore and locking the striker against operation into a striker-releasing position, a lever controlled by the cam, holding originally the bolt in its striker-locking position and adapted to release said bolt when the central spindle and cam have executed a predetermined angular movement, holding means holding fast against rotation the system including the rocking weight, escape mechanism and central spindle and means releasing the last-mentioned holding means upon firing of the missile.

11. In a missile fuse, including a fuse for a rotating missile and a striker slidable axially thereof, the provision of a safety arming mechanism, comprising a central spindle revolubly carried axially of the fuse and provided with a central bore to slidingly house the striker and with a radially directed channel opening into said bore, a driving spring urging said central spindle into rotation, including two parallel arms located symmetrically to either side of the central spindle and two parallel stays rigidly interconnecting said arms, a transverse spindle section rigid with each of said parallel arms and aligned along a common axis crossing perpendicularly the axis of the central spindle, the center of gravity of said weight lying on the axis of the central spindle, said weight being adapted to rock with reference to the body of the fuse around said common spindle axis to either side of a position of non-stable equilibrium, a regulating spring operatively connected with the rocking weight to urge it towards its position of non-stable equilibrium, an escape mechanism including an escape wheel rigid with the central spindle and cylinder rigid with the rocking weight and operatively connected with said escape wheel to provide for constancy of the speed of rotation of the latter, a cam rigid with the central spindle, a bolt extending transversely of the central spindle through its radial channel and adapted to be shifted along said channel out of an original position extending across the bore and locking the striker against operation into a striker-releasing position, a lever controlled by the cam, holding originally the bolt in its striker-locking position and adapted to releasing said bolt when the central spindle and cam have executed a predetermined angular movement, holding means holding fast against rotation the system including the rocking weight, escape mechanism and central spindle and means releasing the last mentioned holding means upon firing of the missile.

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