E. A. SPERRY.

LAUNCHING MECHANISM FOR AEROPLANES.

APPLICATION FILED AUG. 8, 1918.

1,415,847.

Patented May 9, 1922.

3 SHEETS—SHEET 1.

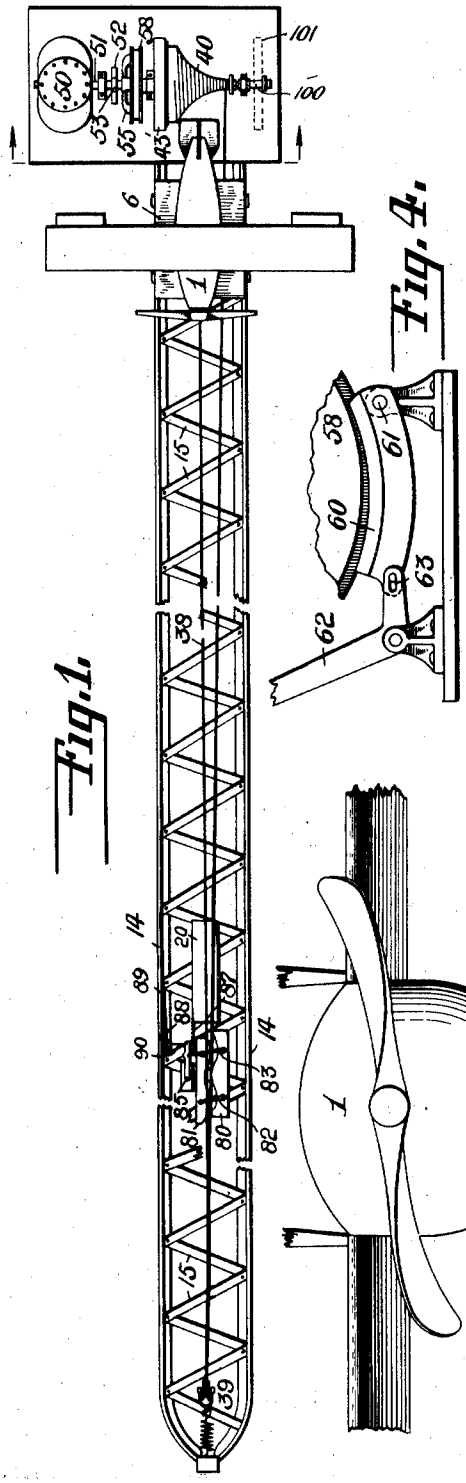


Fig. 1.

Fig. 4.

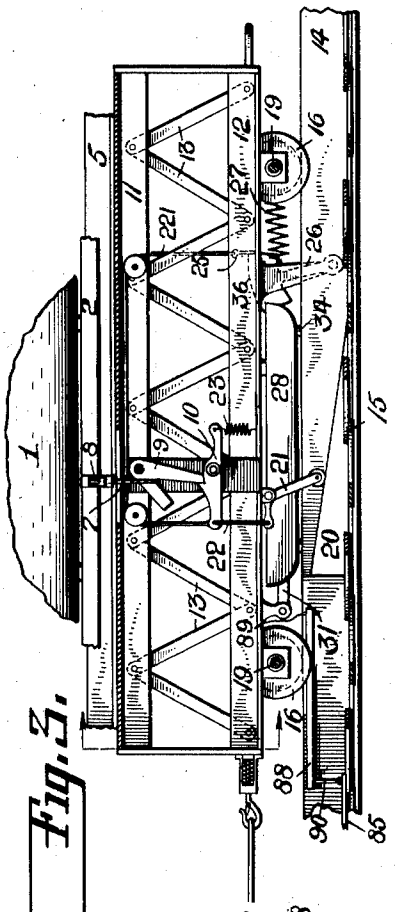


Fig. 3.

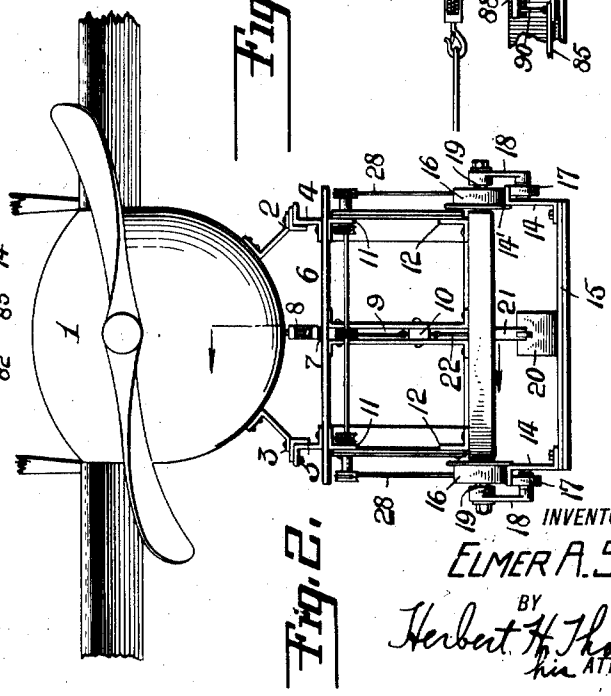


Fig. 2.

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Fig. 5.

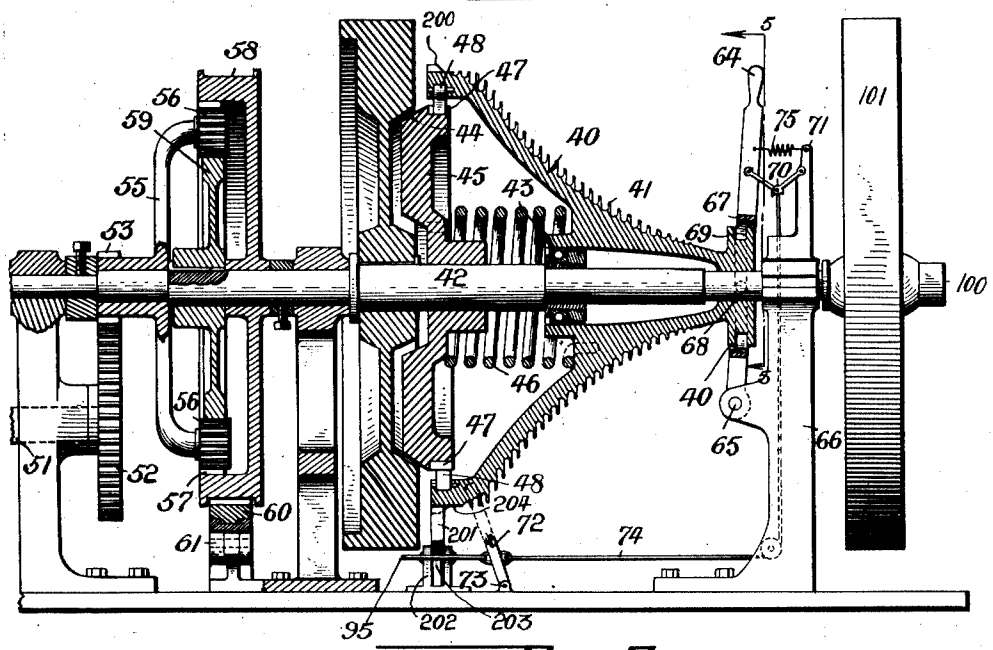


Fig. 6.

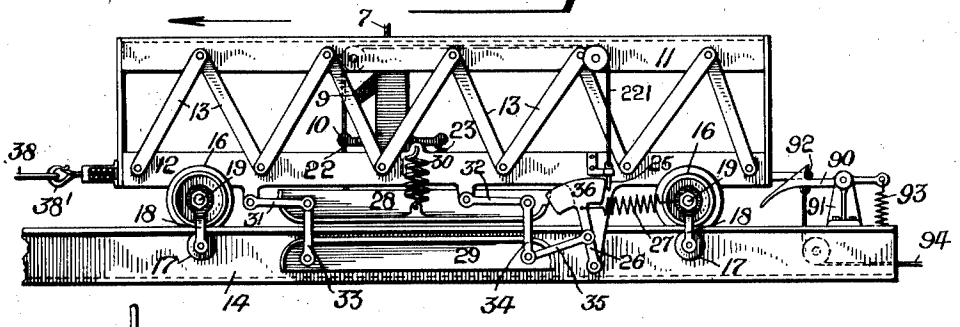
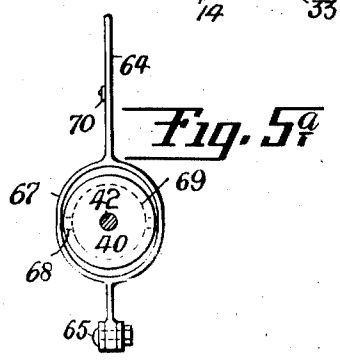


Fig. 5a.



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3 SHEETS—SHEET 3.

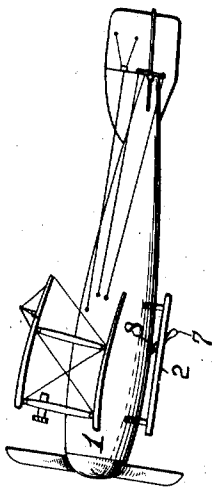


Fig. 7.

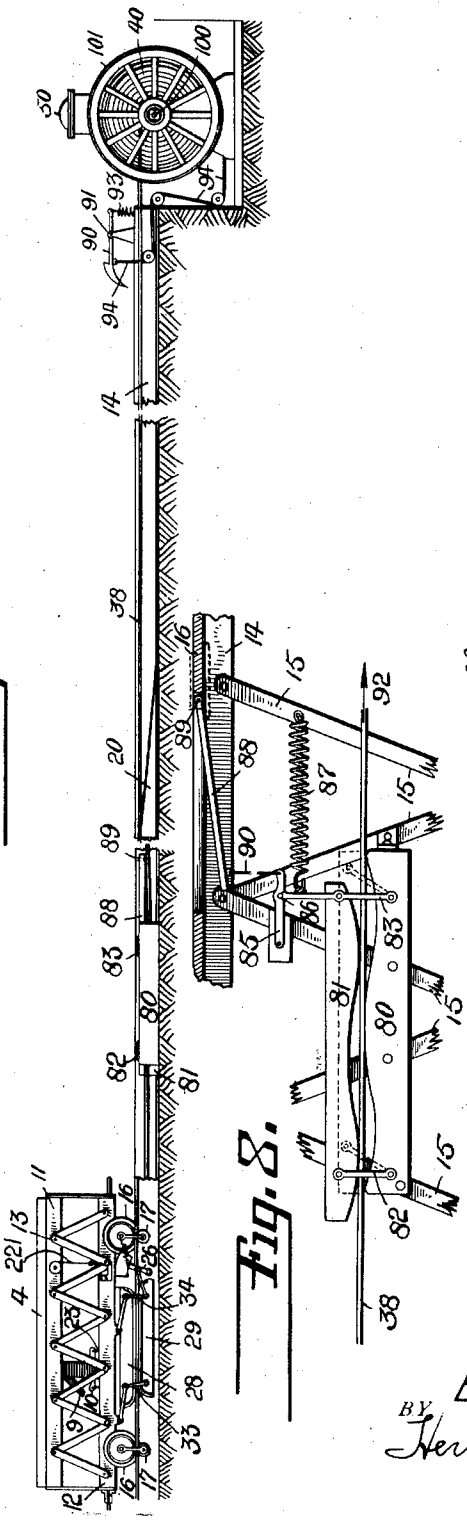


Fig. 8.

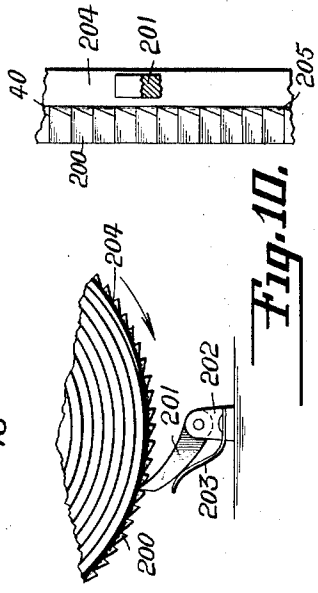


Fig. 10.

Fig. 9.

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UNITED STATES PATENT OFFICE.

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LAUNCHING MECHANISM FOR AEROPLANES.

1,415,847. Specification of Letters Patent. Patented May 9, 1922.

Application filed August 8, 1918. Serial No. 248,834.

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States of America, residing at 1505 Albemarle Road, Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Launching Mechanism for Aeroplanes, of which the following is a specification.

This invention relates to mechanisms for launching aeroplanes or more particularly aerial torpedoes which are launched and flown without a pilot.

In order that this type of launching mechanism may be successful it is necessary that it should be light in weight, easily transported, set up or dismantled, so that it may be moved from place to place dependent upon the location of the opposing forces.

Referring to the drawings in which what are now considered the preferred forms of the invention are shown:

Fig. 1 is a plan view of the launching track and mechanism with an aeroplane mounted thereon.

Fig. 2 is a front view of the car used to support the aeroplane, showing a portion of the aeroplane secured thereto.

Fig. 3 is a longitudinal section of the car and brake.

Fig. 4 is a detail of a portion of the propelling mechanism.

Fig. 5 is a sectional view of the fly wheel which is used as an energy storing device and of the drum upon which the cable is wound.

Fig. 5ª is a section on line 5—5 of Fig. 5.

Fig. 6 is a side elevation of the car as mounted on the track.

Fig. 7 is a side elevation of a car track and power supplying mechanism.

Fig. 8 is a detail plan of the cable brake.

Fig. 9 is a fragmentary detail side elevation showing a portion of the structure illustrated in Fig. 5, the arrow showing the direction of rotation to wind the cable on the drum.

Fig. 10 is an inverted fragmentary plan view of a portion of the structure illustrated in Figs. 5 and 9.

The aeroplane proper 1 is shown as provided with skids 2 and 3, which in launching rest upon angle bars 4 and 5 of the car 6. The aeroplane may be firmly clamped upon the car by means of a stout hook or loop 7 which is preferably provided with a turn buckle 8. Said loop is hooked over the pivoted latch 9 which is normally prevented from turning upwardly by catch 10. The car may be of any suitable light construction, and is shown as made up of angle bars 11 and 12 connected by lattice work 13. The track is preferably formed of Z bars 14 bolted or otherwise secured to cross ties 15. The wheels 16 are provided with flanges in the usual manner. In addition to the said wheels I prefer to provide auxiliary rollers or wheels 17 which may be journaled upon arms 18 secured by axles 19 to any convenient portion of the car. Said rollers are adapted to engage the underneath surface of the tread 14' of the rail as shown and thereby prevent the car from being lifted from the track by the aeroplane and also prevent its tilting backwardly when the car is suddenly started by the mechanism hereinafter described. The mechanism is so designed that the car is accelerated up to a predetermined point on the track approximately three-fifths to two-thirds of the length of the track at which point the aeroplane is released and the brake applied to the car. To effect this purpose a trip 20 is placed on the track at a predetermined position. Said trip engages a projection on the car such as bell crank lever 21 and rotates the same in a counterclockwise direction. Said lever is connected by link 22 to the aforementioned trip 10 and serves to depress the same upon its rotation against the action of the spring 23. Also connected to said trip or to the bell crank lever by means of a flexible connection 221 is a pin 25 which engages a weighted lever 26. Said lever is resiliently pressed to the right by a spring 27 so that when the pin is pulled upwardly by the connection 221 the lever rotates clockwise.

Adjacent one or both of the rails of the track are hung a pair of brake shoes 28—29 (Fig. 6). The upper brake shoe 28 is shown as supported by a spring 30 and is also connected to the car by links 31 and 32. The lower brake shoe is linked to the upper brake shoe and to the car by links 33 and 34. The lower brake shoe also is connected to the aforementioned lever 26 by a link 35. It will be readily seen that by this or other equivalent arrangements a snubbing post action is secured since with the car moving in the direction of the arrow as soon as the pin 25 is jerked out, lever 26 will be drawn to

the right by spring 27 thereby causing the brake shoe 29 to engage the rail, and the friction thereof with the rail will draw it rearwardly thereby drawing the upper brake shoe into engagement with the top of the rail. The greater the friction of the brake shoes the tighter will the shoes grip the tread of the rail therebetween. In order to prevent too severe braking of the car I preferably provide means responsive to the rate of deceleration of the car for lessening the braking action. For this purpose I have shown the lever 26 as weighted at its upper end 36. It will be readily seen that as the car is retarded the momentum of the weighted end 36 will tend to move it forward against the action of the spring 27. The mass of the weight 36 is so adjusted with respect to the tension of the spring 27 that the weight will lessen the braking effect whenever the deceleration of the car becomes greater than the predetermined amount. By such means serious damage to the car and track is avoided and at the same time the car is brought to a standstill in the shortest time possible after application of the brake.

The car is shown as connected to the source of power by cable 38 which is coupled in any convenient manner to the front of the car such as by means of a hook 38'. Said cable is shown as passing through a pulley block 39 at the outer end of the track and back again under the car to the reel or drum 40 around which the cable is coiled. Preferably the said reel is of conical or conoidal shape, for the purpose hereinafter described, and may be provided with guide grooves 41 for the cable. The drum is shown as journaled at or near its center of gravity upon the shaft 42 by means of a friction bearing 43. Said cone is slidably mounted upon the shaft so that it may move toward or away from the heavy fly wheel 43' which is employed as an energy storing device. Said fly wheel is provided with a friction or clutch face 44. A clutch member 45 connected to the drum is adapted to engage the said friction face upon the movement of the drum toward the fly wheel. Said clutch member is shown as connected to the drum by means of a stiff spring 46, so that as the drum is moved to the left, the clutch face will be resiliently and strongly pressed into engagement with the friction surface of the fly wheel. At the same time the drum will not be started up with a pronounced shock since the first shock will be absorbed by the spring 46. I preferably also provide between the clutch member and the drum a ratchet and pawl connection, ratchet teeth 47 being shown as mounted on the clutch member, while the pawls 48 are on the drum member. This is for the purpose of maintaining the spring 46 at its maximum tension and preventing oscillation of the drum with respect to the clutch member.

The source of power is represented as an internal combustion engine 50 which is shown as directly connected to a shaft 51 provided with a gear wheel 52. Said gear meshes with the smaller pinion 53 loosely journaled upon the shaft 42. Said pinion 53 is shown as directly connected to arms 55 which carry pinions 56. Said pinions 56 engage both an internal gear 57 upon a friction member 58, and a gear 59 keyed or otherwise secured to the shaft 42.

It will be readily seen that if the member 58 which is loosely journaled upon the shaft 42 is allowed to rotate freely, little or no movement will be imparted to the gear 59 and hence to the fly wheel 43' by the rotation of the engine. The engine may thus be brought up to speed running without load. As soon as this is accomplished the member 58 may be retarded by any suitable means such as a brake shoe 60 pivoted at 61 and actuated by hand lever 62 which is linked at 63 to the outer end of the brake shoe. By this means the member 58 may be gradually brought to rest and hence the fly wheel may be brought up to speed without stalling the engine. It is obvious that any other suitable connecting means may be employed between the engine and fly wheel within the scope of the invention.

After the fly wheel is brought up to a high speed the aeroplane may then be launched by moving the drum to the left so as to engage the clutch faces. This may be accomplished by hand or otherwise if desired. For this purpose a handle 64 is shown which is pivoted at 65 to the frame 66. The handle is provided with a forked portion 67 having the pins 68 which engage in a circular groove 69 in the drum 40. The clutch when thrown is held in engagement by a toggle 70 operable between the handle 64 and an upstanding arm 71 on the frame. Automatic means are preferably provided for throwing out the clutch when the car has reached a predetermined position on the track, or in other words, has reached the desired speed. For this purpose a trip 72 pivoted at 73 may be provided which lies in the path of the cable as it nears the end of the drum. The cable in unwinding will obviously move the trip 72 to the left thereby pulling downwardly on the flexible connection 74 and breaking the toggle, whereupon the clutch will be disengaged by the action of the spring 75.

The surface of the drum is preferably so designed as to impart a uniform maximum acceleration to the car. If it were possible to maintain the fly wheel up to speed during the car's acceleration, the drum would obviously be a cone up to the point where the aeroplane was released for uniform accelera-

tion. This, however, is obviously unnecessary since it would require an engine of much larger power. I prefer therefore to make use of the energy stored up in the rapidly operating fly wheel for performing the major portion of the work necessary to accelerate the car. The surface of the drum is therefore of a concave, conoidal character.

I find it important that the car be held firmly in place on the track prior to launching so that the cable may be held taut and so that the car will not be carried forward by the aeroplane propeller in case the aeroplane engine is spun up before launching. For this purpose a pivoted catch 90 is shown bolted to the track at 91. Said catch engages a coupling 92 on the car, and is normally held in engagement therewith by a spring 93. Preferably the hook is connected in some manner to the means for throwing in the clutch so that the car is released simultaneously with the aforesaid operation, a flexible connection 94 being illustrated as coupled to the hook and wire 74 through trip 72 (Figs. 5 and 6), thereby connecting the clutch handle 64 and the catch 90.

In addition to the car brake I may provide a separate brake for the drum and cable. In case such brake is provided, the cable may or may not be released from the car when the aeroplane is released. The cable brake is shown as a pair of blocks 80 and 81 (Figs. 1 and 8) one of which, 80, is secured to the track while the other is linked to the first mentioned block by links 82 and 83. Link 83 is normally held in the position shown in Fig. 8 by catch 85 having a notch 86 engaging the end of said link. A spring 87 connected thereto exerts a force tending to draw the link to the right of Fig. 8. A trip 88 pivoted to the track at 89 in the path of the flange of the car wheel is coupled to the catch 85 by link 90, so that as the car passes over the track the catch 85 will be withdrawn and the lever 83 drawn to the right. This, it will be readily seen, will pull the block 81 to the right and clamp both blocks tightly on the rope. The wearing surface of the said blocks may be curved as shown in order to increase the frictional grip on the rope. Preferably the blocks are positioned to grip the rope as it returns to the drum. This condition is indicated by the arrow 92 in Fig. 8 showing the direction of travel of the rope.

The shaft 42 may be extended beyond bracket 66, if desired, thereby forming an axle 100 for a wheel 101 (Figs. 1 and 5). Said wheel may be placed on the axle 100 when it is desired to transport the unit, the whole being adapted to be rolled along the ground on wheel 101 and fly wheel 43′.

The parts may be so designed that the clutch connection between members 40, 43′ will be broken at or about the time the cable brake becomes operative. If desirable, means may also be provided to prevent snarling of the cable when the cable brake becomes operative. This means may assume the form illustrated in Figs. 5, 9 and 10 and constructed substantially as follows.

The drum 40 may be provided with a peripheral row of ratchet teeth 200 adapted to be engaged by a pawl or dog 201 to prevent reverse rotation of the said drum when the cable is gripped by its brake. The pawl 201 is shown pivoted in a bracket 202 secured to the base, on which the drum 40 is mounted, and biased to tooth-engaging position by means of a spring 203. It will be noted that when the drum 40 occupies a position to the left, (as viewed in Fig. 5) i. e., when the clutch 44 is in the operative position, the pawl 201 engages the smooth portion 204 of said drum as shown in Fig. 10, so that little or no retarding effect is exerted by said pawl. However, when the clutch connection between the drum 40 and wheel 43′ is broken, as previously described, the drum moves to the right (as viewed in Fig. 5) and the teeth 200 are then in a position to be engaged by the pawl. Each of the teeth 200 is preferably beveled as indicated at 205 in Fig. 10 to guide the pawl 201 into its operative position.

The manner in which this launching mechanism may be used where firing aerial torpedoes is as follows. The gunner upon being informed of the range and bearings of the target first observes the barometer and the speed and direction of the wind and by consulting a chart is able to make exact allowances for deflection and corrections of the distance gear. The track is then properly turned to point in the required direction and the torpedo mounted on the car 6 and track 14 and locked. The fly wheel is then energized, requiring several minutes, during which the adjustments of the various propelling and directing gear on the torpedo are made. When the shot is ready to fire, the cable 38 being made taut the catch 91 is released and clutch 44 thrown in simultaneously by moving clutch handle 64. At a predetermined point the clutch is released by trip 72 and the shot released from the car by the engagement of lever 21 with track trip 20. As soon as this is effected the powerful track brakes 28 and 29 are automatically applied, the strength of application being preferably governed by the rate of retardation by means of the pivoted weight 36. Also gripping blocks 80 and 81 may be simultaneously applied to the cable if desired. The cable reel is thus slowed down and the entire cable kept taut by forces acting at the outer end of the cable. The pawl 201 cooperating with the ratchet teeth

204 holds the drum against turning backwardly and maintains the cable under all conditions taut. As soon as the clutch 44 is released the engine 50, which is kept continuously running, restores the normal speed to the fly wheel so that it will again possess the necessary energy for a new shot.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, together with the apparatus, which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In a launching device for aeroplanes, the combination with a car, means for detachably securing the aeroplane to the car, a fly wheel, means for driving the same, a normally stationary cable coupled to said car, a cable drum and a clutch connecting said drum and fly wheel for accelerating the drum and car.

2. In a launching device for aeroplanes, a source of power, a fly wheel, change speed gearing connecting said source with said wheel, a normally stationary cable and cable drum adapted to be detachably coupled to the aeroplane, and a clutch for connecting said wheel and drum.

3. In a launching device for aeroplanes, the combination with a trackway and a car, of means for detachably securing the aeroplane to the car, a track brake on the car, and automatic means for applying said brake and releasing the aeroplane at a predetermined point on the trackway.

4. In a launching device for aeroplanes, the combination with a trackway and a car, of means for detachably securing the aeroplane to the car, a brake on said car and means responsive to the rate of deceleration of the car for varying the force of application of the brake.

5. The combination with a car and track adapted for launching aeroplanes of a track brake on the car adapted to grip the tread of the track with a snubbing post action, and means responsive to the rate of deceleration of the car for lessening the braking effect.

6. In a launching device for aeroplanes, the combination with a car, means for detachably securing the aeroplane to the car, a fly wheel, means for driving the same, a cable and cable drum of progressively increasing diameter and a clutch connecting said drum and fly wheel for accelerating the car.

7. In a launching car for aeroplanes, the combination with a clasp brake having a snubbing post action, of means responsive to the rate of deceleration for governing the action of said brake.

8. In a launching device for aeroplanes, a source of power, a fly wheel, change speed gearing connecting said source with said wheel, a car for detachably supporting the aeroplane, a cable drum of progressively increasing diameter adapted to be coupled to the car, and a clutch for connecting at will the wheel and drum.

9. In a launching device for aeroplanes, a car adapted for translatory motion, power means for accelerating the car, automatic means for disconnecting said means at a predetermined point, a brake and automatic means for applying said brake at substantially the same point in the path of said car.

10. In a launching device for aeroplanes, a car, means for detachably securing an aeroplane thereto, power means for accelerating the car, means for disconnecting said means at a predetermined point and means for releasing said aeroplane at substantially the same predetermined point in the path of travel of the car.

11. In a launching device for aeroplanes, a car, a track clasp-brake thereon having a snubbing post action, means for accelerating the car, means for applying the brake and means responsive to the rate of deceleration for governing the action of the brake.

12. In a launching device for aeroplanes, the combination with the launching carriage, of a fly wheel, means for driving the same, a cable drum, a clutch connecting said drum and fly wheel, a cable adapted to connect the aeroplane and drum, means for throwing in said clutch, means for holding the cable taut prior to launching and means operated by the throwing in of said clutch for releasing said last named means.

13. In a launching device for aeroplanes, the combination with a car, means for detachably securing the aeroplane to the car, a fly wheel, means for driving the same, a cable and a cable drum having a clutch connection with the fly wheel, said drum having a concave conoidal surface such that a substantially uniform acceleration is imparted to the car.

14. In a launching device for aeroplanes, the combination with a car, a source of energy for accelerating the same, a cable connecting said car and source, a brake for the car, and a separate brake for the cable.

15. In a launching device for aeroplanes, the combination with a car, a source of energy for accelerating the same, a cable, a cable drum detachably connected to said

source, a cable connecting said drum and car, and a clasp brake for the cable and drum adapted to grip the cable.

16. In a launching device for aeroplanes, a source of energy comprising an internal combustion engine, a fly wheel, change speed gearing connecting said engine and wheel, a cable drum and a clutch connecting said drum and wheel.

17. In a launching device for aeroplanes, the combination with a car, means for detachably securing the aeroplane to the car, a fly wheel, means for driving the same, a cable drum, a clutch connecting said drum and fly wheel for accelerating the car, a cable connecting the car and drum, a stop for holding the cable taut and means for throwing said clutch and releasing said stop.

18. In a launching device for aeroplanes, the combination with a car, a source of energy for accelerating the same, a cable connecting said car and source, a brake for said car, a separate brake for said cable and means for preventing snarling of said cable when said cable brake becomes operative.

In testimony whereof I have affixed my signature.

ELMER A. SPERRY.