June 19, 1945. A. J. BROWN 2,378,749

HOISTING MECHANISM

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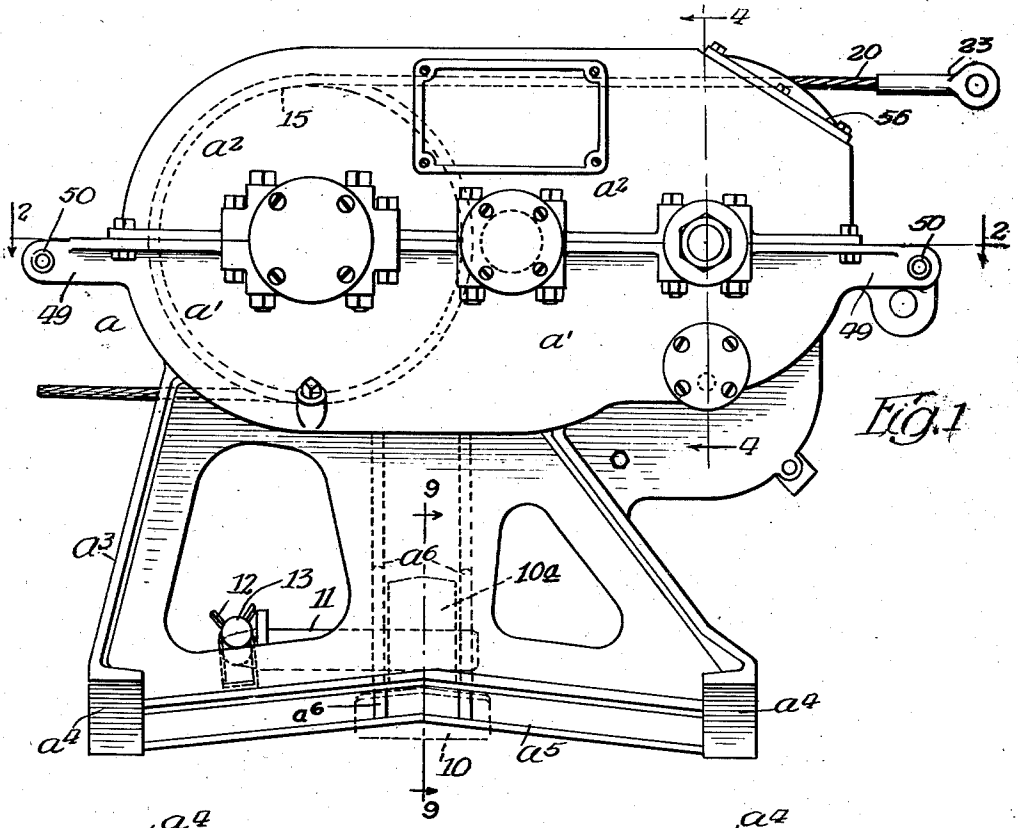

Fig. 1

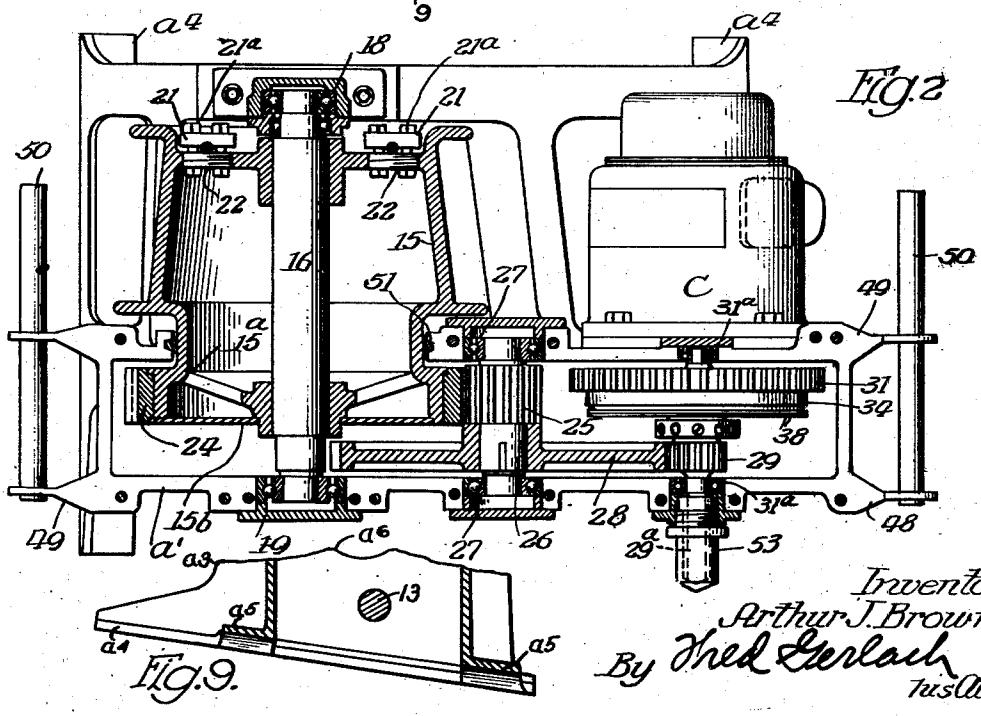

Fig. 2

Fig. 3.

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Fig. 3

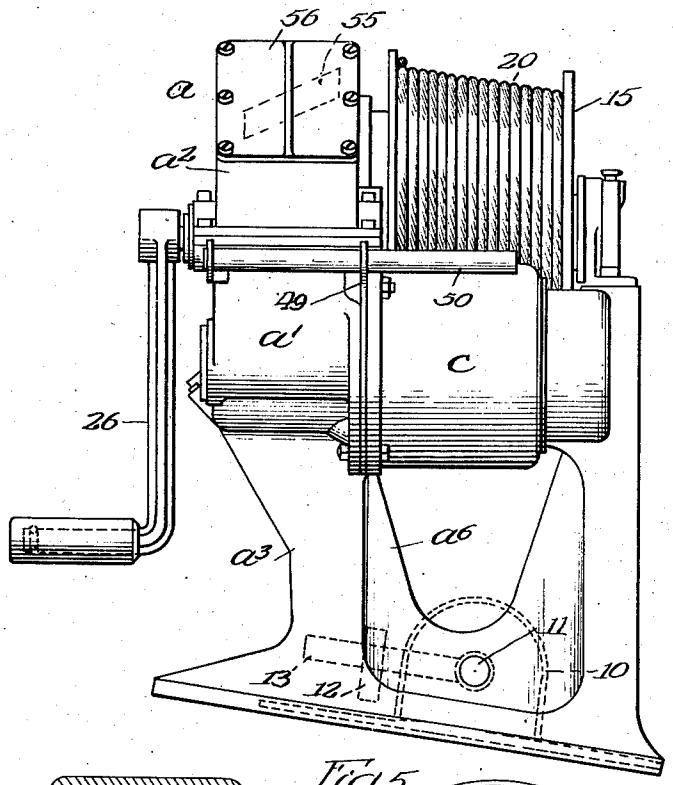


Fig. 4

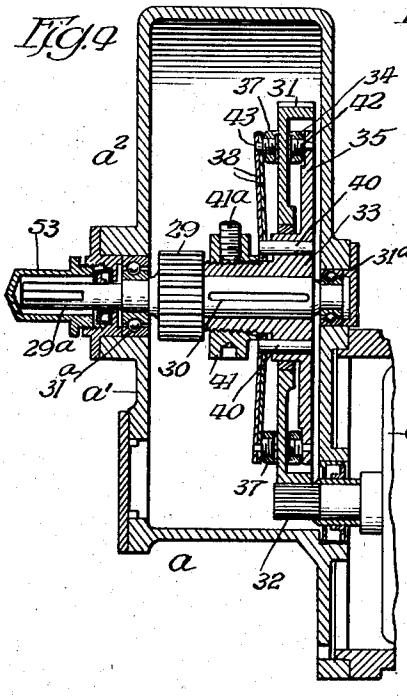


Fig. 5

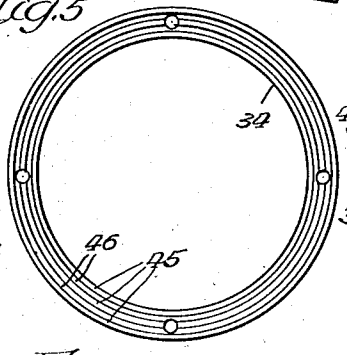


Fig. 7

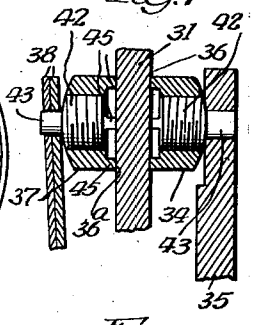


Fig. 6

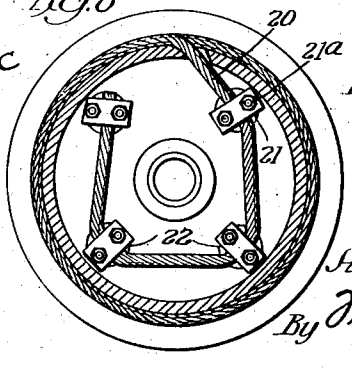
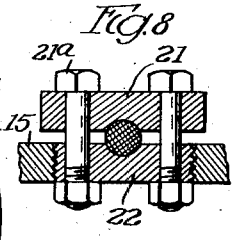


Fig. 8



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HOISTING MECHANISM

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Application September 8, 1941, Serial No. 409,919

5 Claims. (Cl. 254—187)

The invention relates to hoisting mechanism.

One object of the invention is to provide hoisting mechanism of the drum and cable type which is more particularly adapted for hoisting loads, such as bombs, and is usable on airplanes.

Another object of the invention is to provide hoisting mechanism of this type which includes a device for operating the cable to move the load which will become inoperative when the load exceeds a predetermined maximum so that in the event of excessive loading or resistance to the movement of the load, breakage which might result from the continued operation of the hoisting mechanism, will be avoided.

Another object of the invention is to provide hoisting mechanism of this type which is adapted to be detachably mounted on the engine of the airplane so that it can be removed when its use is not desired.

Other objects of the invention will appear from the detailed description.

The invention consists in the several novel features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings: Fig. 1 is a side elevation of hoisting mechanism embodying the invention. Fig. 2 is a horizontal section taken on line 2—2 of Fig. 1. Fig. 3 is an end elevation. Fig. 4 is a section taken on the line 4—4 of Fig. 1. Fig. 5 is a detail of one of the friction rings for driving the lifting drum. Fig. 6 is a detail illustrating the manner of securing one end of the hoisting cable to the drum. Fig. 7 is a section through the friction-rings and the studs on which they are carried. Fig. 8 is a detail section of one of the clamping devices for securing the cable to the drum. Fig. 9 is a section taken on line 9—9 of Fig. 1.

The invention is exemplified in hoisting mechanism which comprises a gear-case a which is horizontally divided and includes a base section a', a removable cover section a^2, and an integral under frame a^3 for supporting the case a on the casing of an engine. The frame a^3 has inturned flanges at its lower end which are adapted to rest on the engine-casing, and comprises an arched members a^5 which are joined to and extend between said flanges, and vertical cross-webs a^6 which are spaced apart to receive between them an ear 10[a] on a bracket 10 which is adapted to be secured to the engine casing. A pin 11 is adapted to extend through holes in the webs a^6 and an upstanding ear on the bracket 10 to hold the frame down on the engine-casing. A spring-clip 12 is mounted on the frame and adapted to hold a handle 13 on the pin 11 in its locking position. The base a' of the gear-case is provided with integral extensions or lugs 49 in which handles 50 are secured, so that the case and mechanism supported thereby can be conveniently transported. This exemplifies a gear-case for hoisting mechanism which can be readily attached to and detached from the casing of an engine.

The hoisting mechanism comprises a drum 15 which is fixed on a shaft 16. The ends of the shaft 16 are journaled in a bearing 18 which is supported from one side of the frame a^3 and in a bearing 19 supported in one side of the gear-case a. A hoisting cable 20 is fixed to the outer side of the drum 15 by an annular series of four clamps. In hoisting mechanism used on airplanes it is desirable to reduce weight and, for that purpose, the cable is secured by parts formed of aluminum. Plugs 22 of aluminum are screw-threaded into one side of the drum and clamps 21 of aluminum secure the cable by means of screws 21a. An eye 23 is usually connected to the free end of the cable 20 for connection to a grapple by which the load may be connected to the cable for transportation or to other means.

An electric motor c, mounted on one side of the case a with its axis parallel to the axis of the drum, furnishes power for driving the drum through speed-reducing gearing in case a. This gearing comprises a ring-gear 24 which is fixed to an integral extension 15[a] of the drum 15; a pinion 25 which meshes with gear 24 and is integral with a shaft 26 which is journaled in bearings 27 in the sides of the case a, respectively; a gear 28 keyed to shaft 26; a pinion 29 which meshes with gear 28 and is fixed on a shaft 30 which is journaled in bearings 31[a] mounted in the sides of the case a; a gear 31 which is rotatable around shaft 30 and is adapted to drive shaft 30 through a friction-device hereinafter described; and a pinion 32 on, and driven by, the shaft of electric motor c. The inner end of extension 15[a] is closed by a plate 15[b] to prevent the escape of lubricant through the drum.

In hoisting mechanism used on or in connection with airplanes it is important to automatically limit the power applied to the lifting cable to a predetermined maximum load, to prevent breakage or damage to the airplane if the load on the cable is retarded or blocked or excessive. For this purpose a friction clutch is included in the gearing for driving the drum, between the gear 31 and the shaft 30 of the pinion 29. This clutch comprises a member or sleeve 33 which

is keyed to shaft 30 and provided with an integral flange 35; a ring 34 carried by flange 35 and engaging a driving face 36 on gear 31; a ring 37 engaging an opposed friction face 36a on gear 31 and carried by and rotatable with a pair of resilient or spring disks 38. Pins 40 in sleeve 33 extend through holes in the central portion of disks 38 and connect said disk and sleeve for conjoint rotation by rings 34, 37. A collar 41 abuts against the inner portion of one of the disks 38, and is adapted to force the outer portion of the disks against ring 37 which clamps the wheel 31 against the ring 34. Collar 41 is screw-threaded to sleeve 33 so it can be adjusted axially to vary the pressure of the outer portion of disks against ring 37 and to vary the clamping pressure between rings 34, 37 and the friction faces on wheel 31. A screw 41a in collar 41 is adapted to lock said collar in its adjusted position. Ring 34 is connected to flange 35 by studs 42 which are screw-threaded to said ring and are provided with integral pins 43 which pass through holes in said flange. Ring 37 is similarly connected by studs 42 to disks 38. Wheel 31 is axially movable on sleeve 33, so that the pressure of ring 37 against friction-face 36a will force the friction face 36 against ring 34, and frictionally clamp said wheel between said rings. The outer sides of rings 34, 37 are convex in cross-section so the inner faces of the rings will be free for self alignment with the friction faces 36, 36a. The gear case a contains oil for lubricating the gearing therein. The clutch mechanism operates in the case a where it contacts with a considerable portion of the oil splashed around the case by the gearing. Each ring 34, 37 is provided on its inner face with circular ribs 45 which are spaced apart by annular grooves 46. Ribs 45 have flat narrow inner faces which fit against the friction faces 36, 36a of wheel 31, and constitute friction surfaces of small or limited area. The resilient disks 38 are adjusted to produce sufficient pressure per square inch between the rib-faces and the opposite friction faces on wheel 31 to break down any tendency of the oil splashed onto the wheel 31 and the rings to form a film between the engaging surfaces of said rings and wheel. As a result of concentrating sufficient pressure on the small areas of the rib-faces, and breaking down an oil-film between the engaging areas of the driving and driven members of the clutch, a substantially constant coefficient of friction is maintained for driving the hoisting mechanism. This prevents slipping of the clutch under normal loads and the resultant wear on the engaging areas. This exemplifies a friction clutch in a gear case containing oil for lubrication which is adapted to become ineffective under a load in excess of a predetermined maximum, and to drive normal loads with a substantially constant coefficient of friction.

The shaft 30 is extended through one side of the gear-case a, as at 29a, so that in the event that electric current is not available for the motor or it is desired to manually hoist the load, a crank 26 can be connected to said shaft. Between the inner portion 15a on which the ring gear 24 is secured and the cable winding portion of the hollow drum which is disposed outside of the gear-case, the drum is provided with an annularly grooved portion which extends through one side of the gear-case. An oil-ring 51 is provided between said annularly grooved portion of the drum and the case for preventing the escape of oil from the casing around the drum. A screw-cap 53 is provided to enclose the end 29a of shaft 29 when the crank is not in use. An oil-deflector 55 is secured on the inside of a removable plate 56, which is bolted to cover a^2.

In the normal operation of the hoisting mechanism, the pressure exerted in an axial direction by the disks 38, causes rings 34, 37 to be frictionally engaged by the gear-wheel 31 with sufficient force to drive shaft 30, pinion 29, gear 28, shaft 26, pinion 25, gear 24 and drum 15 to shift cable 23 and a load of the predetermined maximum on the cable. When the load on the cable does not substantially exceed the predetermined maximum such, for example, as a bomb, the friction drive will be effective to drive the drum and operate cable 23 to move the load. If the load is blocked or attempt is made to hoist a load on the cable 20 which substantially exceeds the predetermined maximum, gear 31 will continue to be driven and rings 34 and 37 will slip on the gear so that no excessive stresses will be applied to the cable. Axial adjustment of collar 41 on sleeve 33 will vary the pressure of ring 37 against gear-wheel 31, so that the friction drive will remain operative under predetermined loading. This feature is of importance because an excessive or a blocked load, if the operation of the drum is continued, will exert stresses on the cable which are likely to damage the airplane. The friction drive included in the speed-reducing gearing will permit the motor to continue to operate and the drum, cable and the gearing between rings 34 and 37 and the drum to remain inoperative.

The invention exemplifies hoisting mechanism which is adapted for use on airplanes and which is adapted to be rendered automatically inoperative when an excessive load is connected to the cable or the load is blocked. It also exemplifies a hoisting mechanism which is provided with means whereby it may be carried about and quickly mounted on, and demounted from, the engine.

The invention is not to be understood as restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In hoisting mechanism, the combination of a gear-case, a frame on the gear case, a winding drum for a cable supported by said gear-case and said frame, an electric motor mounted on the gear-case, and speed reducing gearing in the gear-case and between the motor and the drum comprising a gear connected to be positively driven by the motor, a wheel connected to positively drive the drum, a resilient disk rotatable with said wheel and rings carried by and rotatable with the disk and wheel, respectively, and provided with ribs having narrow faces spaced apart for engaging the opposite sides of said gear for frictionally driving said wheel from said gear and automatically slipping the drum when the load substantially exceeds a predetermined maximum.

2. In hoisting mechanism, the combination of a gear-case, a frame on the gear case, a winding drum for a cable supported by said gear-case and said frame, an electric motor mounted on the gear-case, and speed reducing gearing in the

gear-case between the motor and the drum comprising a gear connected to be positively driven by the motor and a wheel connected to positively drive the drum, a resilient disk rotatable with said wheel, rings carried by and rotatable with the disk and wheel and having ribs provided with substantially annular narrow spaced apart faces for engaging the opposite sides of said gear for frictionally driving said wheel from said gear and automatically slipping the drum when the load substantially exceeds a predetermined maximum, and connections between said rings and the disk and the wheel which permit self alignment of said faces of the rings with the gear-wheel.

3. In hoisting mechanism, the combination of a gear-case, a frame on the gear-case, a winding drum for a cable supported by said gear-case and said frame, an electric motor mounted on the gear-case, and speed reducing gearing in the gear-case between the motor and the drum comprising a gear connected to be positively driven by the motor, a wheel connected to positively drive the drum, a resilient disk rotatable with said wheel, rings engaging the opposite sides of said gear for frictionally driving said wheel from said gear and automatically slipping the drum when the load substantially exceeds a predetermined maximum, and studs carried in said rings and loosely connecting the rings to the disk and wheel, respectively, for permitting self alignment of the rings with the disk and wheel, respectively.

4. In portable hoisting mechanism, the combination of a gear-case, an electric motor mounted on one side and on the outside of the gear-case, a drum for a cable, speed reducing gearing in the casing for driving the drum from the motor, a frame below and integral with a portion of the gear-case, the frame comprising transversely inclined base flanges at its ends adapted to rest on an engine-casing, a longitudinally arched member between the flanges and cross-members connected to said member and centrally disposed adjacent the longitudinal center of the frame adapted to lap a lug on a bracket secured on the engine, and a pin for locking the overlapping members and the lug together and detachably mounting the frame and gear-case on the engine-casing.

5. In portable hoisting mechanism, the combination of a gear-case, an electric motor mounted on one side and on the outside of the gear-case, a drum for a cable, speed reducing gearing in the casing for driving the drum from the motor, a frame below and integral with a portion of the gear-case, the frame comprising transversely inclined base flanges at its ends adapted to rest on an engine-casing, a longitudinally arched member between the flanges and webs connected to said member and centrally disposed adjacent the longitudinal center of the frame and adapted to lap a lug on a bracket secured on the engine, and a pin for locking the webs and the lug together for detachably mounting the frame and gear-case on the engine-casing.

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