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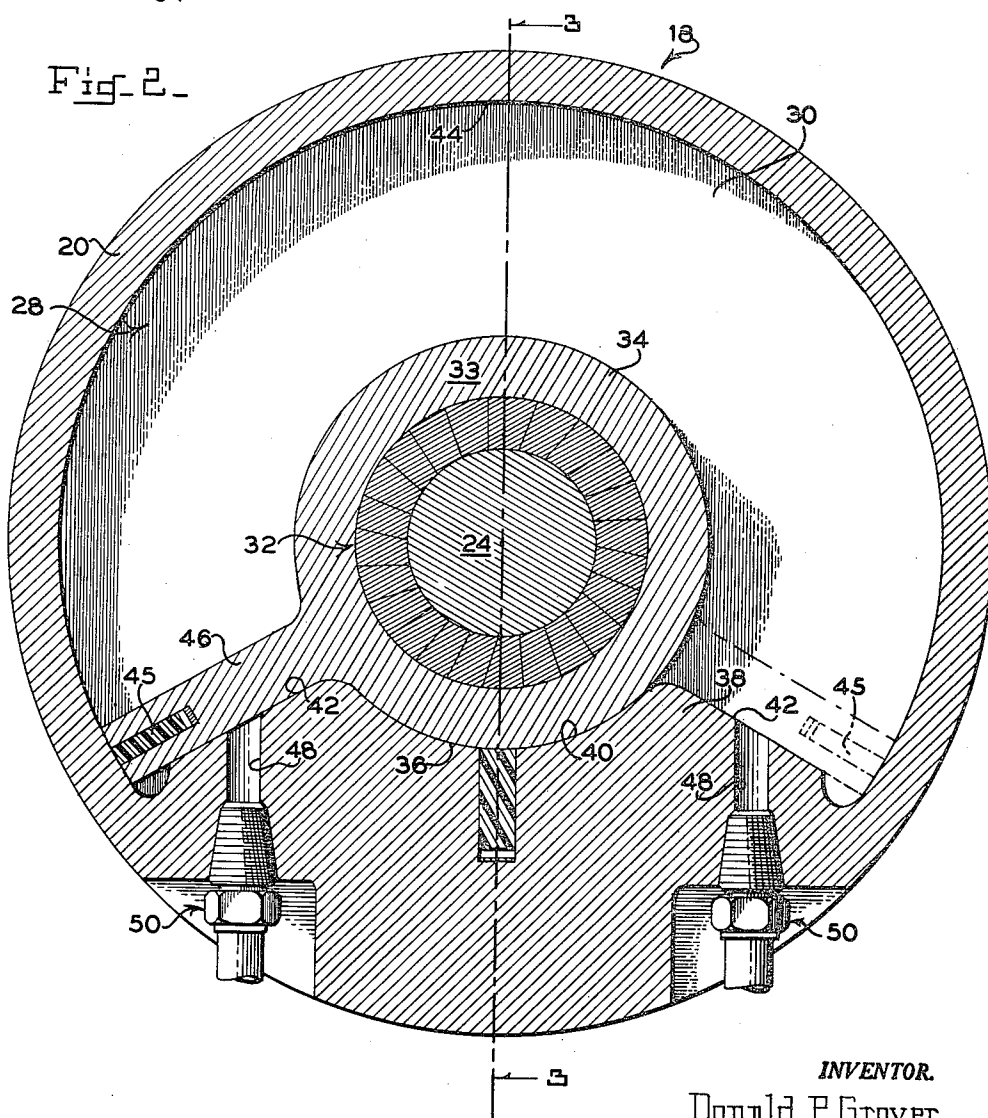
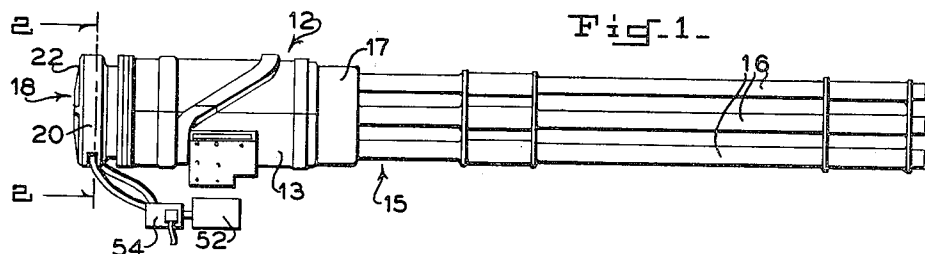
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ROTARY PISTON CHARGER-BRAKE MECHANISM

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2 Sheets-Sheet 1



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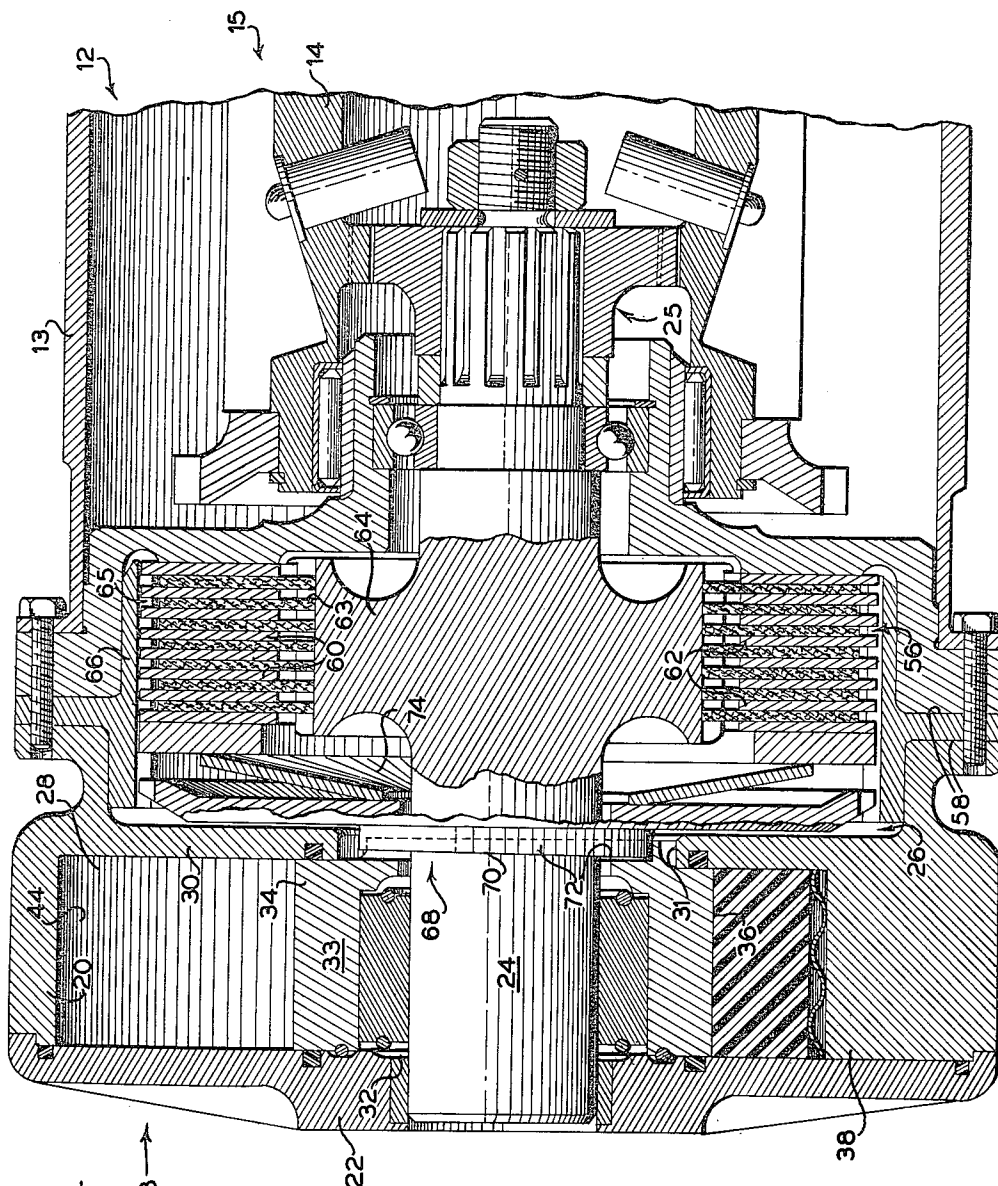


Fig. 3-

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ROTARY PISTON CHARGER-BRAKE MECHANISM

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This invention relates to machine guns having a rotary mass, such as the machine guns of the Gatling-type, and pertains more particularly to devices for starting and braking the rotation of the rotary mass.

With machine guns of the Gatling-type, the rotary mass, which includes a plurality of caged barrels, must be rotated for operation of the gun by a drive motor. Sometimes the drive motors are energized by an external source of power and are either electrically or hydraulically energized. Recently, motors have been introduced which are powered by the pressure of the gases produced during the operation of the gun and which, therefore, require an auxiliary charging device for rotating the rotary mass to fire the first round.

In modern warfare it is important that the machine guns accelerate to operating speed as soon as possible because the time that the target is within range is very limited. The inertia of the rotary mass of the Gatling-type machine guns is considerable as the rotary mass includes the group of caged barrels and, therefore, excessive strain is placed upon the drive mechanisms during acceleration and the motors suitable for gun use do not provide the desired acceleration.

Moreover, with Gatling-type machine guns, it is also important that the rotary mass, which also drives the firing mechanism, be stopped as quickly as possible after firing is stopped to prevent the passage of live cartridges through the gun system.

It is, therefore, an object of this invention to provide for a machine gun having a rotary mass, which is rotated during operation thereof, means for assisting the drive motor in accelerating the rotary mass to operating speed.

It is a further object of this invention to provide for such gun auxiliary charging means for rotating the rotary mass to fire the first round when the gun is self-energized.

It is another object of this invention to incorporate into such starting device means for braking the rotary mass to a stop.

It is a further object of this invention to provide such a starter-brake device which is powered by an oscillatable vane-type piston adapted to start the rotary mass, when actuated in one direction, and to brake it when actuated in the opposite direction.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

FIG. 1 is a side view of a Gatling-type machine gun with the starter-brake device assembled to the rear end thereof;

FIG. 2 is an enlarged view taken along line 2—2 of FIG. 1; and

FIG. 3 is a view taken along line 3—3 of FIG. 2.

Shown in the figures is a machine gun 12 of the Gatling-type which includes a casing 13 with a rotor 14 therein which is part of a rotary mass 15 that also includes a plurality of caged barrels 16. Rotary mass 15 rotates in a counterclockwise direction during the operation of gun 12 and is driven by motor 17 which is energized by discharge gases after the gun begins firing. Mounted to the rear end of casing 13 is a starter-brake device 18 which includes a cylindrical housing 20 and a cover 22 which closes the open rear end thereof. A shaft 24 is

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connected at the front end to rotor 14 by spline means 25 so as to be rotatable with the rotor and is journaled at the rear end to cover 22 so as to coaxially align with the rotor.

Housing 20 is divided into a front-cavity 26 and a rear-cavity 28, which are both of cylindrical configuration, by an annular flange 30 which is integral with the housing and is disposed at right angles to the axis of shaft 24. Flange 30 forms a hole 31 which is concentric to shaft 24. Mounted on shaft 24 within rear-cavity 28 is an overrun clutch which may be of any conventional design suitable for performing the functions noted hereinafter and which is shown schematically at 32. Clutch 32 mounts in turn a vane-type piston 33 having a sleeve-like hub 34 which receives clutch 32 and an outside periphery 36 which is concentric to the inside periphery of the surrounding section of housing 20. The front end of hub 34 has rotating contact with the rear face of flange 30 while the rear end has rotating contact with the front face of cover 22.

Housing 20 includes a pad 38 which is integral therewith and with flange 30 and which extends upwardly into rear-cavity 28. Pad 38 includes an upper end 40, which is concavely formed to matingly contact outside periphery 36 of hub 34, and a pair of sides 42 which are disposed radially respective thereto and are spaced apart at an angle of 120°. Thus, there is formed in rear-cavity 28 an annular chamber 44 which is defined by sides 42, outside periphery 36 of hub 34, the inside periphery of housing 20, the rear face of flange 30, and the inside of cover 22.

Piston 33 includes a vane 46 which extends radially from hub 34 for oscillation in chamber 44 between contact with the opposite sides 42. Vane 46 has sliding contact with the inside periphery of housing 20, the rear face of flange 30 and the inside of cover 22. The contacting surfaces of vane 46 and chamber 44 are polished and suitable seals 45 are provided thereat to make airtight contact therebetween. Suitable seals are also provided between the contacting areas of hub 34, cover 22 and flange 30 as well as between the contacting surfaces of pad 38 and the hub and between vane 46 and housing 20 so that chamber 44 is airtight.

A bore 48 extends through pad 38 to communicate with chamber 44 at each of the sides 42 and each of the bores is provided with a coupling 50 which is connected by tubing means to a gas pressure source 52. A suitable valve 54 is interposed between source 52 and starter-brake device 18 to provide means for directing air pressure from such source to either side of vane 46 for selectively oscillating piston 33 in a counterclockwise starting direction or a clockwise braking direction. Clutch 32 is designed to transfer the rotation of piston 33 in the starting direction to shaft 24, and permit the shaft to overrun the piston when the speed of the shaft exceeds that of the piston, and to permit free rotation of the piston relative to the shaft when the piston is rotated in the braking direction. As sides 42 are spaced at an angle of 120°, vane 46 is oscillatable through an angle of 240° which is sufficient to pass several of the barrels 16 through the firing position of gun 12 for discharge of the cartridges therein to provide the power for energizing motor 17 and, in cooperation with motor 17, accelerate rotary mass 15 to operating speed.

Mounted in front-cavity 26 is a multiple-disc, braking device 56 which is installable therein by housing 20 being separable, as noted at 58, at such front-cavity. Braking device 56 includes a plurality of friction-faced plates 60 with pressure discs 62 disposed therebetween and in front of the first and in back of the rear plate. Plates 60 are connected by spline means 63 to an increased diameter portion 64 on shaft 24 so as to be displaceable longitudinally.

dinally therealong while being restrained from rotation relative thereto. Discs 62 are similarly connected by spline means 65 to a collar insert 66 which is anchored to housing 20 at joint 58. The front one of the discs 62 contacts the front end of housing 20 so as to be blocked thereby from a forward displacement while the rear one of the discs is displaceable by a cam device 68 to squeeze the plates 60 and discs 62 together and thereby transfer the energy in rotary mass 15 to housing 20.

Cam device 68 includes a cam plate 70 which is slidably disposed on shaft 24 in front-cavity 26. Cooperating cam surfaces 72 are provided on the adjacent faces of hub 34 and cam plate 70, which cam surfaces are disposed between the inner periphery of flange 30 and the exterior of shaft 24 and are formed to transfer rotation of piston 33 in the braking direction to forward displacement of cam plate 70 against braking device 56 for stopping the rotation of shaft 24 and thereby the rotation of rotary mass 15. Conversely, cam surfaces 72 release braking device 56 during rotation of piston 33 in the starting direction. A Bellville-type spring 74 is interposed between cam plate 70 and the rear one of the discs 62 to provide a smooth braking action when piston 33 is actuated in the braking direction.

Thus, when gun 12 is inoperative, piston 33, through the previous actuation thereof to brake the gun, is positioned so that vane 46 is in contact with the right one of the sides 42. When gun 12 is started to initiate a burst, valve 54 is simultaneously actuated through a connection with the gun firing mechanism (not shown) to open communication between gas pressure source 52 and the right one of the bores 48. Whereby, gas pressure enters chamber 44 to act upon vane 46 and thereby rotates piston 33 in the counterclockwise starting direction until stopped by contact of the vane with the left one of the sides 42. The rotation of piston 33 is transferred through clutch 32 to shaft 24 for rotation of rotor 14 and thereby pass the succeeding barrels 16 through the firing position for the discharge of the cartridges in such barrels. Whereby, motor 17 is energized to continue the rotation of rotary mass 15 with the pressure of the gases against piston 33 assisting the motor in accelerating rotary mass 15 to operating speed.

When the firing of gun 12 is stopped, the release of the firing mechanism thereof actuates valve 54 to open communication between gas pressure 52 and the left one of the bores 48. Whereby, piston 33 is rotated in the clockwise braking direction and such rotation is converted to longitudinal actuation of braking device 56 to stop the rotation of rotary mass 15 and thereby prevent an overrun which would pass live cartridges through gun 12.

From the foregoing it is clearly apparent that there is provided herein a compact, rugged and simply operated starter-brake device which assists the drive motor of a machine gun in starting the rotation of the rotary mass thereof and accelerate the rotary mass to operating speed and which brakes the rotary mass at the end of a burst to prevent the passage of live cartridges through the gun system.

Although a particular embodiment of the invention has been described in detail herein, it is evident that many variations may be devised within the spirit and scope thereof and the following claims are intended to include such variations.

I claim:

1. In a machine gun having a rotary mass with a rotor contained within a casing, a starter-brake device comprising a cylindrical housing mounted to the rear end of the casing, an annular flange disposed within said housing integral with the inside periphery thereof for forming a front-cavity, a rear-cavity and a hole to provide communication therebetween, a cover for closing the rear end of said housing, a shaft journaled in said cover and con-

nected to the rotor for rotation in axial alignment therewith, a piston mounted over said shaft in said rear-cavity, a clutch disposed between said shaft and piston to mount said piston for oscillating rotation, said clutch being adapted to transfer movement of said piston in the direction of operation of said rotor to said shaft while permitting free movement of said piston relative to said shaft when moved in the opposite braking direction, a multi-disc friction brake disposed in said front-cavity for releasably engaging said shaft to said housing to stop the rotation of the rotary mass, and cam means interposed between said piston and said shaft in said hole formed by said flange for converting rotation of said piston counter to the direction of rotation of the rotor to actuation of said brake.

2. The gun as defined in claim 1 wherein said piston includes a hollow hub for receiving said clutch to mount said piston for oscillating rotary movement around said shaft and a vane extending radially from said hub, and wherein a pad extends upwardly into said rear-cavity integral with said housing and flange, said pad being provided with an upper end having contact with said hub and angularly disposed sides for contactingly limiting the oscillation of said piston, and wherein said vane is slidably disposed in an annular chamber formed by the inside periphery of said housing, the outside periphery of said hub, the rear face of said flange, the inside of said cover and said sides of said pad.

3. In a machine gun having a rotary mass energizable by a motor, a piston disposed in an accommodating chamber for intermittent displacement in alternate directions, a brake device disposed for stopping the rotation of said rotary mass, a first means for transferring displacement of said piston in one of the alternate directions to the rotary mass to cooperate with the motor in accelerating the rotary mass to operating speed and a second means for transferring displacement of said piston in the opposite one of the alternate directions to said brake device for stopping the rotary mass.

4. The gun as defined in claim 3, wherein said chamber is of annular configuration and wherein said piston is of oscillating rotary type and includes a hub with a radially extending vane accommodated for pivotal movement within a limited arc in said chamber.

5. The gun as defined in claim 3, wherein said first means includes an overrun type of clutch whereby the rotation of said piston in one of the alternate directions is transferred to the rotary mass and whereby the rotary mass is permitted to overrun said piston when the movement of said piston is suspended.

6. The gun as defined in claim 3, wherein said second means includes a pair of cam surfaces interposed between said piston and said brake device for converting rotation of said piston to linear displacement of said brake device.

7. In a machine gun having a rotary mass energizable by a motor, a starter-brake device including a fluid actuated vane-type piston disposed for oscillation in a limited arc in an annular chamber, a brake device actuatable to stop the rotation of the rotary mass, a clutch operationally disposed between said piston and the rotary mass for transferring rotation of said piston in one direction thereto, and cam means operationally disposed between said piston and said brake device for actuation thereof to stop the rotary mass when said piston is rotated in the opposite direction.

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