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## (54) MECHANISM FOR THE RELEASE OF RAPID SINGLE FIRE IN AN AUTOMATIC FIRE-ARM

(71) We, WERKZEUGMASCHINENFABRIK OERLIKON-BUHRLE AG., a company organised and existing under the laws of Switzerland, of Birchstrasse 155, CH-8050 Zurich, Switzerland, do hereby declare the invention for which we pray that a Patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:

The invention concerns a device for releasing rapid single fire on an automatic fire-arm having a recoil and counter-recoil movement, with a trigger rod, by means of which the trigger of the fire-arm is activated manually.

Release mechanisms for automatic fire-arms are known. In the Swiss patent no. 419 907, a release mechanism is described which is activated manually by means of trigger rod. The main purpose of the device is to ensure that the force required for activation in the case of large fire-arms in kept sufficiently small and that the weapon can easily be released with one finger. Using this release mechanism however, only high speed mass firing eg. 570-1000 rounds per minute or single fire can be obtained. In the case of single fire, the trigger must be activated with the finger for each shot, thus limiting the speed to a maximum of 1 shot per second. In the Swiss patent no. 565 360, a pneumatic mechanism for firing an automatic fire-arm is described, with which either mass firing, restricted mass firing, or single firing or rapid single firing can be obtained, whereby under mass firing a rate of 570-1000 rounds per minute can be obtained. Restricted mass firing means mass firing governed by a time factor, ie, after a set period of time, the firing is interrupted. In the case of single fire, the trigger must be activated for each shot and in the case of rapid single fire, a substantially slower speed is meant, eg, 30-400 shots per minute, though the trigger need only be activated one. There are pneumatically operated units available, by means of which this smaller speed can be adjusted. However, the disadvantage of the pneumatic device consists in the fact that a compressed air cylinder is required, together with a pneumatic control device, which fails when the compressed air cylinder is empty. In the Swiss Patent No. 569 249, a mechanism for the release of either mass firing or rapid single firing is described, though this is built into the gun itself. In the case of fire-arms, which do not have this mechanism, it is not usually possible to add on the device at a later date on account of lack of space. Furthermore there are no means available for adjusting the speed of rapid single firing.

An object of the present invention is the provision of a release mechanism, which allows itself to be added onto an existing firearm and with which the speed for rapid single firing can be set, eg, 30-400 shots per minute. The purpose of the invention is also to avoid the need for an additional source of compressed air.

According to the invention there is provided a mechanism for releasing rapid single fire in an automatic fire-arm having recoil and counter-recoil movement, the mechanism comprising a trigger rod, by means of which the trigger of the fire-arm is activated manually, the rod having an elbow joint to which is connected a piston having two end positions, which piston is moved into one end position upon recoil of the fire-arm and into the other end position upon counter-recoil of the fire-arm, in the one position the elbow joint being bowed and in the other position being straight, and which piston is controlled in its movement to the other end position by means of a hydraulic damping unit.

An example of the design of the mechanism according to the invention for the

release of rapid individual fire is described in detail in the enclosed drawing.

According to the drawing, the device for the the provision of rapid single firing contains a trigger rod, which can be activated by the safety catch. The trigger rod also possesses a second rod 11, which is connected to the trigger mechanism 47 of the fire-arm not shown in the drawing.

The first rod 10 is connected to a cranked lever 12, which is pivoted about a first axis 13, which is secured in a housing 14.

The second rod 11 is connected to a second cranked lever 15, which is pivoted about a second axis 16, which again is secured in the housing 14.

The two cranked levers 12 and 15 are connected to each other through an elbow joint. This elbow joint comprises a long lever and a short lever, (17 and 18 respectively). The two levers 17 and 18 are connected to each other at one end and on the other end, the long lever 17 is attached to the first cranked lever 12 and the short lever 18 is attached to the second cranked lever 15.

At the connection point of the two levers 17 and 18 a piston rod 20 is attached by means of a rod 19, to which a piston 21 is secured. This piston 21 is located in a cylinder 22, which is secured to the above-mentioned housing 14. The cylinder barrel is divided into two chambers 23 and 24 by means of the piston 21.

The piston 21 has one way valves, which allow the fluid to flow from chamber 23 into chamber 24 but not vice versa. These one way valves are composed of bores 26, which are adjustable by means of a collar 27. This collar 27 is pressed against the bores 26 by means of a spring 28.

The two chambers 23 and 24 are connected to each other by means of an adjustable throttle. This throttle consists of a throttle chamber 29, into which a throttle pin 34 extends, which can be adjusted against the force of a spring 31 by turning the adjustable screw 30. The throttle chamber 29 is connected to the chamber 23 through a first bore 32 and to the chamber 24 through a second bore 33. The tip of the throttle pin 34 is in the position to regulate the flow through the bore 33, depending on how far the throttle pin 34 has been screwed into the throttle chamber 29 by turning the adjustable screw.

The piston rod 20 has a shoulder 35 on the section situated to the left of the piston 21. A first socket 36 is secured to the reduced left hand end of the piston rod with this shoulder engaging a flange 37 on the socket. A second socket 39 is mounted on a slider arrangement with its right flange 44 engaging the piston rod 20 and its left-hand end engaging the first socket 36. A spring 38 acts to press the flange 44 of the second socket 39, against the flange 37 of the first socket 36. The second socket 39 possesses a lug 40 and a spring 42, which engages at one end the cylinder 22 and at the other end the flange 44 acts to press the lug 40 against a sealed housing 41 of the fire-arm.

The housing 14 and the cylinder 22 are fixed in the cradle 43 of the fire-arm, in which the sealed housing 41 is movable. Upon recoil of the fire-arm, the housing 41 moves to the left, i.e. in the direction of the arrow A, whereby the spring 42 by means of its relaxation moves the socket 39 and thus the socket 36 and the piston rod to the left. Upon counter recoil, the sealed housing 41 moves to the right, ie against the direction of the arrow A whereupon the spring 42 is put under compression and the socket 36 and the piston rod are moved to the right. The left hand end position of the sealed housing 41 reached upon recoil of the fire-arm is depicted by a dotted line and designated 41', and the right hand end position of the sealed housing 41 reached upon counter recoil of the fire-arm has been inked in.

Before the fire-arm is fired, the sealed housing 41 is located in its starting position, which is depicted by inked in lines. In this position of the sealed housing, the flange 37 of the first socket 36 under the effect of the spring 38 lies adjacent to a flange 44 of the second socket 39. In this way, the position of the piston rod secured to this socket 36 is determined.

In the interior of the piston rod 20 is located a socket-like piston 45 on a slider arrangement, which is loaded by means of a spring 46, which is secured on one side on the head of the socket-like piston 45 and on the other side on the left hand end of the piston rod 20. The purpose of this socket-like piston 45 is to put the reserve fluid contained inside the piston rod 20 under pressure and to force it through a cross bore 48 into the pressure-free chamber 23 of the cylinder 22, in order to replace any leakage losses, which could arise through the packings of the cylinder 22. A lug 51 is adjustably affixed to the cradle, and is located in the rear position in the case of rapid single firing - this is depicted by inked in lines.

The mode of operation of the described mechanism is as follows-

The described mechanism for rapid single firing finds application on a fire-arm, which can release both a single shot and mass firing.

Under the term mass firing, a speed of 570-1000 rounds per minute is meant, depending on the type of fire-arm. Single shot means the gunner must release the trigger cock after every shot and then re-activate it again. Rapid single firing means firing at a

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speed of between 30 and 400 shots per minute, regardless of the type of fire-arm. As explained below, this speed can easily be set with the aid of the mechanism for rapid single firing as per the invention.

The trigger mechanism 47 of the fire-arm used is switched to single fire in the usual manner and the lug 51 is moved into the retracted position, which is depicted by inked lines. If the described mechanism is not attached to the fire-arm, the trigger mechanism 47 must be activated by means of the rod 11 for every shot, ie when the rod 11 is drawn to the left, only one shot can be released, irrespective of how long the rod 11 is held in its end position. For any further shots, the rod 11 must first be moved back again into its starting position by means of a return spring of the trigger mechanism 47. Manually, it is therefore not possible to release more than about 50-60 shots per minute. Thus if a speed is required that is lower than the mass firing level of about 570-1000 shots per minute and greater than that which can be achieved manually, then preferably the described mechanism for rapid single firing should be used. By using this device, the gunner is not under pressure to activate the hand grip quickly.

Upon activation of the hand grip 49, the canked levers 12 and 15 are moved in clockwise direction by means of the rod 10 and the levers 17 and 18 respectively and the rod 11 is slid into its left hand end position and the first shot fired. If the gunner wishes to release rapid single fire, he will not release the hand grip 49 for that period during which the single firing is to continue.

Upon release of the first shot, the sealed housing 41 is moved by the recoil in the direction of the arrow A to the left and the second socket 39 is also moved to the left by the spring 42. The housing 14 and the cylinder 22, which are secured to the cradle 43, do not undergo this movement. The lug 51 in its retracted position does not prevent movement of the second socket 39.

Movement of the second socket 39 to the left also causes the first socket 36 and thus the piston rod 20 to move to the left, as the flange 37 of the first socket 36 engages on the flange 44 of the second socket 39. As a result of this movement, the elbow joint 17, 18 bows out to the left and the lever 11 moves to the right back into its starting position. Movement of the piston rod 20 and the piston 21 to the left forces the fluid out of the chamber 23 through the non-return valves into the chamber 24. The spring 28 of the non-return valve 25 is very weak and the fluid can flow practically without restriction through the bores 26. The stroke of the piston rod 20 to the left is given by the distance between the piston 21 and the left hand flange of the cylinder 22. This stroke in turn determines the position 41' of the housing 41.

During the subsequent counter recoil, the fire-arm housing 41, and thus the second socket 39 is moved to the right and the spring 42 is compressed. Movement of the socket 39 puts the spring 38 under compression and moves the piston rod 20 to the right by means of the flange 37 and shoulder 35. This movement of the piston rod 20 to the right causes the elbow joint 17, 18 to straighten, the cranked lever 15 to rotate in a clockwise direction, the rod 11 to be slid to the left and a second shot to be released.

During this movement of the piston rod 20 with piston 21 to the right, the fluid must however be forced out of the chamber 24 into the chamber 23. The one way valve 25 does not allow this to flow through. The fluid must therefore flow through the bore 33, throttle chamber 29 and bore 32 into the chamber 23. This flow can be altered with the aid of the throttle pin 30, through which the time taken for leftward movement can be altered and thus release of the second shot can be retarded or accelerated. In this way, a speed in the range 30-4000 shots per minute can be set.

The fire-arm will release a further shot, as long as the hand grip 49 is activated. The rapid single firing will not be interrupted until the hand grip 49 is released.

If only one single shot is to be fired from the fire-arm, the lug 51 is pushed into the position marked with a dotted line and the trigger mechanism 47 is switched to single firing. Upon recoil of the fire-arm in the direction of the arrow A, the movement of the second socket 39 to the left is not possible, and the next shot is no longer automatically released.

If incorporation of the mechanism for rapid single firing is not required, then the rods 10 and 11 are replaced by a single rod, which is then connected direct to the hand-grip 49 and the trigger mechanism 47.

WHAT WE CLAIM IS:-

1. A mechanism for releasing rapid single fire in an automatic fire-arm having recoil and counter-recoil movement, the mechanism comprising a trigger rod, by means of which the trigger of the fire-arm is activated manually, the rod having an elbow joint to which is connected a piston having two end positions, which piston is moved into one end position upon recoil of the fire-arm and into the other end position upon counter-recoil of the fire-arm, in the one position the elbow joint being bowed and in the other position being straight, and which piston is controlled in its movement to the other end position by means of a hydraulic damping unit.

2. A mechanism according to Claim 1, wherein two swivel-mounted cranked levers

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speed of between 30 and 400 shots per minute, regardless of the type of fire-arm. As explained below, this speed can easily be set with the aid of the mechanism for rapid single firing as per the invention.

The trigger mechanism 47 of the fire-arm used is switched to single fire in the usual manner and the lug 51 is moved into the retracted position, which is depicted by inked lines. If the described mechanism is not attached to the fire-arm. the trigger mechanism 47 must be activated by means of the rod 11 for every shot, ie when the rod 11 is drawn to the left, only one shot can be released, irrespective of how long the rod 11 is held in its end position. For any further shots, the rod 11 must first be moved back again into its starting position by means of a return spring of the trigger mechanism 47. Manually, it is therefore not possible to release more than about 50-60 shots per minute. Thus if a speed is required that is lower than the mass firing level of about 570-1000 shots per minute and greater than that which can be achieved manually, then preferably the described mechanism for rapid single firing should be used. By using this device, the gunner is not under pressure to activate the hand grip quickly.

Upon activation of the hand grip 49, the canked levers 12 and 15 are moved in clockwise direction by means of the rod 10 and the levers 17 and 18 respectively and the rod 11 is slid into its left hand end position and the first shot fired. If the gunner wishes to release rapid single fire, he will not release the hand grip 49 for that period during which the single firing is to continue.

Upon release of the first shot, the sealed housing 41 is moved by the recoil in the direction of the arrow A to the left and the second socket 39 is also moved to the left by the spring 42. The housing 14 and the cylinder 22, which are secured to the cradle 43, do not undergo this movement. The lug 51 in its retracted position does not prevent movement of the second socket 39.

Movement of the second socket 39 to the left also causes the first socket 36 and thus the piston rod 20 to move to the left, as the flange 37 of the first socket 36 engages on the flange 44 of the second socket 39. As a result of this movement, the elbow joint 17, 18 bows out to the left and the lever 11 moves to the right back into its starting position. Movement of the piston rod 20 and the piston 21 to the left forces the fluid out of the chamber 23 through the non-return valves into the chamber 24. The spring 28 of the non-return valve 25 is very weak and the fluid can flow practically without restriction through the bores 26. The stroke of the piston rod 20 to the left is given by the distance between the piston 21 and the left hand flange of the cylinder 22. This stroke in turn determines the position 41' of the housing 41.

During the subsequent counter recoil, the fire-arm housing 41, and thus the second socket 39 is moved to the right and the spring 42 is compressed. Movement of the socket 39 puts the spring 38 under compression and moves the piston rod 20 to the right by means of the flange 37 and shoulder 35. This movement of the piston rod 20 to the right causes the elbow joint 17, 18 to straighten, the cranked lever 15 to rotate in a clockwise direction, the rod 11 to be slid to the left and a second shot to be released.

During this movement of the piston rod 20 with piston 21 to the right, the fluid must however be forced out of the chamber 24 into the chamber 23. The one way valve 25 does not allow this to flow through. The fluid must therefore flow through the bore 33, throttle chamber 29 and bore 32 into the chamber 23. This flow can be altered with the aid of the throttle pin 30, through which the time taken for leftward movement can be altered and thus release of the second shot can be retarded or accelerated. In this way, a speed in the range 30-4000 shots per minute can be set.

The fire-arm will release a further shot, as long as the hand grip 49 is activated. The rapid single firing will not be interrupted until the hand grip 49 is released.

If only one single shot is to be fired from the fire-arm, the lug 51 is pushed into the position marked with a dotted line and the trigger mechanism 47 is switched to single firing. Upon recoil of the fire-arm in the direction of the arrow A, the movement of the second socket 39 to the left is not possible, and the next shot is no longer automatically released.

If incorporation of the mechanism for rapid single firing is not required, then the rods 10 and 11 are replaced by a single rod, which is then connected direct to the hand-grip 49 and the trigger mechanism 47.

WHAT WE CLAIM IS:-

1. A mechanism for releasing rapid single fire in an automatic fire-arm having recoil and counter-recoil movement, the mechanism comprising a trigger rod, by means of which the trigger of the fire-arm is activated manually, the rod having an elbow joint to which is connected a piston having two end positions, which piston is moved into one end position upon recoil of the fire-arm and into the other end position upon counter-recoil of the fire-arm, in the one position the elbow joint being bowed and in the other position being straight, and which piston is controlled in its movement to the other end position by means of a hydraulic damping unit.

2. A mechanism according to Claim 1, wherein two swivel-mounted cranked levers

are located in a fixed housing, each lever having two arms, one arm of the first cranked lever is attached to a trigger rod connected to a hand grip and one arm of the second cranked lever is attached to a rod that is connected to the trigger, the other two arms of the cranked levers are inter-connected by means of two inter-connected levers of the elbow joint, and a piston rod bearing the piston is attached at the connection point of the two levers of the elbow joint.

3. A mechanism according to Claim 2, wherein a first socket is secured to the piston rod and has a flange which engages a shoulder of the piston rod, a second socket is slidably located over the piston rod and has a first flange urged into engagement with the flange of the first socket by a first spring extending between the flange of the first socket and a second flange of the second socket, a second spring is located over the piston rod and extends between the first flange of the second socket and the fixed housing of the mechanism, there being a movable housing movable during recoil and counter-recoil whereby the purpose of the second spring is to press the second socket against the movable housing during recoil and thus move the piston rod and the purpose of the first spring is to move the piston rod against the resistance of the hydraulic damper mechanism during counter-recoil.

4. A mechanism for releasing rapid single fire in an automatic fire-arm substantially as described herein with reference to the accompanying drawing.

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