ROTARY SHELL RELOADER

An automatic shell reloader is provided. The shell reloader includes an electric motor coupled to a wheel which, in turn, is pivotally secured at its perimeter to the actuator of the shell reloader. The wheel leverages the power of the electric motor and provides precise control of the reloading operation. The shell reloader is also provided with a current sensing switch to attenuate the electric motor in response to detection of a malfunction.
ROTARY SHELL RELOADER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

The present invention relates to shell reloaders and, more specifically, to automatic shell reloaders.

[0002] 2. Description of the Prior Art

It is known in the prior art to provide shell reloaders with multiple stations to simultaneously perform multiple reloading operations utilizing a single stroke of a reloader handle. It is also known in the art to automate the reloader whereby the operations and indexing of the reloader to advance shells to the next station is done mechanically rather than manually. It is known in the art to utilize hydraulic pumps for such automation.

[0003] One drawback associated with hydraulic systems is the noise associated with the hydraulic motors. The loud noise often masks the sound of the reloading operation. If a user is not able to hear the reloader, the user may miss the sound of a malfunction, which could lead to damage, not only to the shell be processed, but to the reloader, and possibly the user. Another drawback associated with hydraulic systems is that the reloading operation requires a significant amount of power at the top and bottom of the stroke. Accordingly, hydraulic motors must be overbuilt to provide this additional power at the bottom and top of the stroke, leading to increased cost, weight and maintenance associated with the larger motors. Still another drawback associated with prior art hydraulic motors is the inability to precisely attenuate the operation, either at the end of a particular operation or at a point when a malfunction is identified. An additional drawback with hydraulic motors is the inability to identify malfunctions and attenuate operation of the motor. Yet another drawback of the prior art is the difficulty associated with coupling a hydraulic motor to a reloader and the difficulty involved in switching the hydraulic motor between reloaders.

[0004] It would be desirable to provide an automatic reloader which produces little noise and which allows the use of a smaller motor and leverage the work output at the bottom and top of the stroke. It would also be desirable to provide a reloader capable of being attenuated at the end of a particular operation, and in the event a malfunction is identified. It would be additionally desirable to provide an automatic reloader with an automatic system for identifying malfunctions and attenuating the motor in response thereto. The difficulties encountered in the prior art described hereinabove are substantially eliminated by the present invention.

SUMMARY OF THE INVENTION

[0005] The present invention relates to a reloader having means for rotating a rotary motion converter. A linkage couples the rotary motion converter to means for moving a shell and a shell-reloading tool into and out of communication with one another. In the preferred embodiment, the rotating means is an electric motor and the rotary motion converter is a large wheel pivotally coupled at its perimeter to a shaft which actuates the reloader.

[0006] It is an object of the present invention to provide an automatic reloader which is of a low cost, lightweight manufacture.

[0007] It is another object of the present invention to provide an automatic reloader which produces little noise.

[0008] It is yet another object of the present invention to provide an automatic reloader which is adaptable to automatic attenuation upon detection of a malfunction.

[0009] It is another object of the present invention to provide an automatic reloader which is portable.

[0010] It is another object of the present invention to provide an automatic reloader which stops quickly after completion of each reloading stroke.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 illustrates a top perspective view of an automatic reloader of the present invention;

[0012] FIG. 2 illustrates a top perspective view of a reloader prior to conversion to automation according to the present invention;

[0013] FIG. 3A illustrates a top perspective view of the actuation arm assembly of FIG. 1;

[0014] FIG. 3B illustrates an exploded view of the actuation arm assembly of the present invention;

[0015] FIG. 4A illustrates a top perspective view of the link strap assembly of FIG. 1;

[0016] FIG. 4B illustrates an exploded view of the link strap assembly of the present invention;

[0017] FIG. 5 illustrates a top perspective view of the motor subassembly of the present invention;

[0018] FIG. 6 illustrates a top perspective view of the pull rod connected to the actuation wheel;

[0019] FIG. 7 illustrates a bottom perspective view of the motor and actuation wheel;

[0020] FIG. 8 illustrates a top perspective view of the pull rod connected to the actuation arms; and

[0021] FIG. 9 illustrates a side elevation of an alternative embodiment of the present invention showing the rotational motor flexibly coupled to the reloader.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0022] The automatic indexing reloader of the present invention is shown generally as (10) in FIG. 1. Although the reloader (10) may be constructed as a dedicated, automatic indexing unit, in the preferred embodiment, the present invention is used to convert a standard reloader (12) into an automatically indexing reloader (10). FIGS. 1 and 2.

[0023] As shown in FIG. 2, the reloader (12) includes a base (14), preferably constructed of sheet steel and coupled to a column (16). Provided around the column (16) is a shell carrier (18). Also provided around the column (16) for movement in relationship to thereto is a turret assembly (20). Coupled to the top of the column (16) is a shot container (22) which, in turn, is coupled to a drop tube (24), such as those known in the art. Similarly, a powder container (26) is coupled to a drop tube (28). Also secured to the column (16) is a primer tray (30).
A handle (32) is coupled to the turret assembly (20) by a plurality of linkages (34), in a manner such as that known in the art, to linearly actuate the turret assembly (20) downward toward the shell carrier (18), and to linearly actuate the turret assembly (20) upward away from the shell carrier (18). Although the foregoing elements may be combined in any manner, size, configuration or orientation known in the art, in the preferred embodiment, the reloader (12) is an MEC Reloader Model 9000 manufactured by Mayville Engineering Company of Mayville, Wis.

When it is desired to convert the reloader (12) to the automatically indexing reloader (10) of the present invention, the handle (32) is removed, along with its associated linkages. The handle (32) is replaced by a pair of actuation arms (36) and (38) which, as shown in FIG. 3, are preferably generally L-shaped steel arms provided with three sets of holes (40), (42), (44), (46), (48) and (50). The actuation arms (36) and (38) are secured to the column (16) by a link bolt (52). The link bolt (52) is provided through a first washer (54), one side (56) of the column (16), a spacing washer (58), the second side (60) of the column (16), and through a second washer (62). A nut (63) is then secured to the end of the link bolt (52). It is important not to over tighten the link bolt (52), as the actuation arms (36) and (38) should move freely relative to the column (16).

Once the actuation arms (36) and (38) have been installed, link straps (64) and (66), and the cam plate (68) are installed. As shown in FIG. 4, the link straps are provided with two sets of holes (70), (72), (74) and (76), and are each provided with a threaded hole (78) and (80). The cam plate (68) is provided with a hole (82) and a slot (84). The link strap (64) and (66) are coupled to the turret assembly (20) by a link bolt (86) provided through the hole (74) in the first link strap (64), a washer (88), the turret assembly (20), a second washer (90), the hole (76) in the second link strap (66), a hole (92) in the original cam plate (94) and a nut (96). The nut is not overly tightened so as to allow the link straps (64) and (66) to rotate relative to the turret assembly (20). The original link bolt (98) is provided through hole (70) in the first link strap (64), through a washer (100), through the hole (44) in the first actuation arm (36), through the hole (46) in the second actuation arm (38), through a washer (102), through a hole (104) in the original indexing actuation bracket (106), through a hole (108) in the original cam plate (94), and through the slot (84) in the cam plate (68). The cam plate (68) is provided with a slot (84), rather than a hole, to allow for adjustment of the cam plate (68) relative to the cam plate (94). The link bolt (98) is secured by a nut (109) which, again, is not overly tightened so as to allow the linkages to rotate relative to one another. Thereafter, a steel bar called a reloader support bracket (110) is secured to the existing bar actuation mounting bracket (112) on one end and to the existing side plate index (115) on the other end, using bolts (114) and nuts (116) to reduce frame flex and sid in adjusting the system. The remainder of the reloader (12) is then reassembled.

Once the reloader (12) has been reassembled, it is thereafter secured to a motor housing assembly (118). FIG. 5. The motor housing assembly (118) is preferably constructed of a housing (120) fabricated from 3/16 inch carbon steel and formed using any desired means known in the art. As shown in FIG. 6, a rectangular motor bracket face (122) with triangular gussets and constructed of 3/16 inch carbon steel is welded or otherwise secured to the underside of the housing (120). Secured to one side of the motor bracket face (122) and to the housing (120) is a motor (124) which, preferably, is a one-twelfth horsepower motor, such as those well-known in the art. While the motor may be of any desired configuration or construction, in the preferred embodiment the motor (124) is a 120-volt, 60 cycle electric motor with a one hundred twenty to one drive ratio designed to generate rotational motion utilizing a stainless steel shaft (126) passing through the motor bracket face (122). Secured to the end of the shaft (126) is a stainless steel shaft hub (128) which, in turn, is secured to an actuation wheel (130). As shown in FIG. 6, the actuation wheel (130) is fabricated from 3/16 inch carbon steel and is six inches in diameter. Preferably, the perimeter of the actuation wheel (130) is provided with a plurality of holes (132), each positioned 1/8 inch closer to the center of the actuation wheel (130). Also provided around the perimeter of the actuation wheel (130) is a second set of holes (134), which are equidistant from the center of the actuation wheel (130), and each sized to accommodate a 1/4 inch by 5/8 inch carriage bolt (136) secured through one of the holes (134) by a nut (138).

As shown in FIG. 6, a limit switch (140) is secured to the motor bracket face (122) and electrically coupled to the motor (124) such that as to deactivate the motor (124) upon contact of the carriage bolt (136) with the limit switch (140). The carriage bolt (136) may be adjusted to different holes (134) around the perimeter of the actuation wheel (130) to vary the point at which the carriage bolt (136) triggers the limit switch (140). A pull rod (142) is secured through one of the holes (132) in the actuation wheel (130) by a bolt (144) and nut (146). The other end of the pull rod (142) is secured between the actuation arms (36) and (38) by a pin (148) passing through the holes (40) and (42) of the actuation arms (36) and (38). The pin is secured into place with a metal clip (150) passing through a hole (152) in the pin (148). As shown in FIG. 6, the motor (124) is preferably coupled to a current sensor (154), such as a TCS series alternating current sensor with programmable logic controller interface, sold by SSAC, Inc. of Baldwinsville, N.Y. The current sensor (154) is preferably coupled to a circuit board (156) which, in turn, is coupled to the limit switch (140). The circuit board (156) is preferably programmed to override the current sensor (154) during the first second of start-up of the motor (124), in which the amperage may spike three times the normal operating amperage. The circuit board (156) is also preferably constructed to coordinate with the limit switch (140) to override the current sensor (154), preferably during the last fifteen percent, and more preferably, during the last ten percent, of the loading stroke, where the majority of the loading pressure is required.

The circuit board (156) is also programmed to detect an overage current in excess of 1.0 amps during the remainder of the loading procedure. The amount of current required to trigger the circuit board (156) to reverse the motor (124) may, of course, be adjusted as desired, but is preferably adjusted so as to slightly reverse and stop the motor (124) in response to a shell (158), such as a hull or case, being crushed during the reloading procedure.

Coupled to the housing (120) is a faceplate (162) and back plate (164), preferably constructed of steel and secured to the housing (120) by bolts or weldments. Provided on the face plate (162) is an on/off switch (166) which
is coupled to the motor (124). Also provided on the faceplate (162) is a fuse (168), which is coupled to the motor (124) for easy replacement if amperage to the motor (124) exceeds a predetermined amount. Provided on either side of the housing (120) are actuation switches (170) and (172). The actuation switches (170) and (172) are spaced sufficiently far apart to prevent actuation of both with one hand. The switches (170) and (172) are preferably coupled to the circuit board (156), which is coded to actuate the motor (124) only upon simultaneous actuation of the actuation switches (168) and (170) to avoid a user moving a hand into the automatic indexing reloader (10) during the reloading process.

[0033] The reloader (12) is coupled to the housing (120) by a plurality of bolts (174). Although the reloader (12) may be secured to the housing (120) by any suitable means, in the preferred embodiment the reloader (12) is releasably coupled to the housing (120), making it possible to utilize the motor housing assembly (118) in association with additional reloaders.

[0034] When it is desired to utilize the automatic indexing reloader (10) of the present invention, a user inserts a shell (158) into the shell carrier (18) actuates the on/off switch (166) and actuates the switches (170) and (172) causing the motor (124) to rotate the actuation wheel (130). This, in turn, causes the pull rod (142) to move the reloader (12) through a reloading cycle, and index the shell (158) to the next station. Once the operation has been performed and the shell (158) indexed to the next station, the carriage bolt (136) actuates the limit switch (140) to shut off the motor (124). An additional shell (158) may be positioned on the shell carrier (18) and the actuation switches (170) and (172) again actuated to move the reloader (12) through another reloading stroke and index the shell (158) to the next station. This process continues until one of the consumables used in the reloading process is gone, a malfunction occurs, or the desired number of shells (158) have been loaded.

[0035] In the event a shell (158) is reloaded incorrectly, is misshappen or, for any other reason, begins to be crushed by the reloader (12) during the reloading process, the increased pressure against the turret assembly (20) causes the current sensor (154) to trigger the circuit board (156) to slightly reverse actuation of the motor (124). The crushed shell (158) may thereafter be discarded, fixed or thrown away, depending on the severity of the crushing and the consistency required in the reloading process.

[0036] An alternative embodiment of the present invention is shown generally as 176 in FIG. 9. In this embodiment, a reloader 178 is provided which operates in response to a shaft 180 being rotated by a handle 182. The reloader 178 is of a type known in the art to require a first manual operation after the shaft 180 is rotated in a first direction and a second manual operation after the shaft 180 is rotated in a second, opposite direction. In the preferred embodiment, the reloader 178 is a Platinum 2000 reloader manufactured by Ponsness/Warren of Rathdrum, Id. In this embodiment, the handle 182 is removed, and a flexible shaft coupling, such as a "Lovejoy" coupling is coupled between the shaft 180 of the reloader 178 and a shaft 186 coupled to a motor 188 such as that described above. In this alternative embodiment, the motor 188 is coupled to a standard alternating current outlet 190 and bolted to a base plate 192 by a pair of shoulder straps 194. The motor 188 is also coupled to a computer chip 196, such as those well known in the art. The chip 196 is programmed to act as a central processing unit and is coupled to a button switch 198. When the switch 198 is actuated, the chip 196 actuates the motor 188 to turn the shaft 180 a predetermined amount sufficient to place the reloader 178 in a position for a first manual operation, after which the chip 196 causes the motor to stop. When the switch 198 is again depressed, the chip 196 actuates the motor 188 to turn the shaft 180 in the opposite direction a predetermined amount sufficient to place the reloader 178 in a position for a second manual operation, after which the chip 196 causes the motor to stop. When the switch 198 is actuated again, the chip 196 actuates the motor 188 to turn the shaft 180 back in the opposite direction a predetermined amount sufficient to place the reloader 178 in the position for the first manual operation, after which the chip 196 causes the motor to stop. Every time the switch 198 is reversed, the chip 196 actuates the motor 188 to turn the shaft 180 in the direction opposite the last direction.

[0037] When it is desired to use the alternative embodiment of the present invention, the user (not shown) actuates the switch 198 to turn the shaft 180 a predetermined amount sufficient to place the reloader 178 in a position for a first manual operation, after which the chip 196 causes the motor to stop. The user then inserts a wad 200 into a powder-filled hull 202. The user then depresses the switch 198 again to turn the shaft 180 in the opposite direction a predetermined amount sufficient to place the reloader 178 in a position for a second manual operation, after which the chip 196 causes the motor to stop. The user then inserts an empty hull 204 into the reloader 178. The user then repeats these operations until the desired number of operations have been performed.

[0038] The foregoing description of the drawings merely explain and illustrate the invention, and the invention is not limited thereto, except insofar as the claims are so limited, as those skilled in the art who have the disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention. By way of example, although all assemblies described herein are preferably constructed within a ninety percent variance, and more preferably within a twenty-five percent variance, from the dimensions listed above, the automatic indexing reloader (10) may be constructed of any desired material, or of any suitable dimensions.

What is claimed is:
1. An improved system for moving a shell loading tool and a shell into and out of contact with one another, said improvement comprising:
   (a) a rotary motion converter;
   (b) means coupled to said rotary motion converter for rotating said rotary motion converter;
   (c) means for moving the shell loading tool and the shell into and out of contact with one another; and
   (d) a linkage coupled between said rotary motion converter and said moving means.
2. The improved system for moving a shell-loading tool and a shell into and out of contact with one another, wherein said rotating means is means for rotating said rotary motion converter through at least 300 degrees of rotation.
3. The improved system for moving a shell-loading tool and a shell into and out of contract with one another of claim 1, wherein said rotating means is means for rotating said rotary motion converter through at least 740 degrees of rotation.

4. The improved system for moving a shell loading tool and a shell into and out of contract with one another of claim 1, wherein 360 degrees of rotation of said rotary motion converter moves the shell loading tool and the shell into and out of contact with one another.

5. The improved system for moving a shell loading tool and a shell into and out of contract with one another of claim 1, wherein said rotary motion converter is a plate.

6. The improved system for moving a shell loading tool and a shell into and out of contract with one another of claim 1, wherein said plate is provided with a substantially arcuate perimeter.

7. The improved system for moving a shell-loading tool and a shell into and out of contract with one another of claim 1, wherein said linkage is coupled to said plate.

8. The improved system for moving a shell-loading tool and a shell into and out of contract with one another of claim 1, wherein said linkage is coupled to said plate in a manner which allows said rotary motor to rotate said plate at least 360 degrees.

9. The improved system for moving a shell-loading tool and a shell into and out of contract with one another of claim 1, wherein said linkage is coupled to said plate through at least one of said plurality of holes.

10. The improved system for moving a shell-loading tool and a shell into and out of contract with one another of claim 1, wherein said rotating means is a wire winding positioned between a plurality of brushes.

11. The improved system for moving a shell-loading tool and a shell into and out of contract with one another of claim 1, further comprising means for adjusting a length of said linkage.

12. A loader for loading a shell, said loader comprising:

(a) a shell loading tool;
(b) a rotary motor;
(c) a plate coupled to said rotary motor; and
(d) means for converting rotation of said plate into movement of said shell loading tool and the shell into and out of contact with one another.

13. The loader for loading a shell of claim 12, wherein said converting means comprises:

(a) means for moving said shell loading tool and the shell into and out of contact with one another; and
(b) a linkage coupled between said plate and said moving means.

14. The loader for loading a shell of claim 13, wherein linkage is coupled to said plate in a manner which allows said rotary motor to rotate said plate at least 360 degrees.

15. The loader for loading a shell of claim 13, wherein said plate has a first side and a second side wherein said rotary motor is coupled to said first side of said plate and wherein said linkage is coupled to said second side of said plate.

16. The loader for loading a shell of claim 12, wherein said plate is provided with a substantially arcuate perimeter.

17. The loader for loading a shell of claim 16, wherein said plate is provided with a plurality of holes located at different distances from said radius.

18. The loader for loading a shell of claim 16, wherein said plate is provided with a plurality of holes defining a plurality of holes located at different distances from said radius.

19. An actuator, a shell loader having a shell loading tool and a shell, said actuator comprising:

(a) a rotary motor;
(b) a plate having a first side and a second side, said first side coupled to said rotary motor; and
(c) a linkage coupled to said second side of said plate.

20. The actuator, a shell loader having a shell loading tool and a shell, of claim 19, wherein linkage is coupled to said plate in a manner which allows said rotary motor to rotate said plate at least 360 degrees.

* * * * *