July 26, 1966 W. E. MARTWICK ET AL 3,262,367

DUAL ROTOR MACHINE GUN

Original Filed March 18, 1964

FIG. 1

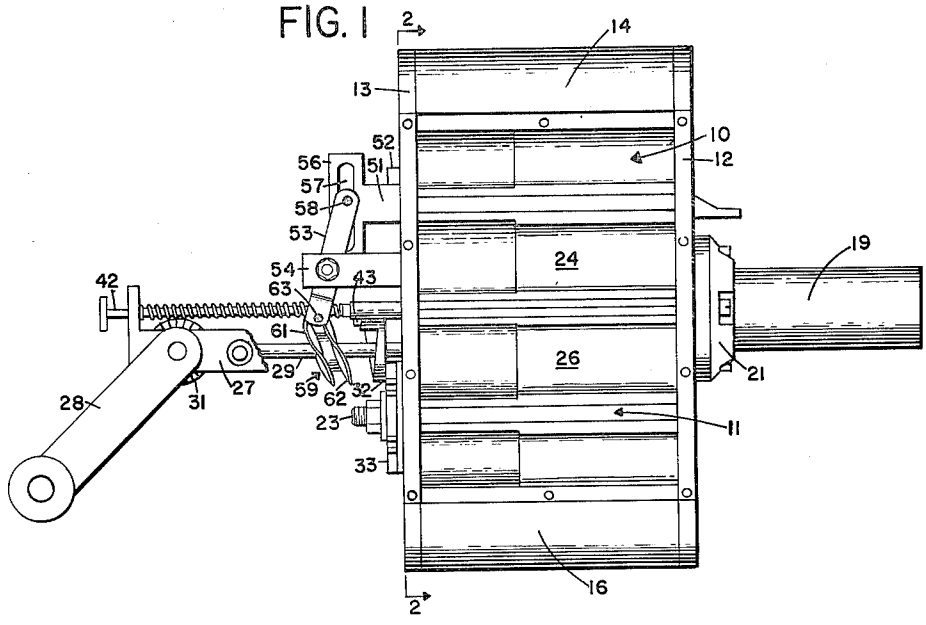


FIG. 2

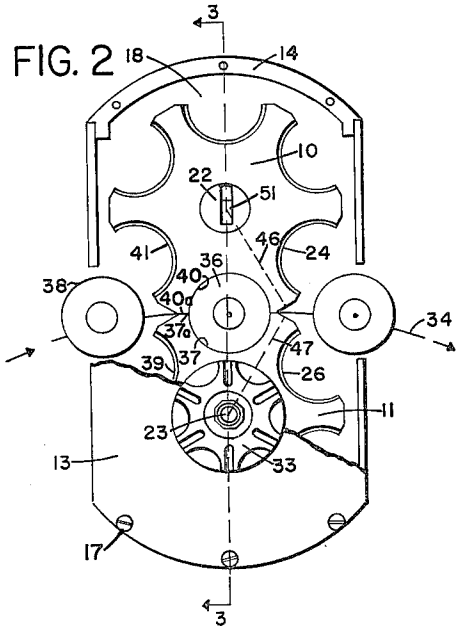
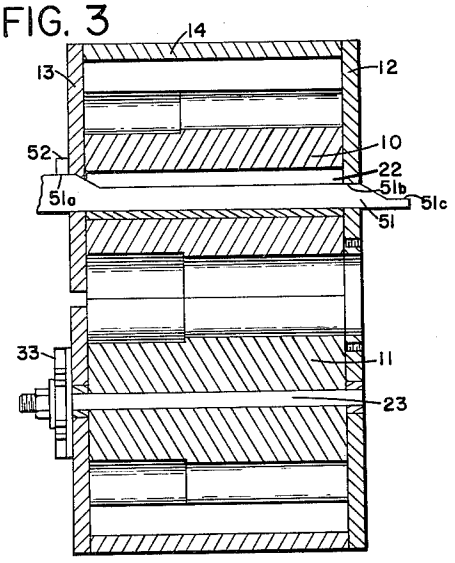


FIG. 3



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DUAL ROTOR MACHINE GUN

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4 Claims. (Cl. 89—13)

This application is a continuation of our copending application Serial No. 352,999, filed March 18, 1964, now abandoned, for Rapid Fire Weapon. The invention concerns an improved mechanism for operating a machine gun in which cartridges are fed between a pair of rotating cylinders, each having a plurality of equally spaced half cartridge chambers formed in the periphery thereof, that are rotated into positions adjacent each other to form a complete single chamber from which a cartridge is fired.

Modern machine guns generally utilize a reciprocating mechanism to feed and fire cartridges that are supplied from a drum or from a belt. A sliding bolt pushes the cartridges into a breech chamber that surrounds and supports the cartridge. The bolt itself serves as a support for the rear of the cartridge during firing. Since the cartridge is fully surrounded and supported by the breech and bolt assembly, the full explosive power of the propellant is applied to the bullet. The expanding gas cannot escape from the sealed chamber, and the cartridge itself cannot rupture because of the supporting structure surrounding the cartridge. Although these reciprocating mechanisms are somewhat complicated, they are in wide use today because of the reliability and speed which have been engineered into them.

The prior art reveals that the reciprocating mechanism is but one of the many different mechanisms that have been invented for the purpose of firing cartridges in rapid succession. Many of these other mechanisms were inherently less complicated than the reciprocating mechanism, but most of them never came into popular usage. In many cases, one or two flaws in an otherwise excellent idea prevented acceptance of the idea.

The present invention provides a mechanism to correct an important flaw in an early approach to achieving rapid fire. The basic system includes a pair of rotatable rotors or cylinders that are mounted on parallel shafts in a suitable frame. Both cylinders are of generally circular cross-section, and each has a plurality of equally spaced half cartridge chambers formed in the periphery thereof parallel to the shafts about which the cylinders rotate. One cylinder is mounted directly above the other cylinder with its lower surface adjoining the upper surface of the lower cylinder. Means are provided to rotate the two cylinders in opposite directions, such that half chambers from the upper cylinder are positioned adjacent corresponding half chambers on the lower cylinder to form a complete cartridge chamber. Cartridges are fed between the cylinders from the side, and means are provided to fire each cartridge after the complete cylinder has surrounded the cartridge.

This basic system is set forth in the Glov Patent 1,164,498, which issued December 14, 1915. In the Glov patent, both the upper and the lower cylinder are directly geared to a Geneva mechanism that is driven by a hand crank. The Geneva mechanism converts the continuous rotation of the hand crank into intermittent rotation of the two cylinders. A dwell period is provided each time two half chambers coincide to form a full chamber. During this dwell period a firing pin is activated to fire the cartridge. The rotation then continues to place a second pair of half chambers in conjunction at which time another dwell period is provided for firing the second cartridge.

In the Glov device the lower cylinder picks up a cartridge from a drum that is mounted on the side of the weapon. The cartridge is carried by the lower cylinder into position to be fired.

The Glov magazine gun is basically a desirable weapon because of its simplicity. There are relatively few moving parts, the parts themselves are not complicated to manufacture or assemble, and the mechanism does not operate at the extremely rapid rate that is necessary in the reciprocating type of machine gun. Wear and tear on the individual components is thus reduced considerably.

As previously mentioned, the present invention utilizes the same basic structure as that disclosed by Glov. There is a basic flaw, however, in the Glov device which renders it almost useless as a practical weapon.

The flaw in the Glov device results from the fact that the two cylinders rotate about parallel shafts that are mounted in the frame at a fixed distance apart. The two cylinders are thus at a fixed distance apart during firing and during rotation. In such a system it is impossible to seal the cartridge chamber during firing.

If the geometry of the system is analyzed, the fact that the cartridge chamber cannot be sealed becomes clearly apparent. The two circular cylinders are mounted on parallel shafts that are at a distance apart equal to the sum of the radii of the two cylinders. With this configuration, the outer surfaces of the two cylinders make contact along a line that is formed by a plane containing the two shafts. The two shafts must be at least this distance apart in order to prevent interference of the surfaces of the cylinders during rotation. When the two concave half cartridge chambers, which are formed in opposing cylinders, are positioned adjacent each other to form a complete chamber, each of the half chambers is bisected by the previously mentioned plane. Since the two surfaces can meet only where they intersect the plane, it is obvious that the junction between the edges of opposing half chambers will be slightly open. This physical structure can be clearly seen in FIGURE 2 of the Glov patent.

These openings in the junctions between the opposing edges of the adjacent half chambers result in an inoperable weapon for all practical purposes. Each time the cartridge is fired a large amount of gas will escape from these openings. Because of the high pressures formed in the chamber, the large amount of gas escaping during rapid fire of the weapon would generate an intolerable environment for the operator of the weapon. In addition, the loss of pressure would degrade the performance of the bullet. An even more serious problem is the fact that most cartridge cases are not designed to withstand the pressures developed during firing. The cartridges are designed to be completely surrounded by the walls of the breech chamber during firing. It is probable that many of the cartridges being fired from the Glov magazine gun would rupture during firing. The ruptured cartridges would be dangerous to the operator, and could also foul the mechanism of the gun.

The present invention removes this flaw in the system by providing a mechanism for tightly sealing the chamber during firing. This sealing function is provided by mounting the upper rotor on a shaft that is allowed limited movement in the plane containing the axes of the two shafts, and in a direction perpendicular to the two axes. The range of motion is such that the upper cylinder can be pressed firmly against the lower cylinder during the dwell period to seal tightly the junction between the adjoining edges of the adjacent half chambers. During rotation of the cylinders, the upper cylinder is free to move upwardly so that the adjoining surfaces of the cylinders will not bind. The exact mechanism for accomplishing this alternate locking and releasing of the upper

cylinder will be explained in detail in a later portion of the specification.

In the present invention, the upper cylinder is not geared directly to the drive mechanism that operates the lower cylinder as it is in the Glov devices. The cartridges are also inserted between the two cylinders by means of a cartridge belt rather than from a magazine. In the lower cylinder, which in this invention is driven through a Geneva mechanism by a hand crank, the half chambers mesh with the cartridges in the belt to draw the cartridges into the firing position. The cartridges in turn mesh with the half chambers in the upper cylinder to effect its rotation.

It is therefore a primary object of the present invention to improve the operation of a rapid fire weapon utilizing a pair of revolving cylinders in which concave half cartridge chambers formed in the surface of each cylinder are joined to form a complete cartridge chamber, by providing a mechanism which will seal the junction between the half chambers during firing, and allow separation of the cylinders during rotation to prevent interference between the surfaces thereof.

A further object of the present invention is to provide a new and more effective means of sealing the junction between the half cartridge chambers during firing of a split breech weapon.

These and other objects of the present invention will become apparent when considered in view of the accompanying drawings in which:

FIGURE 1 is a side view of the rapid fire weapon from which the outside shell or cover has been removed to show the firing mechanism in detail;

FIGURE 2 is a cut away front view of the weapon taken generally along line **2—2** of FIGURE 1; and

FIGURE 3 is a sectional side view of the two revolving cylinders or rotors and the sliding cam member used to lock the rotors during firing, taken along line **3—3** of FIGURE 2.

Referring now to the drawing, there is disclosed in FIGURE 1 a side view of the subject invention. An upper rotor or cylinder **10** and a lower rotor or cylinder **11** are mounted in a frame which includes a forward member **12**, a rear member **13**, an upper member **14**, and a lower member **16**. The frame members are firmly connected together by screws, such as **17** (FIGURE 2), to form a chamber **18** in which rotors **10** and **11** are mounted. Attached to the front of forward frame member **12** is a barrel **19** having a bore therein (not shown). Barrel **19** is firmly attached to front member **12** by an annular housing member **21**.

Referring now to FIGURE 2, it can be seen that rotor **10** is mounted for rotation in chamber **18** on a shaft **22**. Rotor **11** is mounted for rotation in chamber **18** on a shaft **23** that is journalled in rear frame member **13** and forward frame member **12**. Shafts **22** and **23** are mounted in parallel in the frame, with shaft **22** being directly above shaft **23**.

FIGURES 1 and 2 disclose that rotors **10** and **11** have a generally cylindrical configuration, and have a nominal circular cross-section. Formed about the periphery or surface of rotors **10** and **11** in parallel with shafts **22** and **23** are a plurality of concave half cartridge chambers such as **24** and **26**. In the preferred embodiment disclosed herein, there are six such half chambers evenly spaced around the periphery of each rotor.

FIGURE 1 discloses a mechanism for rotating rotors **10** and **11**. The driving mechanism is mounted on a support member **27**, which is bolted to the rear of frame member **13**. A hand crank **28** provides the motive power for the weapon as it is revolved in a clockwise direction as seen in FIGURE 1. This rotation of hand crank **28** is transferred to a drive shaft **29** through a bevel gear **31** and a similar bevel gear on drive shaft **29** (not shown). Attached to the end of drive shaft **29** adjacent frame member **13** is a drive cam **32** which engages a Geneva star wheel **33** mounted on shaft **23**. The continuous rotation of drive shaft **29** is thus converted into intermittent rotation of shaft **23** and rotor **11** by Geneva wheel **33** in a manner well known in the art.

As rotor **11** is revolved in a clockwise direction, as shown in FIGURE 2, by Geneva wheel **33**, the half chambers therein mesh with cartridges carried by a cartridge belt **34**. Thus, in FIGURE 2, a cartridge **36** has been carried between the rotors by a half chamber **37** and a new cartridge **38** will be carried between the rotors by a half chamber **39** as the rotation of rotor **11** continues.

Upper rotor **10** is not driven directly by hand crank **28** and the associated driving means. Rotor **10** is driven in a counterclockwise direction as viewed in FIGURE 2 by the meshing of the half chambers in rotor **10** with the cartridges being pulled between the rotors by rotor **11**. For example, as cartridge **36** is expelled from between the rotors by the rotation of rotor **11**, a counterclockwise rotation is imparted to rotor **10**. As cartridge **38** is drawn between the rotors, it will mesh with a half chamber **41** in rotor **10** to continue this counterclockwise rotation.

The drive mechanism is constructed such the intermittent revolution of the rotors is achieved. As the rotors reach the position shown in FIGURE 2, the Geneva drive is scheduled to reach its dwell period. During this dwell period, the firing of the cartridge takes place. In FIGURE 1, a spring loaded firing pin **42** is mounted on support member **27** and rear frame member **13**. A cam follower **43** mounted on firing pin **42** rides the surface of a ramp on drive cam **32**. As drive shaft **29** is rotated, cam follower **43** gradually forces firing pin **42** to the rear against the action of the spring. When the dwell period is reached, cam follower **43** reaches the high point of the ramp on drive cam **32** and is suddenly released to allow the firing pin to activate the ignitor of the cartridge. The mechanism is synchronized so that each time a new cartridge reaches the position of cartridge **36** in FIGURE 2, the firing pin is released.

After each cartridge is fired, Geneva wheel **33** again imparts rotation to rotor **11**. It is obvious from FIGURE 2 that such further rotation would not be possible unless means were provided to increase the distance between shafts **22** and **23**. The sum of a radius **46** of rotor **10** and a radius **47** of rotor **11** is obviously greater than the distance between shafts **22** and **23**. The outer surfaces of rotors **10** and **11** would thus bind unless the two rotors were separated during rotation.

In order to allow separation of rotors **10** and **11** during rotation, rotor **10** is mounted on shaft **22**, which in turn is mounted in the frame for limited movement in a plane containing the axes of the two shafts and in a direction perpendicular to the axes. This translational movement of rotor **10** is sufficient to allow rotor **10** to move from the position shown in FIGURE 2 to a position in which shafts **22** and **23** are at a distance apart greater than the sum of radius **46** and radius **47**.

The mechanism which controls the translational movement of rotor **10** is disclosed in FIGURES 1 and 3. FIGURE 3 discloses that shaft **22** is supported in the frame by a shifting cam member **51** that is inserted longitudinally through a slot in shaft **22**. Cam member **51** is longitudinally movable within the slot in shaft **22**. In the position shown in FIGURE 3, cam member **51** has a high portion **51*a*** thereon in contact with a stop **52** that is mounted on rear member **13**. An intermediate portion **51*b*** on the opposite end of cam member **51** also engages the upper surface of a slot in forward member **12**. In this position, cam member **51** firmly locks rotor **10** in the position shown in FIGURE 2. This locked position, which occurs during the dwell period, effectively seals the chamber which surrounds cartridge **36** during firing. In FIGURE 2 this chamber is formed by half chamber **37** and half chamber **40**. The junction between half chamber **37** and half chamber **40** is formed by a

pair of flat surfaces **37***a* and **40***a* that have been formed along a line perpendicular to the plane that contains the axis of shaft **22** and shaft **23**. In this manner a relatively wide junction surface on each side of cartridge **36** is obtained in order to effectively seal the cartridge chamber and support cartridge **36**. Cam member **51** is thus constructed such that it will apply a predetermined amount of pressure downward on rotor **10** in order to effectively seal the chamber.

After the dwell period, during which firing of the cartridge occurs, Geneva wheel **33** again begins to rotate rotor **11**. Before this rotation can begin, however, rotor **10** must be free to move upwardly. This is accomplished by moving cam member **51** to the left, as shown in FIGURE 3. As cam member **51** moves to the left, high portion **51***a* and intermediate portion **51***b* are removed from their position in contact with the frame. Intermediate portion **51***b* now comes in line with stop **52**, and a lower portion **51***c* is positioned in the slot in frame **12**. Rotor **10** is now free to move upwardly the required distance, as the outer surfaces of the two rotors begin to bind during rotation.

This movement of cam member **51** must of course be synchronized with the rotation of the rotors. The mechanism for accomplishing this synchronization is disclosed in FIGURE 1. The mechanism includes a rocker arm **53** that is pivotally mounted on a support member **54** attached to rear member **13**. Attached to the rear of sliding cam member **51** is a cross member **56** having a slot **57** therein. A cam follower end **58** of rocker arm **53** is positioned within slot **57**. Mounted on shaft **29** is a guide cam **59** having a rear member **61** and a forward member **62**. Positioned between members **61** and **62** is a cam follower end **63** of rocker arm **53**. As drive shaft **29** is rotated, a reciprocating motion is transmitted to rocker arm **53** by guide cam **59**. The reciprocating motion of rocker arm **53** imparts the previously described axial motion to sliding member **51**. Slot **57** allows vertical movement of cam follower **58** during reciprocation of rocker arm **53**. Guide cam **59** and rocker arm **53** are again programmed so that sliding member **51** is positioned as shown in FIGURE 3 during the dwell period of the rotors and is withdrawn to allow upward movement of rotor **10** during rotation of the rotors.

This alternate locking and releasing of rotor **10** completely seals the cartridge chamber during firing and then allows the upper rotor to float during rotation such that no interference between the rotor surfaces is present.

Certain changes in design may occur to those skilled in the art without departing from the invention. The preferred embodiment disclosed herein utilizes but one of many possible mechanisms for alternately locking and freeing the upper rotor. In some instances, it might be desirable to use a gas operated mechanism to drive cam member **51** rather than to use a purely mechanical linkage. In other applications, it might be desirable to provide means to drive the upper rotor directly from the drive shaft. Although the form of the invention described herein constitutes a preferred embodiment, it will be understood that these and other changes may be made within the spirit of the invention. I therefore intend to be limited only by the scope of the appended claims.

I claim as my invention:

1. A machine gun, comprising:

a frame;

a gun barrel mounted in said frame having a bore;

a first cylindrical rotor mounted in said frame for rotation about a first longitudinal axis in parallel with said bore, said first rotor having a plurality of semi-cylindrical concave half chambers formed longitudinally in the periphery thereof and positioned therein so as to be successively aligned with said bore during rotation of said first rotor;

a second cylindrical rotor mounted adjacent said first rotor in said frame and being rotatable about a second longitudinal axis in parallel with said first axis, said second rotor having a plurality of semi-cylindrical concave half chambers corresponding in size and number to the chambers in said first rotor formed longitudinally in the periphery thereof and positioned therein so as to be successively aligned with said bore during rotation of said second rotor;

a Geneva wheel connected to said first rotor;

a crank operated continuously rotatable Geneva drive shaft mounted in said frame and connected to said Geneva wheel, said Geneva wheel converting the continuous rotation of said drive shaft into intermittent rotation to thereby rotate said first rotor to successively align said half chambers with said bore and to provide a timed dwell period for said first rotor after said alignment is achieved;

a sliding cam member extending through a slot in said frame and through said axis of said second rotor to support said second rotor within said frame;

a rocker arm pivotally mounted on said frame having a first end connected to said sliding cam member and a second cam follower end positioned to follow a rotating guide cam mounted on said Geneva drive shaft;

said guide cam being designed to impart a reciprocating motion to said rocker arm during rotation of said drive shaft, said sliding cam member being moved axially by said rocker arm between a first position and a second position, said sliding cam member in said first position having a first portion thereon in said slot having dimensions corresponding to said slot to prevent lateral movement of said second rotor, said sliding cam member in said second position having a second portion thereon in said slot with reduced dimensions with respect to said slot to allow lateral movement of said second rotor in a direction away from said rotor;

and means for rotating said second rotor simultaneously with the rotation of said first rotor, said guide cam being programmed to move said sliding cam member to said first position during the dwell period of said first rotor and to move said sliding cam member to said second position during rotation of said first rotor.

2. A machine gun, comprising:

a frame;

a first cylindrical rotor mounted in said frame for rotation about a first longitudinal axis; said first rotor having a plurality of semi-cylindrical concave half cartridge chambers formed longitudinally in the periphery thereof;

a second cylindrical rotor mounted adjacent said first rotor in said frame and being rotatable about a second longitudinal axis in parallel with said first axis, said second rotor having a plurality of semi-cylindrical concave half cartridge chambers corresponding in size and number to the chambers in said first rotor formed longitudinally in the periphery thereof;

a Geneva wheel connected to said first rotor;

driving means including a continuously rotatable Geneva drive shaft mounted in said frame and connected to said Geneva wheel, said Geneva wheel converting the continuous rotation of said drive shaft into intermittent rotation to thereby rotate said first rotor to successively position said half chambers in a cartridge firing position and to provide a timed dwell period for said first rotor after said positioning is achieved;

a sliding cam member extending through a slot in said frame and through said axis of said second rotor to support said second rotor within said frame;

a rocker arm pivotally mounted on said frame having a first end connected to said sliding cam member and a second cam follower end positioned to follow

a rotating guide cam mounted on said Geneva drive shaft;

said guide cam being designed to impart a reciprocating motion to said rocker arm during rotation of said drive shaft, said sliding cam member being moved axially by said rocker arm between a first position and a second position, said sliding cam member in said first position having a first portion thereon in said slot having dimensions corresponding to said slot to prevent lateral movement of said second rotor, said sliding cam member in said second position having a second portion thereon in said slot with reduced dimensions with respect to said slot to allow lateral movement of said second rotor in a direction away from said first rotor; and

means for rotating said second rotor simultaneously with the rotation of said first rotor, said guide cam being programmed to move said sliding cam member to said first position during the dwell period of said first rotor and to move said sliding cam member to said second position during rotation of said first rotor.

3. A machine gun, comprising:

a frame;

a first rotor mounted in said frame for rotation about a first axis, said first rotor having a plurality of concave half cartridge chambers formed in the periphery thereof in parallel with said first axis;

a second rotor mounted adjacent said first rotor in said frame and being rotatable about a second axis in parallel with said first axis, said second rotor having a like plurality of concave half cartridge chambers formed in the periphery thereof;

a Geneva wheel connected to said first rotor;

continuously rotatable Geneva drive means mounted in said frame and connected to said Geneva wheel, said Geneva wheel converting the continuous rotation of said drive means into intermittent rotation to thereby rotate said first rotor to successively position said half chambers in a cartridge firing position and to provide a timed dwell period for said first rotor after said positioning is achieved;

a sliding cam member extending through a slot in said frame and through said axis of said second rotor;

means operated by said driving means for axially reciprocating said sliding cam member between a first position and a second position during rotation of said drive means, said sliding cam member in said first position having a first portion thereon in said slot having dimensions corresponding to said slot to prevent lateral movement of said second rotor, said sliding cam member in said second position having a second portion thereon in said slot with reduced dimensions with respect to said slot to allow lateral movement of said second rotor in a direction away from said first rotor; and

means for rotating said second rotor simultaneously with the rotation of said first rotor, said sliding cam member being programmed to move to said first position during the dwell period of said first rotor and to move to said second position during rotation of said first rotor.

4. A machine gun, comprising:

a frame;

first and second rotors mounted in said frame for individual rotation about a pair of axes, each of said rotors having at least two concave half cartridge chambers formed in an outer surface thereof;

drive means for intermittently rotating said rotors to position a half chamber in said first rotor adjacent a half chamber in said second rotor to form a complete single cartridge chamber, and to provide a timed dwell period after said chamber is formed;

a sliding cam member extending through a slot in said frame and through said axis of said second rotor;

means operated by said driving means for axially reciprocating said sliding cam member between a first position and a second position, said sliding cam member in said first position having a first portion thereon in said slot having dimensions corresponding to said slot to prevent lateral movement of said second second rotor, said sliding cam member in said second position having a second portion thereon in said slot with reduced dimensions with respect to said slot to allow lateral movement of said second rotor in a direction away from said first rotor; and

means for rotating said second rotor simultaneously with the rotation of said first rotor, said sliding cam member being programmed to move to said first position during the dwell period of said first rotor and to move to said second position during rotation of said first rotor.

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