May 31, 1960 K. GISS 2,938,513

AIR GUN

Filed April 17, 1956 4 Sheets-Sheet 1

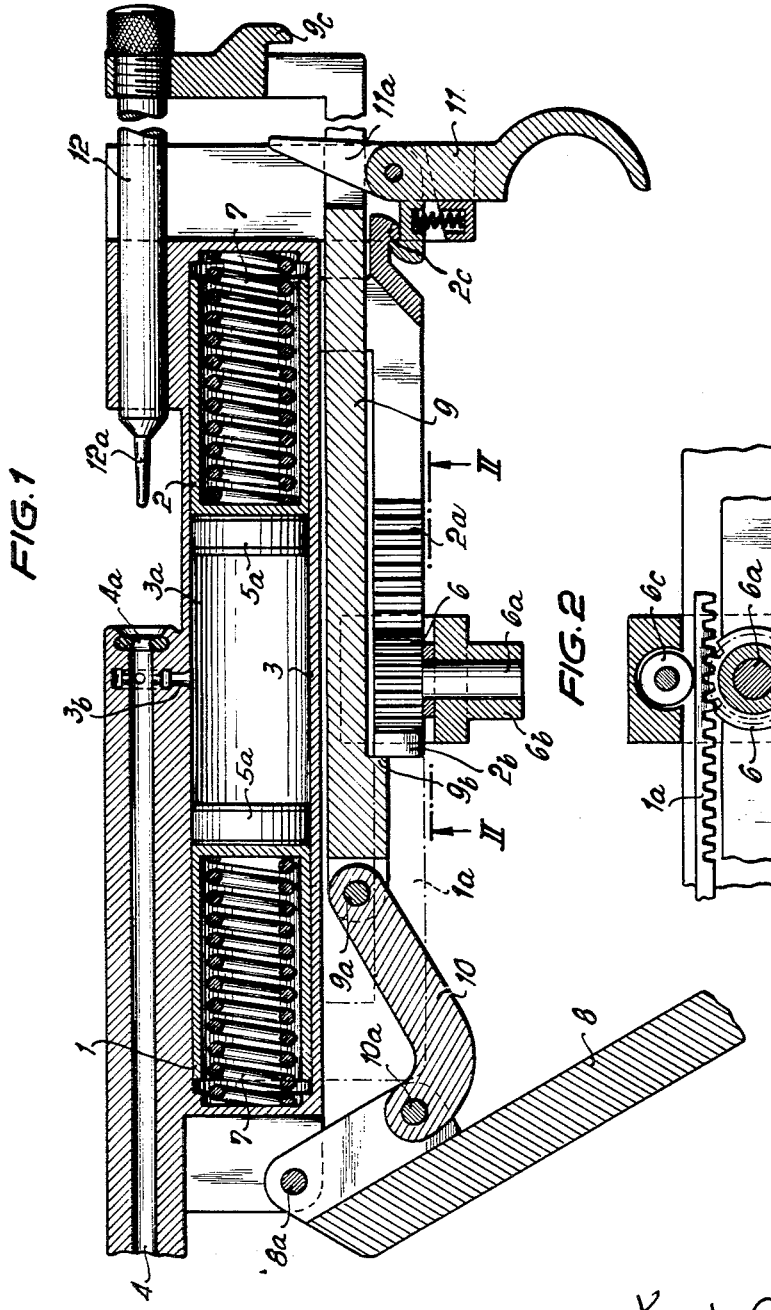

FIG. 1

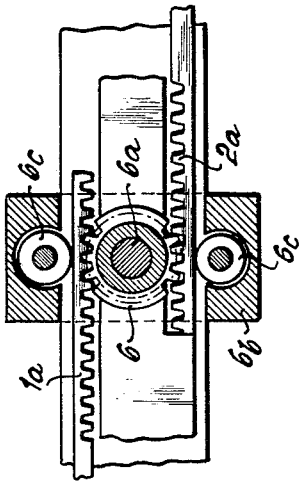

FIG. 2

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AIR GUN

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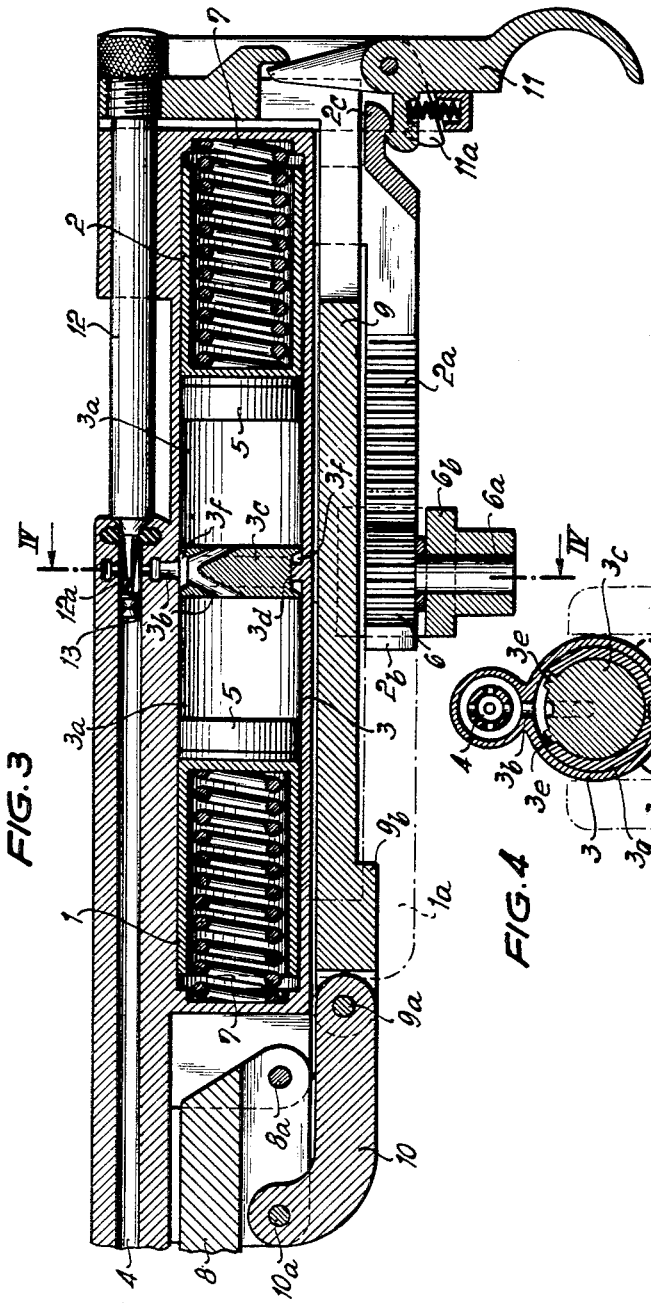

FIG. 3

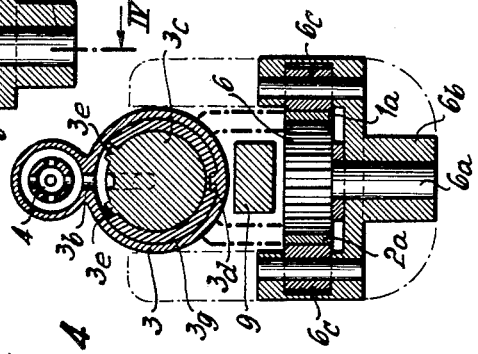

FIG. 4

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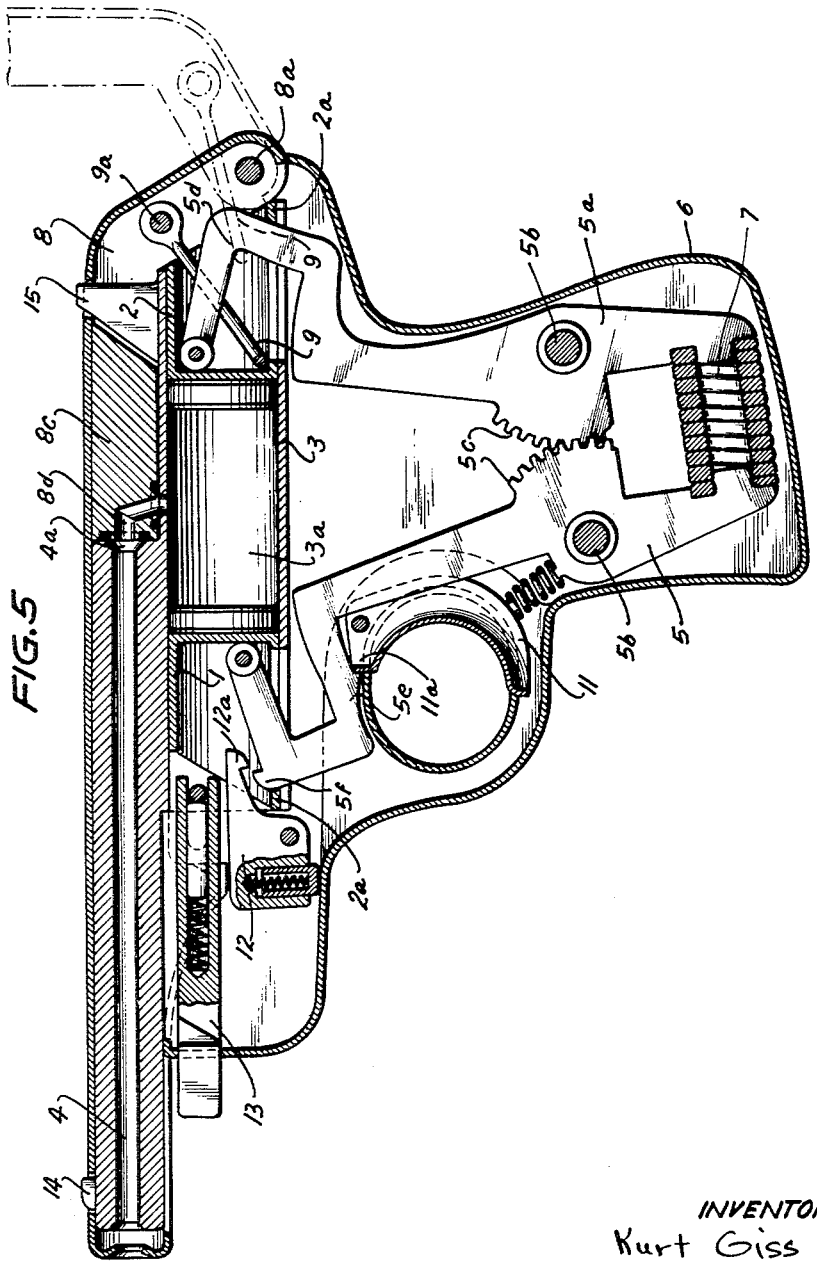

FIG. 5

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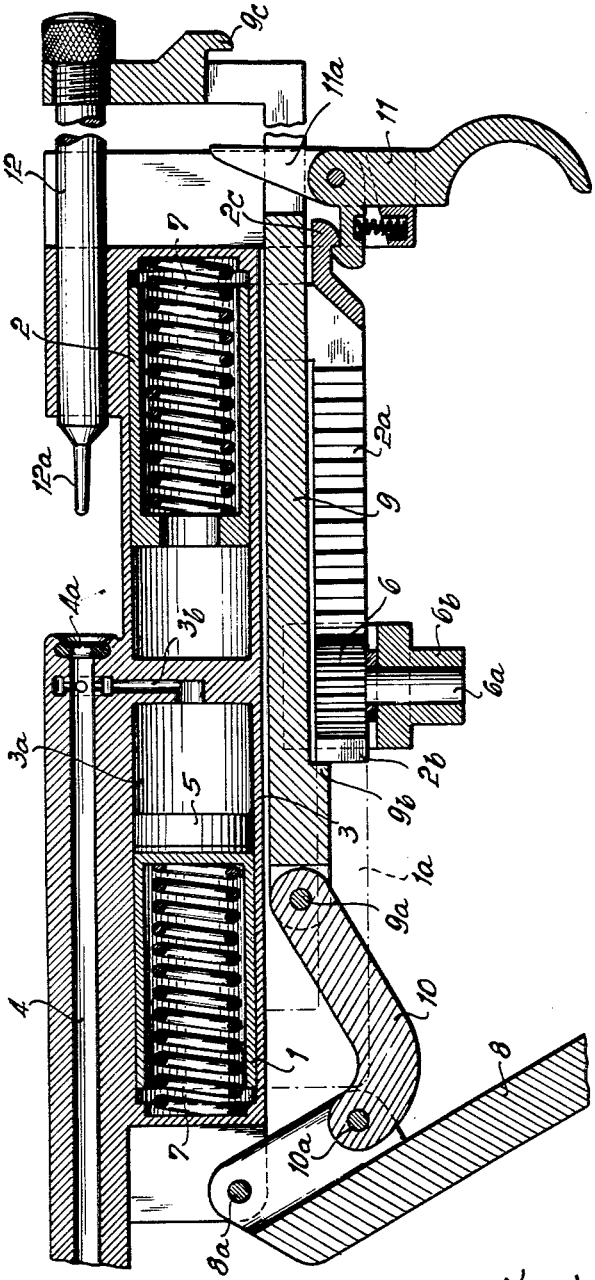
FIG. 6



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United States Patent Office 2,938,513 Patented May 31, 1960

2,938,513

AIR GUN

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Filed Apr. 17, 1956, Ser. No. 578,794

16 Claims. (Cl. 124—15)

The present invention relates to air guns.

One of the objects of the present invention is to provide an air gun capable of eliminating recoil and at the same time having an exceedingly simple operating structure.

Another object of the present invention is to provide an air gun capable of eliminating recoil through the medium of a pair of oppositely movable pistons with a means cooperating with only one of the pistons for controlling the operation of the gun.

A further object of the present invention is to provide an air gun of the above type with a structure which guarantees that the pistons will always move equally and oppositely with respect to each other.

An additional object of the present invention is to provide an air gun capable of preventing recoil and having but one piston which actually compresses air.

A further object of the present invention is to provide an air gun with a pair of balanced pistons for preventing recoil which also includes a means for automatically regulating the compression chambers which cooperate with these pistons.

Also, the objects of the present invention include the provision of structure capable of accomplishing the above objects and at the same time composed of simple and ruggedly constructed elements which are very reliable in operation.

With the above objects in view the present invention mainly consists of an air gun which includes a cylinder in which a pair of pistons are slidable, at least one of these pistons forming with part of the cylinder a compression chamber. A barrel communicates adjacent its breech end with the compression chamber and a means is operatively connected to the pistons for compelling the same to move at the same speed as well as equally and oppositely with respect to each other.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary longitudinal sectional view of one possible construction of an air gun according to the present invention;

Fig. 2 is a fragmentary sectional view taken along line 2—2 of Fig. 1 in the direction of the arrows;

Fig. 3 is a longitudinal sectional fragmentary view of an air gun similar to Fig. 1 having a shiftable partition in the cylinder between the pistons therein;

Fig. 4 is a sectional elevational view taken along line 4—4 of Fig. 3 in the direction of the arrows;

Fig. 5 is an elevational longitudinal sectional view through another embodiment of an air gun according to the present invention; and

Fig. 6 is a fragmentary longitudinal sectional elevational view of an air gun similar to Fig. 1 but having only one piston which actually compresses air for discharging a projectile from the barrel.

In the embodiment of the invention which is shown in Figs. 1–4 pistons 1 and 2 are slidable within a cylinder 3. In the arrangement of Fig. 1 a compression chamber 3*a* is formed in the cylinder 3 between the pistons 1 and 2 while in Fig. 3 there is shown a partition 3*c* between the pistons 1 and 2 which provide a pair of compression chambers 3*a* cooperating with the pistons 1 and 2 of Fig. 3. The piston sealing members 5 associated with the pistons 1 and 2 of the Fig. 3 are different from the sealing members 5*a* of the pistons 1 and 2 of Fig. 1 and cooperate properly with the partition 3*c*. In Figs. 1 and 3 there is shown the barrel 4 which is fixed to the cylinder 3 and which communicates with the compression chamber 3*a* through a bore 3*b* which is of extremely small size. As is particularly evident from Fig. 4, the bore 3*b* communicates with an annular channel formed in the barrel 4 adjacent its breech end where the sealing ring 4*a* is located, and this annular channel in turn cooperates with bores passing from the annular channel through the wall of the barrel to the interior thereof, as is shown at the upper portion of Fig. 4. The partition 3*c* shown in Fig. 3 is freely shiftable within the cylinder 3 and is formed with passages which communicate with the portions of chamber 3*a* on opposite sides of the partition 3*c* as well as with the bore 3*b*, as shown in Fig. 3.

The cylinder 3 of Fig. 3 is provided at its lowermost inner surface portion beneath the bore 3*b* with a projection 3*d* which is located within an annular groove 3*f* formed in the outer periphery of the partition 3*c*, and this partition 3*c* is itself provided within the groove 3*f* with a pair of projections 3*e*, as shown in Fig. 4. In the groove 3*f* of the partition 3*c* there are pressed a pair of brake lining members 3*g* in the manner shown in Fig. 4, so that the projection 3*d* of the cylinder 3 is located between the brake lining members 3*g* and so that the upper ends of the latter respectively engage the projections 3*e*. With this arrangement there is a frictional engagement between the members 3*g* and the inner face of the cylinder 3 which maintains the partition 3*c* in the position to which it is automatically moved by the pistons 1 and 2. Furthermore, the cooperation of the projection 3*d* with the members 3*g* prevents turning of the partition 3*c* about its axis and limits it to axial movement. The extent of axial movement of partition 3*c* is small, but as is clearly evident from Fig. 3, there is a sufficient degree of axial movement of the partition 3*c* to enable the latter to be properly positioned by the pistons 1 and 2 themselves without the possibility of cutting off communication between the passages in the partition 3*c* with the bore 3*b*.

The cylinder 3 is formed with a pair of axial slots which are overlapped by the pistons 1 and 2 in the position thereof shown in Figs. 1 and 3 and which do not extend beyond the head ends of the pistons 5 or 5*a*. A pair of racks 1*a* and 2*a* are fixed to extensions which extend through these slots and are respectively fixed to the pistons 1 and 2 adjacent their rear ends, respectively, so that in this way the racks 1*a* and 2*a* are movable together with the pistons and are capable of moving the latter, while at the same time the compression chambers 3*a* do not communicate with the outer atmosphere because the slots do not extend up to the compression chamber when the pistons are in their starting position shown in Figs. 1 and 3. As is evident from Fig. 2, the racks 1*a* and 2*a* are laterally spaced from each other and respectively mesh with opposite sides of a pinion 6 which is turnably carried by a pin 6*a* which is in turn carried by a substantially U-shaped bracket 6*b* which has its upwardly extending legs fixed to the cylinder 3 at the

outer surface thereof approximately midway between the pistons when the latter are in the position shown in Figs. 1 and 3. The teeth of the racks 1*a* and 2*a* are directed toward each other and these racks respectively have smooth faces directed away from each other and engaging the rollers 6*c* which are also turnably carried by the bracket 6*b* and which guarantee that the racks 1*a* and 2*a* remain in meshing engagement with the pinion 6. Thus, the racks and pinion form a means for compelling the pistons to move at all times at the same speeds and in equal and opposite directions.

A cocking lever 8 is pivoted at 8*a* to a forwardly extending projection of the cylinder 3, and a link 10 is pivoted at 10*a* to the cocking lever 8. This link 10 is in turn pivotally connected at 9*a* to a motion transmitting member 9 which extends through the space between the pinion 6 and the cylinder 3 to the rear end of the latter where the motion transmitting member 9 has an upwardly extending leg fixed to the rear end of an elongated locating and closure pin 12. This pin 12 is slidably guided in a bore of an upwardly extending projection at the rear end of the cylinder 3 and includes at its front end an elongated portion 12*a* which guarantees that the projectile 13 is located ahead of the barrel opening which communicates with the compression chamber of the cylinder 3. Thus, it will be seen that the pin 12 guarantees that the motion transmitting member 9 is guided for horizontal forward and rearward movement, and this motion transmitting member 9 has a shoulder 9*b* which engages the front end 2*b* of the rack 2*a* when the cocking lever 8 is turned from the position of Fig. 3 to that of Fig. 1, so that in this way the motion transmitting member 9 moves the rack 2*a* to the rear whenever the cocking lever 8 is actuated. The motion transmitting member 9 engages only the rack 2*a*, the rack 1*a* moves because of its connection to the rack 2*a* through the pinion 6. Springs 7 are located in the cylinder 3 and urge the pistons 1 and 2 toward each other, respectively, so that when the cocking lever 8 is actuated the springs 7 are compressed and volume of the compression chamber 3*a* increases.

The rack 2*a* is provided at its rear end portion with a pawl 2*c* which cooperates with a tooth of a trigger 11 which is pivotally carried by a projecting portion which extends rearwardly and downwardly from the rear end of the cylinder 3. The spring shown at the lower right portion of Figs. 1 and 3 urges the trigger 11 to turn in a clockwise direction, as viewed in Figs. 1 and 3, so that when the tooth 2*c* rides over the tooth of the trigger 11 the latter will catch the rack 2*a* and will retain the latter in the position shown in Figs. 1 and 3.

A safety bell crank member 11*a* is pivotally carried by the rear projection of the cylinder 3 for turning movement about the same pivot pin which turnably carries the trigger 11, the latter being limited in its forward movement by the recessed portion of the projection of cylinder 3 which carries the spring which acts on the trigger 11. The bell crank safety member 11*a* also has a tooth which cooperates with the tooth 2*c* to retain the rack 2*a* in the position shown in Fig. 1 until the cocking lever 8 is returned to its rest position shown in Fig. 3. The motion transmitting member 9 has a tooth 9*c* which engages the top end of the lever 11*a* when the cocking lever 8 is returned from the position of Fig. 1 to that of Fig. 3, and thus when this cocking lever is located in the position of Fig. 3 the tooth 9*c* turns the safety lever 11*a* to the position shown in Fig. 3, so that now the rack 2*a* is held in its cocked position only by the trigger 11.

It is evident that when the gun is thus cocked, the breech end of the barrel 4 is opened, and a projectile 13 may be placed through the sealing member 4*a* in the interior of the barrel 4. Then when the lever 8 is returned to its rest position shown in Fig. 3, the pin 12 engages with its front end portion 12*a* the projectile 13 to make certain the latter is located in proper firing position, as shown in Fig. 3. Furthermore, it will be noted that the frusto-conical portion of the pin 12 immediately behind the front end portion 12*a* thereof cooperates with the sealing ring 4*a* to close the rear end of the barrel 4. Now, when the trigger 11 is actuated by the operator who turns the trigger 11 into counterclockwise direction, the rack 2*a* will be released, and the springs 7 will move the pistons 1 and 2 toward each other so that the air compressed within the compression chamber 3*a* drives the projectile 13 out of the barrel. The gun is provided with a suitable stock which is not illustrated since it forms no part of the present invention.

In the embodiment of the invention which is illustrated in Fig. 5, the barrel 4 is also fixed to the cylinder 3 within which the pistons 1 and 2 are slidably located for movement toward and away from each other. As is evident from Fig. 5 the pistons are formed with elongated slots cooperating with slots formed in the portions of cylinder 3 which are located beyond the head ends of the pistons 1 and 2 in the position thereof shown in Fig. 5, so that a pair of levers 5 and 5*a* may extend through the pairs of aligned slots into the interiors of the pistons 1 and 2 behind the head ends thereof. Rollers carried by the free ends of the levers 5 and 5*a* engage the pistons 1 and 2. Furthermore, the rear edge portions of the levers 5 and 5*a* adjacent their upper ends engage the rear ends of the slots formed in the pistons 1 and 2 so that the levers are capable of moving the pistons. A compression chamber 3*a* is formed in the cylinder 3 between the pistons 1 and 2.

The levers 5 and 5*a* are housed within the hollow handle 6 of the gun of Fig. 5, and they are pivotally carried by the pivot pins 5*b*, as shown in Fig. 5. Furthermore the levers 5 and 5*a* are formed with gear sectors 5*c*, respectively, whose centers of curvature coincide with the axes of pivot pin 5*b*. These gear sectors 5*c* which mesh with each other thus compel the levers 5 and 5*a* to turn at all times equally and oppositely with respect to each other. A compression spring 7 is located between and engages the bottom free ends of the levers 5 and 5*a* to urge the latter apart from each other, the gun being shown in Fig. 5 in its cocked position where the spring 7 has been compressed.

The cocking lever 8 of the embodiment of Fig. 5 is in the form of an elongated channel of substantially U-shaped cross section which forms an outer covering of the barrel 4 when the gun is in the position shown in Fig. 5. As is evident from Fig. 5 the front end of the cocking lever 8 has an opening aligned with the muzzle end of the barrel 4, and furthermore the cocking lever 8 is provided with openings through which the sighting and aiming projections 14 and 15 respectively extend, projection 14 being fixed to the barrel 4 while the projection 15 is fixed to the cylinder 3.

The cocking lever 8 is pivoted at 8*a* to the housing 6, and a motion transmitting member 9 in the form of a hook shaped member is pivoted at 9*a* to the cocking lever 8. Thus, when the cocking lever 8 is turned from the position shown in Fig. 5 in solid lines to the position shown fragmentarily in dot-dash lines, the motion transmitting hook member 9 engages the lever 5*a* at the angle portion 5*d* thereof, as shown in Fig. 5, and thus the lever 5*a* is turned in a clockwise direction to the position shown in Fig. 5, this turning of the lever 5*a* compelling the lever 5 to turn in a counterclockwise direction to the position shown in Fig. 5, and the spring 7 thus being compressed.

It will be noted that the lever 8 carries a plug 8*c* which extends into and fills the gap between the breech end of the barrel 4 and the projection 15. This plug 8*c* forms an air-tight seal with the breech end of the barrel when the cocking lever is in its rest position shown in Fig. 5, and the plug 8*c* is formed with a passage 8*d* providing communication between the compression chamber 3*a* and the breech end 4*a* of the barrel 4.

When the lever 8 is in the dot-dash line position shown in Fig. 5, a spring which acts on the pawl member 12 causes the tooth of the latter to engage the tooth 5*f* of the lever 5, so that the pawl member 12, which is pivoted within the housing 6, forms a safety catch which retains the parts in the position shown in Fig. 5 temporarily. Furthermore, the lever 5 has a tooth 5*e* which cooperates with the corner 11*a* of the trigger 11 which is accessible through an opening formed in the housing 6 to the finger of the operator. Thus, cooperation between the trigger 11 and the tooth 5*e* also retains the parts in the position shown in Fig. 5, and it will be noted that a spring is located between and engages the trigger 11 and the lever 5 to urge the latter apart from each other, this spring guaranteeing that the trigger 11 remains in the position shown in Fig. 5 where it is available to the operator for actuation of the gun.

The lever 8 has a downwardly extending projection which extends through a suitable cutout within the housing 6 into engagement with the upper face portion of the lever 12 so as to turn the latter in a counterclockwise direction to the position shown in Fig. 5 when the lever 8 is returned to its rest position shown in solid lines in Fig. 5, and in this way the tooth 12*a* is moved out of engagement with the tooth 5*f*, so that when the lever 8 is returned to its rest position the safety catch is disengaged and the gun is ready to fire. Of course, before the lever 8 is returned a projectile is placed into the barrel through the opening 4*a* thereof. Also, the gun includes a manually operable locking pin 13 which extends over the bottom projection of lever 8 which engages the safety member 12 in order to maintain the lever 8 in the position shown in Fig. 5. This locking member 13 extends through an opening in the front wall of the housing 6 and has a pair of shoulders which may be optionally placed in engagement with the inner face of the housing by the operator. As shown in Fig. 5, a spring urges the locking member 13 outwardly, and it is guided on a projecting portion located within the housing 6 for forward and rearward movement as well as for lateral movement. The spring engages one of these projections in the housing 6 and also engages the pin 13 in the manner shown in Fig. 5. Thus, when it is desired to release the lever 8 for operation the operator need only push the pin 13 in slightly and then push it laterally away from engagement with the lever 8 which is then free to be moved to the dot-dash line position shown in Fig. 5. Then the pin 13 may be returned to the position shown in Fig. 5 after lever 8 is returned to its rest position in order to retain the lever 8 in its rest position.

With the gun thus cocked and with a projectile located in the barrel 4, it is only necessary for the operator to pull the trigger 11 in order to release the lever 5, and in this way the force of the spring 7 acts through the levers 5 and 5*a* on the pistons 1 and 2 to move the latter toward each other, so that in this way air within the compression chamber 3*a* moves through the passage 8*d* into the barrel in order to expel the projectile through the barrel.

It will be noted that the pistons 1 and 2 of Fig. 5 are provided with portions 2*a* at the ends of the slots therein which engage the edges of the levers 5 and 5*a*. Furthermore, it will be noted that the trigger 11 is located behind a portion of the lever 5, in Fig. 5, and that the projection 5*e* of the lever 5 extends from the lever 5 into engagement with the trigger 11.

In the embodiment of the invention which is shown in Fig. 6, the structure is identical with that of Fig. 3 except that instead of a shiftable partition 3*c* the embodiment of Fig. 6 includes a partition which is fixed within the cylinder 3 and which is formed with a bore, as shown in Fig. 6 communicating with the bore 3*b* and the compression chamber 3*a* formed between the permanent partition and the piston 1. Only the piston 1 acts to compress air in the compression chamber 3*a* in the embodiment of Fig. 6. The piston 2 acts only as a balance in order to prevent recoil. For this purpose the piston 2 is formed with a thickened head end so that it has the same weight as the piston 1, and it will be noted that the head end of the piston 2 in the embodiment of Fig. 6 is formed with a relatively large opening so that no air is compressed by the piston 2.

It will be noted that with the above described structure of the invention although a pair of pistons move in opposite directions with respect to each other and at the same speeds the structure for controlling the release of the pistons and the cocking of the air gun operates on only one of the pistons rather than on both of them. The piston which is not acted upon by the cocking and releasing structure is maintained in its proper position by its connection to the piston which is acted upon by the cocking and releasing structure.

Although particular structures have been described above, it is possible instead of using a pair of pistons to use a pair of groups of pistons, and instead of operating with gear sectors or with racks and pinions, it is possible to use scissors-type linkages, bell crank linkages, cables and pulleys, or sprocket wheels and sprocket chains, or the like. Also, instead of using pistons which cooperate with compression chambers located outside of the pistons, it is possible to use with the structure of the invention pistons which have the compression chamber in themselves, and this latter type of arrangement has the advantage of an exceedingly small passage between the barrel and compression chamber. This is true for fixed barrels as well as tiltable barrels.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of air guns differing from the types described above.

While the invention has been illustrated and described as embodied in recoilless air guns, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In an air gun, in combination, a cylinder; a pair of pistons slidable in a direction inwardly toward and in a direction outwardly away with respect to each other in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; separate actuating means for each piston jointly effective to permanently urge said pistons in one of said directions; and synchronizing means cooperative with said actuating means and operatively interconnecting said pistons in such a manner that thereby both pistons will move in synchronism at the same speed in their movement in said one of said directions at least during the compression stroke; cocking means cooperating with said synchronizing means for moving said pistons to the end of their respective movements in the other of said directions against the urging of said actuating means and for holding them in said positions; and trigger means operable to release said pistons for movement synchronously in said one of said directions by the action of said

actuating means and said synchronizing means whereby said pistons are adapted to obtain simultaneously the end positions of their movements in said one of said directions.

2. In an air gun, in combination, a cylinder; a pair of pistons slidable inwardly toward and outwardly away with respect to each other in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; separate actuating means for each piston, said means jointly effective to permanently urge said pistons toward each other; synchronizing means cooperative with said actuating means and operatively interconnecting said pistons in such a manner that movement imparted to one piston will produce equal simultaneous movement of the other piston thereby moving both pistons in synchronism at all times; cocking means cooperating with said synchronizing means for moving said pistons to the end positions of their respective outward movements away from each other against the urging of said actuating means and for holding them in said positions; and trigger means operable to release said pistons for movement synchronously toward each other by the action of said actuating means and said synchronizing means whereby said pistons are adapted to obtain simultaneously the end positions of their movements toward each other.

3. In an air gun, in combination, a cylinder; a pair of pistons slidable inwardly toward and outwardly away with respect to each other in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber, said cylinder having between said pistons a partition which forms a compression chamber with said one piston and the other of said pistons having a head end formed with a relatively large bore passing therethrough so that said other piston is incapable of compressing a fluid and acts only as a balancing weight; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; a pair of elements engaging said pistons for movements therewith and for moving the same towards each other; and synchronizing means operatively interengaging with both said elements, providing positively acting operative interconnection between said elements at least during the compression stroke in such a manner that both pistons will move at the same speed during the compression stroke and will simultaneously attain the end positions of their movements toward each other.

4. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and defining between themselves a compression chamber in said cylinder; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber; synchronizing gear means operatively interconnecting said pistons in such a manner that movement imparted to one piston will produce equal simultaneous movement of the other piston thereby moving both pistons in synchronism at all times and in both directions.

5. In an air gun, in combination, a cylinder; a pair of pistons slidable inwardly toward and outwardly away with respect to each other in said cylinder and defining between themselves a compression chamber in said cylinder; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber; separate actuating means for each piston jointly effective to permanently urge said pistons toward each other; synchronizing means cooperative with said actuating means and operatively interconnecting said pistons in such a manner that thereby both pistons will move in synchronism at the same speed in their movement toward each other during the compression stroke; cocking means cooperating with said synchronizing means for moving said pistons to the end positions of their respective outward movements away from each other against the urging of said actuating means including a safety catch member spring urged to engage said synchronizing means for holding the pistons in said outward end positions; a breech closure member movable between breech closing and breech opening positions as well as toward and away from said safety catch member, said breech closure member being adapted when in breech closing position to disengage said catch member from said synchronizing means; and trigger means operable to release said pistons for movement synchronously toward each other by the reaction of said actuating means whereby said pistons are adapted to attain simultaneously the end positions of their movement toward each other.

6. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and defining between themselves a compression chamber in said cylinder; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber; means operatively connected to said pistons for compelling the same to move at equal speeds and in opposite directions; and a partition shiftable in said cylinder between said pistons and formed with passages communicating with said barrel adjacent said breech end thereof and with the spaces in said cylinder on opposite sides of said partition, so that the location of said partition in said cylinder is determined by said pistons.

7. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and defining between themselves a compression chamber in said cylinder; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber; means operatively connected to said pistons for compelling the same to move at equal speeds and in opposite directions; a partition shiftable in said cylinder between said pistons and formed with passages communicating with said barrel adjacent said breech end thereof and with the spaces in said cylinder on opposite sides of said partition, so that the location of said partition in said cylinder is determined by said pistons; and friction means carried by the periphery of said partition and engaging the inner face of said cylinder for frictionally maintaining said partition in the position to which it is moved by said pistons.

8. In an air gun, in combination, a cylinder; a pair of pistons slidable inwardly toward and outwardly away with respect to each other in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; a pair of elements engaging said pistons for movement therewith and for moving the same towards each other; and synchronizing means operatively interengaging with both said elements, providing positively acting operative interconnection between said elements at all times in such a manner that both pistons will move at equal speeds at all times and will simultaneously attain the end positions of their movements toward each other.

9. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; and means operatively connected to said pistons for compelling the same to move at all times at the same speed and in op-

posite directions, said means comprising a pair of racks fixed to said pistons and a pinion located between and meshing with said racks.

10. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; and means operatively connected to said pistons for compelling the same to move at all times at the same speed and in opposite directions, said means comprising a pair of levers engaging said pistons, respectively, for movement therewith and for moving the same towards each other, and a pair of gear sectors fixed to said levers, respectively, and meshing with each other said gear sectors being turnable coaxially with respective levers.

11. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectible out of said barrel; means operatively connected to said pistons for compelling the same to move at all times at the same speed and in opposite directions, said means comprising a pair of levers engaging said pistons, respectively, for movement therewith and for moving the same towards each other, and a pair of gear sectors fixed to said levers, respectively, and meshing with each other, said gear sector being turnable coaxially with respective levers; and spring means engaging said levers for acting through the latter on said pistons for urging the latter toward each other.

12. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; means operatively connected to said pistons for compelling the same to move at all times at the same speed and in opposite directions, said means comprising a pair of racks fixed to said pistons and a pinion located between and meshing with said racks; and spring means in said cylinders engaging said pistons for urging the same toward each other.

13. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; a pair of elements engaging said pistons for movement therewith and for moving the same towards each other; and synchronizing means operatively interengaging with both said elements, providing positively acting operative interconnection between said elements at least during the compression stroke in such a manner that both pistons will move at the same speed during the compression stroke and will simultaneously attain the end positions of their movements toward each other.

14. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; means operatively connected to said pistons for compelling the same to move at all times at the same speed and in opposite directions, said means comprising a pair of racks fixed to said pistons and a pinion located between and meshing with said racks; and means cooperating with only one of said racks for moving said pistons to a starting position where the volume of said compression chamber is largest and for releasing said pistons to move toward each other.

15. In an air gun, in combination, a cylinder; a pair of pistons slidable in said cylinder and at least one of said pistons forming with part of said cylinder a compression chamber; a barrel connected to said cylinder and communicating adjacent its breech end with said compression chamber, so that when said one piston reduces the volume of said compression chamber the air compressed therein will drive a projectile out of said barrel; means operatively connected to said pistons for compelling the same to move at all times at the same speed and in opposite directions, said means comprising a pair of levers engaging said pistons, respectively, for movement therewith and for moving the same towards each other, and a pair of gear sectors fixed to said levers, respectively, and meshing with each other, said gear sectors being turnable coaxially with respective levers; spring means engaging said levers for acting through the latter on said pistons for urging the latter toward each other; and means cooperating with only one of said levers for moving both of said pistons to a position where the compression chamber has its largest volume.

16. In an air gun, in combination, a barrel; an air compression cylinder having communicative connection with said barrel adjacent to the breech end portion thereof; a pair of piston means adapted to be moved toward and away with respect to each other with at least one of said pistons forming with said cylinder a compression chamber, so that when said piston means are moved toward each other, the air compressed between them will drive a projectile out of the barrel, synchronizing means operatively interconnecting said pistons in such a manner that movement imparted to one piston will produce equal simultaneous movement of the other piston so that the pistons will move in synchronism at all times; actuating means for permanently urging said pistons towards each other; cocking means for moving said pistons to the end positions of their respective movements away from each other against the urging of said actuating means; and trigger means operable to release said pistons for moving synchronously towards each other by the action of said actuating and said synchronizing means whereby said pistons are adapted to attain simultaneously the end portion of their movement toward each other.

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