The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

My invention has to do with a new and useful improvement in firearms and is designed to provide a mechanism performing the dual function of supporting that part of the piece moved by the recoil in firing and of so receiving the effect of the force of the recoil as to control the movement of that part. The essential feature of the invention is the utilization of one or more distortable elements, such as torsion bars, capable of supporting the moving part and being so distorted by the force of the recoil causing the movement of the part, as to be tensioned to the desired degree to effect the desired result. Application of my improved mechanism to pieces operating with counter-recoil affords the means for producing the desired form of counter-recoil.

While I have illustrated in the drawings filed herewith and have hereinafter fully described the structure and operations of one specific embodiment of my invention, it is to be distinctly understood that I do not consider my invention to be limited to said specific embodiment, but refer for its scope to the claims appended hereto. In the aforesaid specific embodiment I have shown my improved mechanism applied to a submachine gun, such as the standard caliber .45 M1, having the breech bolt reciprocated in recoil and counter-recoil, but it is obvious that the improved mechanism is equally applicable to any other form of firearm having a part movable by recoil.

In the drawings:
Figure 1 is a longitudinal section of my device, on the line 1—1 of Figure 2.
Figure 2 is a vertical section on the line 2—2 of Figure 1 in the direction of the arrows.
Figure 3 is a fragmentary side elevation of the bolt in the direction of the arrow 3 of Figure 2.
Figure 4 is a vertical section on the line 4—4 of Figure 1 in the direction of the arrows.
Figure 5 is a vertical section on the line 5—5 of Figure 1 in the direction of the arrows.
Figure 6 is a vertical section on the line 6—6 of Figure 1 in the direction of the arrows.
Figure 7 is a view similar to Figure 3 showing a modified form of roller jaws for the torsion bars.
Figure 8 is a vertical section on the line 8—8 of Figure 9, showing a modified form of anchoring means for the torsion bars.
Figure 9 is a vertical section on the line 9—9 of Figure 8 in the direction of the arrows.

As illustrated in the drawing, my improved firearm is provided with a receiver 1 having a rear end wall 2, and to the forward end of which a barrel sleeve 3 has been secured in any suitable way. A barrel 4 is threadedly engaged with the internally threaded sleeve 3 by the externally threaded barrel bushing 8. The receiver 1 serves as a housing for the bolt assembly which comprises the breech bolt 6 formed with an integral firing pin 7. A pair of bores 8 is provided through the bolt 6 parallel to its longitudinal axis. Received in each bore 8 is a torsion bar 9. The rear ends of the bars 9 are non-rotatably mounted in a plate 10 provided with slots 11 through which pass the flattened end portions 12 of bars 9. Shoulders 13 are provided on bars 9 to bear against plate 10 when it is seated against the rear end wall 2 of retainer 1, and a pin 14 is provided on the end of each bar 9. The pins 14 are received through holes 15 in the wall 2, to correctly position the rods 16 in receiver 1. The forward ends of the bars 9 are rotatably journaled in a plate 12 having keys 12a received in keyways 12b in barrel sleeve 3, and bearings 12b in which are received the reduced cylindrical portions 12c of bars 9. The spring rollers pass forwardly of the plate 12 where they have peripheral grooves 16. The enlarged cylindrical portion 17 of each bar 9 rearwardly of the plate 12 provides a shoulder 18 and a spring clip 13 seated in grooves 19 serves to confine the plate 12 loosely against the shoulders 18. The forward extending ends of portions 16 of rods 9 are received in an internal channel 5a of bushing 5, and when bushing 5 has been properly engaged with sleeve 3 its inner end 5b is seated against the forward face 12c of plate 12.

The bolt 6 is provided with a suitably disposed and configured transverse bore 14 in which is received a block 15 in which are journaled two pairs of jaw rollers 16. The block 15 may be movably mounted in bore 14 and staked in position by countersunk screws 15a threaded commonly in the meeting faces of the bolt 6 and block 15. The rollers 16 have their pintles 16a journaled in the block 15 so as to dispose the surfaces of the rollers 16 of each pair sufficiently relatively spaced to contact the opposite faces, respectively, of the flattened portion 16b of the bars 9. As illustrated in Figures 2 and 3, the rollers 16 are so mounted in block 15 that their longitudinal axes lie in the same plane which is parallel to the sides of the block 15. In Figure 7 another arrangement of the rollers is illustrated in which the roller 16b on the near side of bar 9 is inclined rearwardly and the roller 16c on the
far side of bar 9 is inclined forwardly. It is to be understood that the pair of rollers co-acting with the other bar 9 is also inclined but in the reverse relation.

As illustrated in Figure 1, the bolt 6 is disposed forwardly in receiver 1, its firing pin 7 in operative engagement with the percussion cap of the cartridge C in the chamber 17 of barrel 4, the forward end 6a of the bolt 6 containing the rear face of plate 12. When the bolt 6 is in this position, the cylindrical portions 9f of the bars 9 extend through bores 8 in bolt 6 rearwardly from the plate 12 to that portion of the bolt 6 immediately forward of the block 16 carrying the rollers 16, to afford support for the bolt 6. Rearwardly of the plate 10, the cylindrical portions 9f of the flattened portions 9h extend between the rollers 16 and to the rear end portions 8a anchored as above described. As illustrated in Figures 1 and 6, the flattened end portions 8a are disposed substantially horizontally and as illustrated in Figures 1, 5, and 7, the forward ends of the flattened portions 9h passed between the rollers 16 are disposed substantially vertically, causing the flattened portions 9h to have a 90° twist between the plate 10 and the rollers 16. It will be noted (Figure 1) that these twists are oppositely directed.

In Figures 8 and 9 there is illustrated a modified form of anchoring means for the bars 9. In this form, the receiver 101 has a removable rear end wall 102 attached to the receiver 101 by bolts 103. A plate 110 is provided which has a number of bores 111 therein with radial keyways 112, and in which are received, respectively, sockets 114 having radial keys 114a co-acting with keyways 112, and slots 115 to receive therein the flattened ends 9a of the rods 9. The plate 110 has bores 116 in which are received the end portions 9h of the bolts 103 to correctly position rods 9 in receiver 101.

From the foregoing description of the details of construction of my improved firearm its use and operation will be obvious. The parts are assembled by inserting both 9 back to back into the holes 8b in the forward ends of both 8a and passing the flattened portions 9h of bars 9 between the rollers 16 which have been mounted in bolt 6 by mounting block 15 in bore 14. The flattened portions 9a are then inserted in slots 11 of plate 10 care being had that the bar 9 be reversely twisted. The plate 12 is then placed on the forward ends of bars 9, the reduced portions 9d passing into bores 12b and projecting forwardly of the face 12c. The clip 13 is then placed in grooves 9e to lock plate 12 on bars 9. The bolt 6, bars 9 and plates 10 and 12 thus assembled are then inserted into receiver 1 through its open forward end. Plate 10 is seated against rear end wall 2, the pins 9g passing through holes 2a to properly relate the rear ends of bars 9 to the receiver 1, and the keys 114a on plate 12 are received in keyways 11a in sleeve 5 to properly relate the forward ends of bars 9 to the receiver 1. After the parts have been disposed in the receiver 1, the bushing 5 is engaged with sleeve 3, and the parts are in the positions illustrated in Figure 1.

The modified form of anchoring means illustrated in Figures 8 and 9 is used, the degree of the initial twist of the bars 9 can be determined nicely by the adjustment of sockets 113 in bores 111 of plate 110. After the ends 9a have been inserted in slots 115 of the sockets 113, the bars 9 can be twisted to the desired degree by rotation of sockets 113 and when the sockets 113 are placed in bores 111 of plate 110, the keys 114 prevent movement of sockets 113, the bars 9 will be retained under the desired degree of tension. Since the rear end wall 102 of the receiver 101 is removable, the bars 9 and plate 110 can be moved rearwardly to project from the receiver 101, after the plate 12 has been removed from the forward end of bars 9, for any subsequent readjustment of the tension on the bars 9. Also in this form of the device, the assembled bolt 6, rods 9 and plates 12 and 110 can be inserted into the receiver 101 through its opened rear end.

Firing of the cartridge C by the firing pin 7 projects the bullet B through the barrel 4, and the blowback drives the case of the cartridge C rearwardly causing the bolt 6 to travel rearwardly on its supporting bars 9. As the jaw rollers 16 carried by the bolt 6 travel rearwardly over the flattened portions 9h of bars 9, they exert a twisting moment on the bars 9 since the rear ends 9a of the bars 9 are anchored to prevent rotation and the forward ends 9d of bars 9 are journalled to permit rotation. Due to the fact that the initial twists of the bars 9 (Figure 1) are oppositely directed, the respective twisting moments of the pairs of rollers 16 are oppositely directed. This distortion of bars 9 caused by the recoil of bolt 6 builds up the requisite tension to produce the counterrecoil of bolt 6 when the force of the recoil has been spent, and the bolt 6 is returned to battery, as shown in Figure 1. Just as the force of the recoil drives bolt 6 rearwardly and causes the rollers 16 to press upon the bars 9, and twist the bars 9, so the force of the tension of the twisted bars 9 causes the bars 9 to press against the rollers 16 and drive the bolt 6 forwardly in counterrecoil.

With the disposition of rollers 16b and 16c, illustrated in Figure 7, there is a forward component in this action, assisting in driving the bolt 6 to battery.

It is to be understood that the parts are so related than when the bolt 6 has recollected its rearward limit of movement, putting the bars 9 under their maximum tension, the forward end of the bolt 6 is forward of the rear ends 9a of the cylindrical portions 9h of the bars 9, so that, the bolt 6 is constantly supported by the portions 9h in bores 8a at its forward end and by the pressed contact of rollers 16 and portions 9h at its rear end, thus insuring proper reciprocation of bolt 6 in both recoil and counterrecoil.

Having described my invention, what I claim is:

1. In a firearm, a receiver, a bolt reciprocable in said receiver and having a pair of spaced parallel bores parallel to the direction of recoil and counterrecoil of said bolt, first and second torsion rods in said receiver, each passing through a respective one of said bores, each rod comprising a forward cylindrical portion fitting its respective bore, and a rearward, flat portion, means carried by said receiver journaling said rods at their forward end, means at the rear end of said receiver fixing the rear ends of each flat portion against rotation, said rods being initially oppositely stressed in torsion, and two pairs of rollers, journalled in said bolt on spaced parallel axes normal to the direction of recoil and counterrecoil of said bolt, the rollers of each pair being spaced to receive the flat portion of a respective torsion bar between them.

2. An automatic firearm comprising a receiver, a bolt reciprocable in said receiver, there being a pair of spaced bores in said bolt parallel with the direction of recoil and counterrecoil thereof, first and second torsion rods in said receiver, each rod
comprising a forward cylindrical portion having a smooth fit in a respective bore, and a rearward strap portion, means fixed with said receiver journaling the forward ends of said rods, means rigid with said receiver at the rear end of said rods fixing the ends thereof against rotation relatively to said receiver, there being a diametrical bore in the rearward portion of said bolt, a block slidably fitting said bore and having openings through which the strap portion of a respective rod passes, first and second pairs of rollers journal in said block on axes transverse to the direction of recoil and counterrecoil of said bolt, the rollers of said first pair engaging respective flat sides of said first rod and the rollers of said second pair engaging respective flat sides of said second rod, all said rollers lying substantially in a plane transversely of said rods, said strap portions being equally and oppositely twisted between the rear end of said receiver and said rollers, whereby increased torsion in said flat portions is effected in response to rearward translation of said bolt.

RAY K. WINDHAM.

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