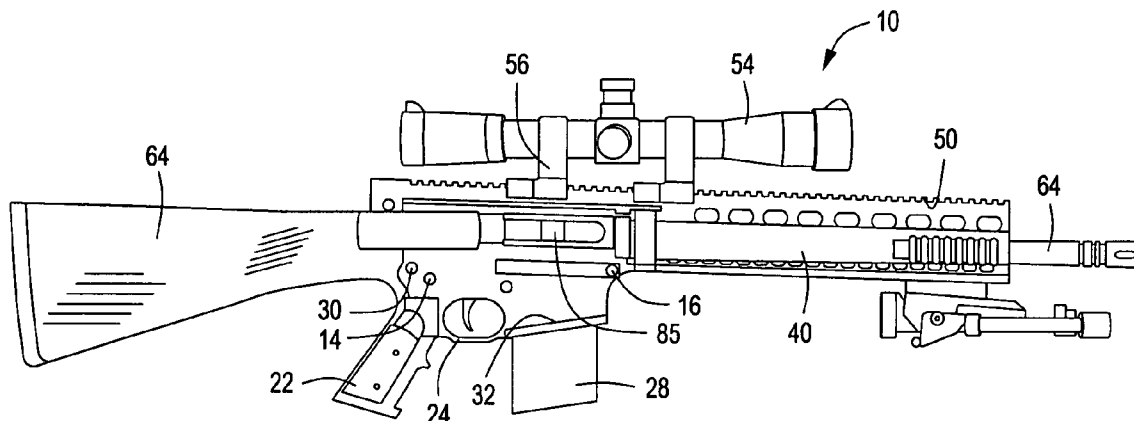




US 20110119981A1

(19) **United States**(12) **Patent Application Publication**
Larue(10) **Pub. No.: US 2011/0119981 A1**(43) **Pub. Date: May 26, 2011**(54) **TACTICAL FIREARM HAVING HEAT
SHIELDING PROPERTIES AND IMPROVED
GAS ENERGIZED CARTRIDGE FEEDING**(76) Inventor: **Mark C. Larue**, Leander, TX (US)(21) Appl. No.: **12/592,245**(22) Filed: **Nov. 20, 2009****Publication Classification**(51) **Int. Cl.**
F41C 23/16 (2006.01)
F41G 1/387 (2006.01)(52) **U.S. Cl.** **42/71.01; 42/125**(57) **ABSTRACT**

A tactical firearm having a receiver and a handguard connected by flanges that are secured by fasteners and each define co-planar rail mounting surfaces. A one-piece elongate sight mounting rail extends along the combined length of the receiver and handguard and has a mounting surface in face to face relation with the rail co-planar rail mounting surfaces of the receiver and handguard. The rail is tapered along its length to provide an angle of cant and to permit mounting sight devices at any desired location along its length. A barrel extends through the handguard and is secured to the receiver in a manner achieving clearance and thermal isolation of the handguard from the barrel and barrel retainer. A cartridge gas energized bolt carrier and bolt mechanism is moveable within the receiver and is provided with anti-tilt guidance with respect to a spring energized buffer mechanism and moves a cartridge from a magazine into the cartridge chamber of the barrel and returns the bolt mechanism to its closed and locked condition upon dissipation of the cartridge gas energizing force.



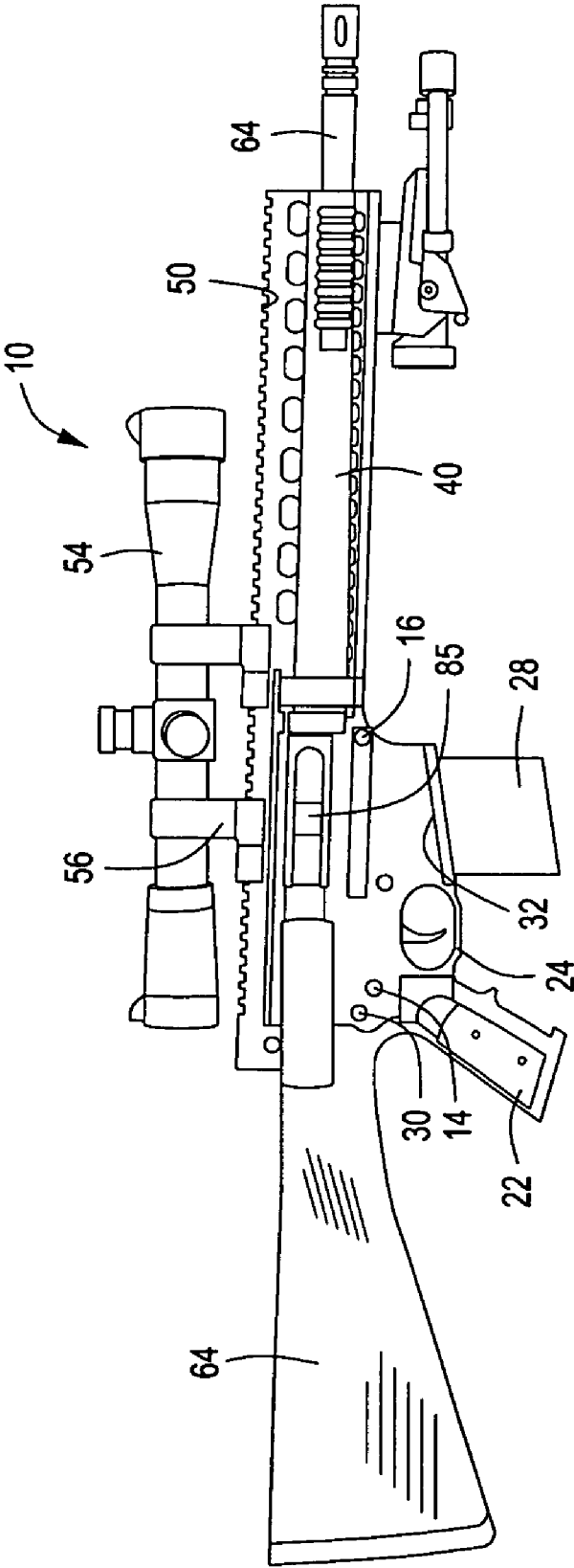


FIG. 1

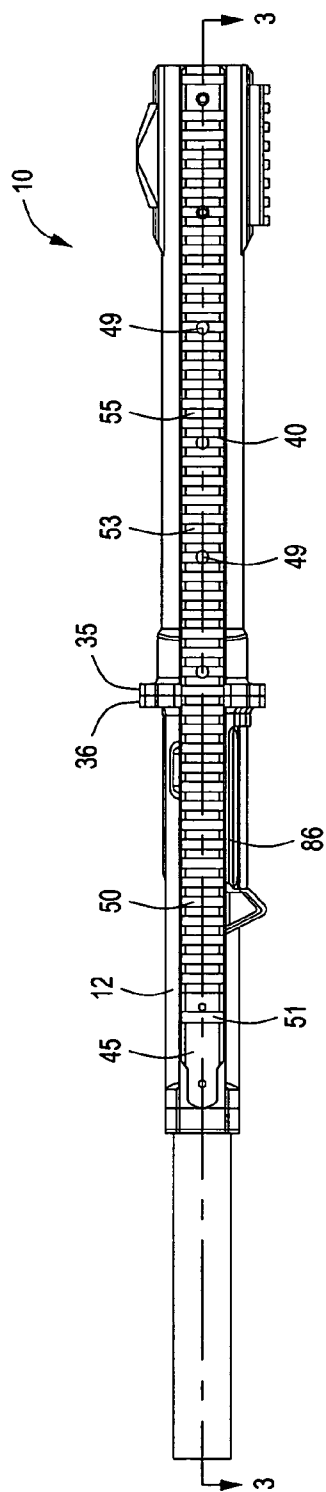


FIG. 2

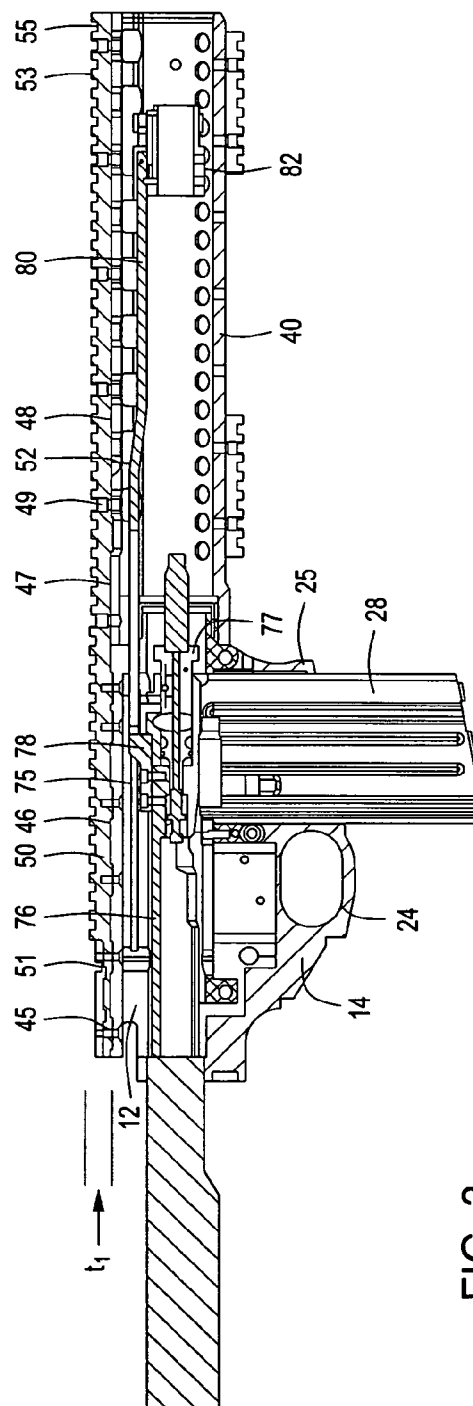


FIG. 3

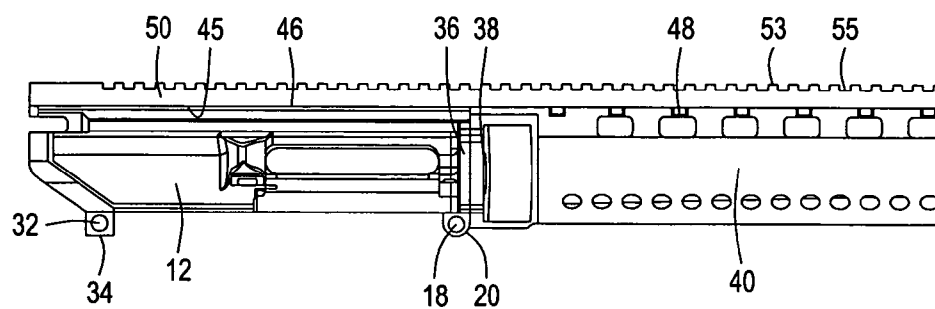


FIG. 4

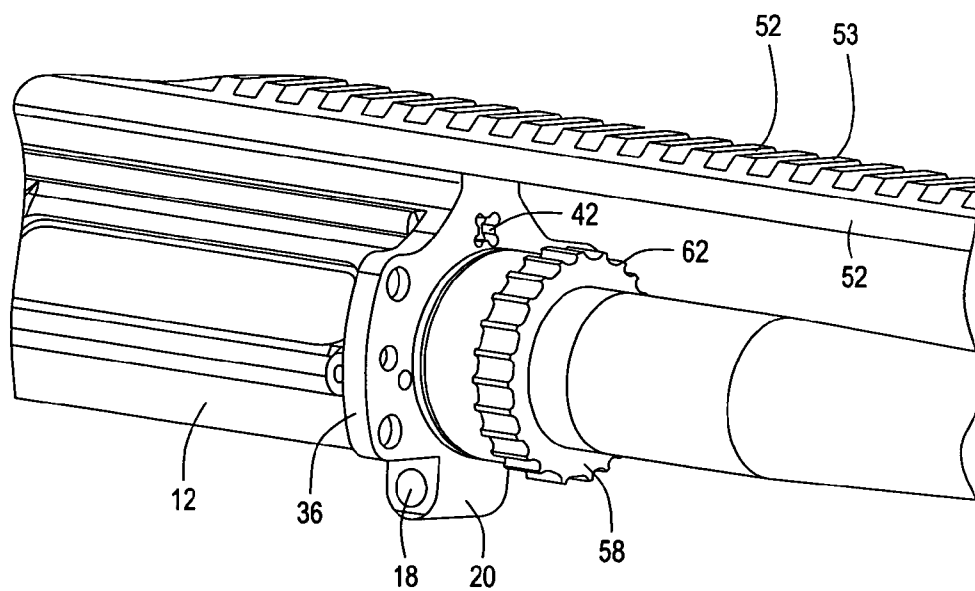


FIG. 5

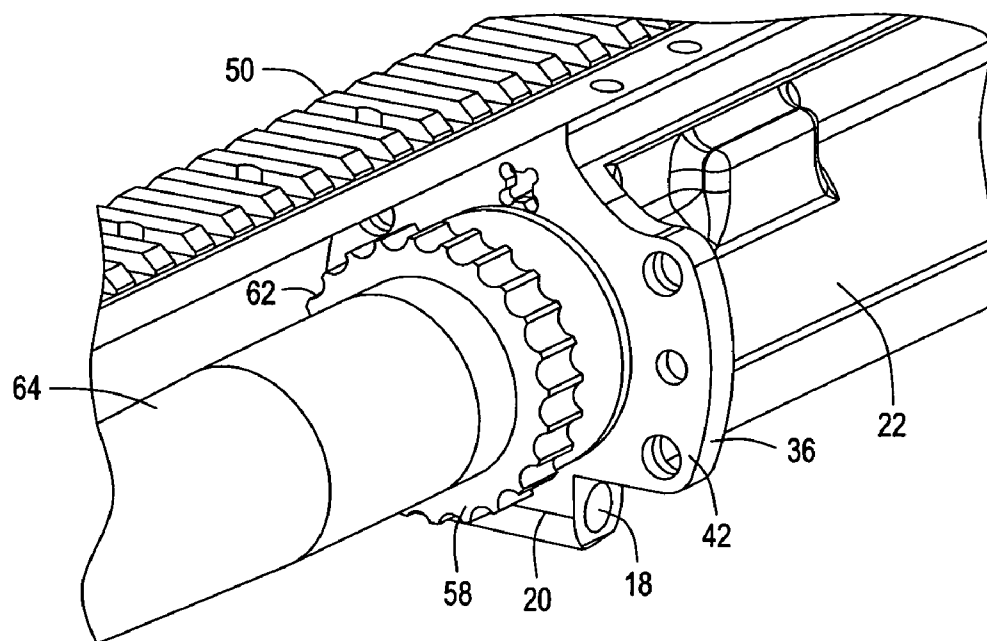


FIG. 6

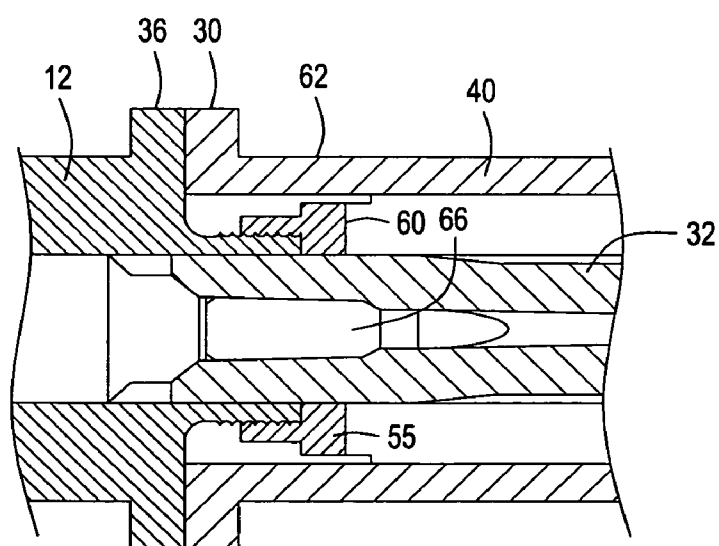


FIG. 7

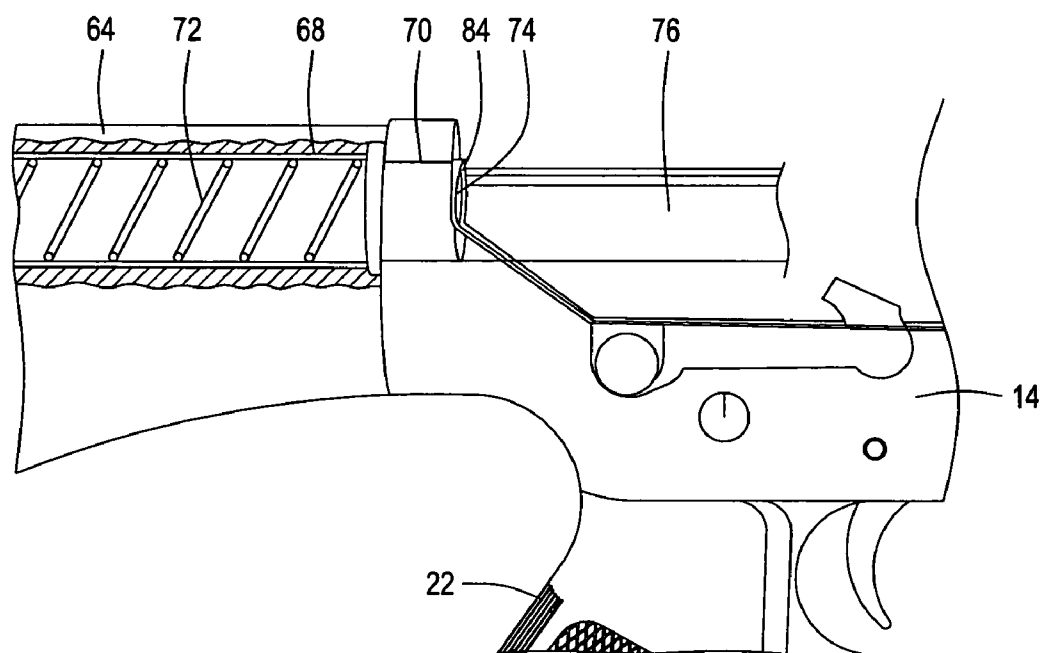


FIG. 8

**TACTICAL FIREARM HAVING HEAT
SHIELDING PROPERTIES AND IMPROVED
GAS ENERGIZED CARTRIDGE FEEDING**

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates generally to firearms and more particularly to semi or full automatic tactical firearms such as rifles. More particularly, the present invention concerns a tactical rifle that may be provided with semiautomatic and full automatic cartridge loading, firing and ejecting capability and is designed specifically for use of a relatively heavy bullet cartridge such as the .308 which has a bullet diameter of 7.62 mm. The present invention also concerns a tactical firearm having heat shielding properties to minimize the transfer of heat from the barrel to the handguard such as during sustained rapid fire activities. Even more specifically the high accuracy tactical firearm of the present invention is designed with a continuous mounting rail having a desired angle of taper or cant to receive pivot actuated locking mounts of the type that is set forth in U.S. Pat. No. 7,272,904 of Mark C. LaRue and to permit the mounts to be located virtually anywhere along the length of the continuous mounting rail.

[0003] 2. Description of the Prior Art:

[0004] During prolonged or sustained rapid fire activities the typically metal handguards of tactical firearms often become heated to the extent that soldiers or law enforcement personnel or shooters in competitive matches need to wear gloves or use other protective devices to provide thermal isolation of the hands from the excessive heat of the handguard. This excessive heating condition is exacerbated by the fact that the handguards of most tactical rifles in use by the U.S. Military and other related services are composed of a light-weight metal such as an aluminum alloy, which is an efficient heat conducting material. Typically in military rifles a barrel nut is employed to secure the barrel of the firearm to the receiver and the handguard defined a large internal barrel chamber, within which the barrel is mounted in free floating relation. The rear end portion of the handguard is retained in supported assembly with the receiver and is in supported heat transferring relation with the outer periphery of the barrel nut. In the event the barrel should become excessively heated, such as during rapid fire and sustained fire activities, the excessive heat build-up in the region of the cartridge chamber of the barrel is typically transferred through the barrel mounting nut to the handguard. The handguard can rapidly become heated to the extent that it can burn and cause pain or injury to the bare hands and arms of a firearm user. It is desirable therefore to provide a novel tactical firearm incorporating the usual barrel nut for releasable free floating barrel mounting but providing for thermal isolation of the handguard from the barrel nut so that heat from the barrel will not be transferred in any substantial extent to the handguard by heat transferring direct metal contact of the handguard with the barrel or barrel support structure.

[0005] For highly accurate shooting activities, such as in the case of long range marksmanship activities and for tactical sniper activities, it has been well known for quite some time that well designed heavier rifle bullets, such as bullets of 7.62 mm and greater have more consistent accuracy in a wider variety of shooting conditions. While 6 mm bullets are known to be quite accurate at short and medium ranges, such as up to 300 meters for example, they are not typically considered particularly desirable for precision long range shooting. At

greater distances, such as distances of 600 to 1000 meters or more the trajectory of smaller diameter bullets tends to become adversely affected by lateral wind conditions and wind resistance to a greater extent as compared with larger diameter heavier bullets. During tactical conditions of firearm use, however, a greater number of the smaller diameter and lighter weight cartridges can be more efficiently carried by the average soldier, which provides the advantage of greater firing rate during tactical operations. It is desirable therefore to provide a novel tactical firearm that is designed for long range highly accurate shooting activity such as when the firearm is being used during long range match shooting activities or is being used during sniper activities by military or law enforcement personnel.

[0006] During the rapid fire use of virtually all firearms combustion of the propellant of cartridges causes the development of considerable heat which causes heating of the barrel, especially in the region of the firing chamber and causes heating of the receiver to some extent. If the firearm is provided with a heat conducting handguard, which is typical of tactical firearms, the handguard can become heated to the extent that it can be painful to touch or hold it with the hands of the user. This condition is especially prevalent when a tactical firearm is used during rapid firing conditions. The M-16 and M-14 tactical rifles employ barrel nuts that are tightened to secure the barrel in removable relation with the receiver of the firearm. The metal handguard is typically a two piece unit that is composed of an aluminum alloy and is mounted in contact with and thus in heat transferring relation with the barrel nut. Forwardly of the barrel nut the barrel is for the most part free floating and it often becomes heated during rapid fire conditions so that it is too hot to touch. Excessive heat buildup of the barrel of typical tactical firearms during rapid fire conditions is directly transferred through the barrel nut to the handguard and causes excessive heating of the handguard. It is desirable therefore to provide a tactical firearm employing a barrel nut to releasably secure a barrel to the receiver and to provide the firearm with a handguard that is isolated from direct heat transferring relation with the barrel and barrel nut, thus permitting a user to easily hold the handguard of the firearm even during conditions of rapid firing without encountering conditions of excessive heat.

[0007] Tactical rifles, such as the M-16 and M-14 of the United States Armed forces, each incorporate a spring loaded bolt that is moved rearwardly against a spring force acting on the bolt responsive to rifle firing by cartridge gas pressure that is communicated to the bolt from the barrel via a barrel port and gas tube after a bullet moving within the barrel bore has cleared the barrel port. The rear portion of the bolt is typically unsupported as the bolt is moved rearwardly to engagement with the buffer member by the force of cartridge gas pressure. After having contacted the buffer member the bolt enters the buffer chamber and causes cushioning movement of a buffer member against the force of a buffer spring. At times, especially during conditions of rapid fire, the rear portion of the bolt can become misaligned or tilted with respect to the opening of the buffer receptacle during its rearward movement. This misalignment or tilting of the bolt mechanism can retard bolt movement and/or cause failure of the cartridge case extractor of the bolt mechanism to properly extract a spent cartridge case from the firing chamber and eject it from the ejector opening of the receiver of the firearm. When this undesired condition occurs the spent cartridge case, being

improperly extracted and ejected, can become jammed or otherwise interfere with bolt movement as the bolt is subsequently moved forwardly by the force of the buffer spring. This condition will cause failure of the bolt mechanism to properly feed a fresh cartridge from the magazine of the firearm and can require time consuming manual adjustment of the cartridge feeding mechanism of the firearm to restore it to proper operating condition. Most importantly, this cartridge extracting, ejecting and feeding can jeopardize the safety of personnel if it should occur during tactical conditions. It is desirable therefore to provide a novel tactical firearm mechanism incorporating an anti-tilt characteristic that ensure precise and efficient guiding of the bolt carrier and bolt mechanism during all stages of its rearward gas energized movement and its forward spring energized movement during firearm use to thus ensure efficient cartridge case auto-ejection and fresh cartridge feeding during all stages of mechanical activity as the firearm is operated either during conditions of slow fire or sustained rapid fire.

[0008] M-16 and M-14 tactical rifles and similar rifles, such as the AR-15 semi-automatic rifle, typically incorporate a handguard that is secured to the receiver of the firearm by means of a handguard retainer nut that is typically tightened manually. At times the handguard retainer nut is locked in place after it has been tightened. While this manner of receiver/handguard attachment is typically desirable for lightweight, small bore tactical rifles and permits disassembly of the handguard from the receiver, even in field conditions, for a heavier bore and highly accurate long range rifle, the stability and structural integrity of the mechanism that joins the handguard to the receiver mechanism is considered paramount. The accuracy of the rifle can be adversely affected if the receiver/handguard connection results in a somewhat flexible assembly. Accordingly, it is considered desirable to provide a firearm having a connection joint between the receiver and the handguard that has enhanced structural integrity thus resulting in a quite rigid firearm structure which materially enhances the accuracy of the firearm.

[0009] Many tactical rifles are provided with sight mounting rails, such as the Picatinny rail, for example, with a section of a sight mounting rail located on the receiver and with another section of sight mounting rail located on the handguard. Lateral and bottom mounting rails of similar design are typically mounted on the handguard so that various accessories, such as white or ultraviolet lights can be mounted to the firearm to aid firearm sighting by the user during various conditions of light. Since a handguard is typically mounted to the receiver by means of a handguard retainer nut and nut locking mechanism, it is not practical to mount sighting devices on the rail of the handguard since the handguard is typically a free floating device and its position can vary with respect to the receiver and barrel of the firearm. Rather, sighting devices are typically mounted to the rail of the receiver since the receiver and barrel are secured in immovable assembly. It is desirable, however, to provide a firearm with a sight mounting rail system that is arranged to permit location of a sighting device at any desired location along the combined length of the receiver and handguard. It is also desirable to provide a sight mounting rail system that permits two or more sighting devices to be mounted in series along the combined length of the receiver and handguard and also permits a mechanical sighting device to be mounted to the rear

portion receiver and to be used for sighting when the optical sighting devices have been removed from the mounting rail.

SUMMARY OF THE INVENTION:

[0010] It is a principal feature of the present invention to provide a novel tactical firearm having a handguard that is mounted to the receiver in such manner that the handguard is substantially isolated from the barrel and barrel retainer nut of the firearm from the standpoint of thermal conductivity, thus preventing excessive heating of the handguard even during conditions of sustained rapid fire so that the firearm can be efficiently utilized by personnel.

[0011] It is another feature of the present invention to provide a novel tactical firearm mechanism that permits the barrel of the firearm to be substantially free floating within and substantially along the entire length of the handguard and to maintain the handguard in spaced and thermally isolated relation with the barrel to protect the user from the excessive heat that typically builds up during rapid firing conditions.

[0012] It is also a feature of the present invention to provide a novel tactical firearm mechanism that provides the reciprocating bolt carrier and bolt of a semi-automatic or full automatic tactical rifle with efficient guiding during the entirety of its rearward and forward auto-loading movement, thus preventing misalignment or tilting of the bolt during its rearward movement;

[0013] It is another feature of the present invention to provide a novel auto-loading tactical firearm that ensures proper cartridge case extraction and ejection during rearward movement of the bolt carrier and bolt thereof and facilitating efficient cartridge loading during forward movement and also minimizing the potential for cartridge mis-feeding.

[0014] It is an even further feature of the present invention to provide a novel tactical firearm having a handguard and receiver that are joined in a manner that lends significant structural integrity and rigidity to the assembly of the receiver and handguard which contributes significantly to the accuracy of the firearm.

[0015] It is another feature of the present invention to provide a novel tactical firearm that is designed with an elongated sight mounting rail such as a Picatinny rail and wherein the rail extends substantially the entire length of the combined receiver and handguard and is provided with a predetermined angle of tilt or cant to facilitate the mounting of a sight at any selected location along the length of the mounting rail. The elongate sight mounting rail is also designed to facilitate the mounting of a conventional mechanical sighting device, typically referred to as an "iron sight" for use of the firearm when optical sights are not present on the sight mounting rail.

[0016] It is another feature of the present invention to provide a novel tactical firearm having a sight mounting rail system that permits two or more sighting devices to be mounted in series along the combined length of the receiver and handguard.

[0017] Briefly, the various objects and features of the present invention are realized by providing a tactical firearm having a receiver and handguard that are connected by mounting flanges that are secured in surface to surface engagement by a plurality of retainers to provide a receiver and handguard assembly of enhanced structural integrity. A single upper sight mounting rail having a length substantially equal to the combined length of the receiver and handguard of the tactical rifle is fixed to both the receiver and handguard. The single

upper mounting rail further enhances the structural integrity of the flange connection of the receiver and handguard and has an angular cant of a desired angle that permits one or more sighting devices to be mounted at any suitable location along the length of the single upper mounting rail. A desired angular cant of 20 minutes of angle has been found desirable for a tactical rifle representing a preferred embodiment of the present invention. However, it is to be understood that the present invention is not intended to be limited by a cant of 20 minutes of angle, it being within the spirit and scope of the present invention to provide the single sight mounting rail with any other desired angle of cant. The sight mounting rail is provided with a desired exterior profile, such as the cross-sectional profile of a Picatinny rail for example, to permit lever actuated cam energized rail clamping mechanisms to be releasably attached thereto so that sighting devices can be removed and replaced without loss of zero. A preferred lever actuated cam energized rail clamping mechanism for this purpose is constructed according to the teachings of U.S. Pat. No. 7,272,904 of Mark C. LaRue. Additionally, the rear portion of the single mounting rail defines a rail seat for a rear mechanical sighting device, typically referred to as an "iron sight" which is typically adjustable for windage and elevation and can be used for mechanical sighting when the optical, laser or other sighting devices have been removed from the mounting rail.

[0018] Bolt or bolt carrier tilting takes place because the rear portion of a conventional bolt mechanism is typically unsupported during its gas energized rearward movement responsive to the sudden rearward movement that occurs as a cartridge is fired. This tilting or misalignment causes the bolt mechanism to come into contact with structure surrounding the inlet opening of a buffer mechanism, causing jarring or jamming of the bolt mechanism so that the cartridge case of the cartridge that has been fired will often fail to be properly extracted and ejected. In response to the force of a buffer spring that has been loaded during rearward movement of the bolt mechanism, as the bolt mechanism begins to be moved forwardly the improperly extracted and ejected cartridge case will often interfere with the capability of the bolt to remove a fresh cartridge from the cartridge magazine and charge the fresh cartridge into the cartridge chamber of the barrel and cause locking movement of the bolt. This condition typically results in a jam that prevents further operation of the firearm until the jam has been cleared.

[0019] According to the principles of the present invention firearm jamming due to bolt tilting during firing is largely eliminated by ensuring that the bolt carrier and bolt mechanism are guided and prevented from becoming tilted during all phases of bolt and bolt carrier movement. A buffer housing is located within a portion of the buttstock of the tactical rifle and contains a tubular buffer member that is urged forwardly toward a stop member by a buffer spring. Within the receiver of the firearm is provided a bolt and bolt carrier assembly that are moved rearwardly by cartridge gas pressure and are moved forwardly by the force of a compressed buffer spring. The bolt carrier has a rear end portion that is positioned in guided relation with a guide member located within the inlet opening of the buffer opening of the buffer housing. When the bolt carrier and bolt are in closed and locked relation within the receiver the rear end portion of the bolt carrier member is in engagement with the guide member. This causes the bolt carrier to be guided during all phases of its forward and rearward movement by the internal guide member within the

inlet portion of the buffer housing so that the bolt carrier member cannot become tilted or in any way misaligned with respect to the inlet opening of the buffer housing. This anti-tilt bolt guiding structure is a positive co-axial bolt carrier alignment system that ensures accurate guided positioning of the bolt assembly at all stages of its travel. The bolt tilt problem that typically plagues the cartridge case ejection and cartridge feeding activity of many tactical firearms is overcome by the alignment and guiding activity of the positive co-axial bolt carrier alignment system of the tactical firearm of the present invention. Since no bolt tilting can occur during rearward gas energized movement of the bolt mechanism the cartridge case extraction and fresh cartridge feeding activity of the tactical firearm, the bolt alignment and guiding system ensures against cartridge jamming that can result from bolt tilting.

[0020] The barrel of the tactical firearm is mounted in immovable but releasable relation with respect to the receiver by a barrel nut that is in threaded engagement with a threaded barrel retainer extension of the receiver. When tightened by a barrel nut wrench the barrel nut causes forcible engagement of an annular rib or flange of the barrel with the circular end surface of the barrel retainer extension. The handguard is composed of a metal such as an aluminum alloy that is chosen for its light weight characteristics. Unfortunately this light weight metal is also capable of efficiently conducting heat. The handguard defines a central chamber within which the barrel is free floating. The forward end of the handguard is positioned about and in spaced and thermally isolating relation with the barrel nut so that the space between the handguard and the barrel nut prevents rapid transfer of heat from the barrel of heat from the barrel through the barrel nut to the handguard. Since the barrel nut is quickly heated by heat transfer from the barrel due to the firing of cartridges within the cartridge chamber of the barrel, the spaced relation of the handguard about the barrel nut prevents the handguard from being excessive heat such as would occur if the handguard were in metal to metal thermal transferring contact with the barrel. This heat shielding or thermal isolating feature permits a user of the firearm to efficiently grip the handguard and handle the firearm, even during conditions of sustained rapid fire, without experiencing any discomfort that might otherwise be caused by touching an excessively heated firearm component.

[0021] The lower receiver portion of the tactical firearm of the present invention is provided with a magazine receptacle within which is received a replaceable spring loaded magazine containing a number of cartridges that are positioned to be individually moved from the magazine into the cartridge chamber of the barrel as the bolt mechanism is moved from its rearmost position forwardly by the force of the buffer spring. Ease of cartridge movement from the magazine occurs due to the presence of internal guide bosses that establish minimal metal to metal contact with the case of the leading cartridge and thus minimize the frictional resistance to cartridge movement as the moving bolt mechanism is moved forwardly by the force of the buffer spring.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0022] So that the manner in which the above recited features, advantages and objects of the present invention are attained and can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to the preferred embodiment thereof

which is illustrated in the appended drawings, which drawings are incorporated as a part hereof.

[0023] It is to be noted however, that the appended drawings illustrate only a typical embodiment of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

In the Drawings:

[0024] FIG. 1 is an elevational view showing a tactical firearm embodying the principles of the present invention;

[0025] FIG. 2 is a top plan view showing the flange mounted upper receiver and handguard of the firearm of FIG. 1 and further showing the elongate one-piece sight mounting rail thereof being mounted to the upper receiver and handguard of the firearm;

[0026] FIG. 3 is a sectional view taken along line 3-3 of FIG. 2 and showing further details of the firearm mechanism of FIGS. 1 and 2;

[0027] FIG. 4 is a side elevation view showing the flange mounted upper receiver and handguard of the firearm of FIG. 1 and also showing the relation of the one-piece sight mounting rail to the upper receiver and handguard;

[0028] FIG. 5 is an isometric illustration showing the mounting flange of the upper receiver in detail and further showing mounting of the barrel of the firearm to the upper receiver;

[0029] FIG. 6 is another isometric illustration showing the mounting flange of the upper receiver from another point of view and also showing the barrel and barrel mount nut of the firearm;

[0030] FIG. 7 is a fragmentary sectional view showing the flanged mounting of the upper receiver and handguard illustrating the thermal isolation of the handguard from the barrel retainer nut of the firearm; and

[0031] FIG. 8 is a partial side elevational view showing portions of the upper receiver, lower receiver and buttstock and illustrating the bolt anti-tilt mechanism of the firearm.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0032] Referring now to the drawings and first to the elevational view of FIG. 1, there is shown a tactical firearm generally at 10 embodying the principles of the present invention. The firearm 10, is preferably in the form of a tactical rifle of relatively heavy bore, such as being chambered for the 7.62 mm United States Military cartridge, also referred to as the .308 caliber rifle cartridge. However, it should be borne in mind that the present invention is applicable to firearms of both lighter and heavier bore without departing from the spirit and scope of the invention. For purposes of simplicity, though the scope of this invention encompasses a wide range of firearm devices, the invention is referred to herein as a tactical rifle.

[0033] The tactical rifle 10 incorporates an upper receiver 12 to which a lower receiver 14 is pivotally mounted by means of a pivot pin 16 which extends through corresponding pivot openings of the lower receiver 14 and a pivot opening 18 of a downwardly extending pivot projection 20 of the upper receiver 12. The pivot pin 16 permits the relative pivotal movement of the upper and lower receivers so that the breach of the firearm can be exposed for cleaning, servicing or for field maintenance as needed. The lower receiver 14 is provided with a handgrip 22, a trigger guard 24 and a magazine

receptacle 26. A cartridge containing magazine 28 is received by the magazine receptacle and is secured in place by a magazine catch. The magazine maintains the first of a number of cartridges in position to be fed from the magazine and into the firing chamber of the rifle barrel as the bolt mechanism of the rifle is moved forwardly. The closed and locked position of the lower receiver with respect to the upper receiver is shown in FIG. 1 and is achieved by a locking pin 30 which is moveable to a locking position in engagement within the locking opening 32 of a locking lug 34 that projects downwardly from the rear portion of the upper receiver 12 as shown in FIG. 2.

[0034] It is desirable from the standpoint of the present invention to provide the tactical rifle with a receiver and handguard assembly having considerable structural integrity so that the handguard and receiver are immovable one relative to the other. This feature is important to promote the efficient long range firing characteristics of the rifle and to permit the location of sighting devices at any selected location along the combined length of the receiver and handguard. This feature is accomplished by a first mounting flange 36 which is located at the front end of the upper receiver 12 and by a second mounting flange 38 that is provided at the rear end of a handguard member 40. The mounting flanges 36 and 38 each define planar surfaces such as shown at 42 in FIGS. 5 and 6 which are disposed in surface to surface engagement when the handguard is secured in tight assembly with the upper receiver. The second mounting flange 38 of the handguard is provided with a plurality of internally threaded retainer openings which are in registry with a like number of retainer openings 44 of the mounting flange 36 of the upper receiver 12. Fastener members, such as Allen screws or any other suitable fasteners, are threaded into place and secure the first and second mounting flanges 36 and 38 in immovable assembly. Alternatively, if desired a plurality of bolt and nut assemblies may be employed to secure the mounting flanges to one another. After the mounting flanges have been secured in this manner the resulting elongated structure of the upper receiver and handguard constitute an elongated essentially rigid unitary rifle component having a length that is essentially defined by the combined length of the upper receiver 12 and handguard 40.

[0035] As is evident in the sectional view of FIG. 3 and the elevation view of FIG. 4 the upper receiver 12 defines an upper generally planar rail mounting surface 46 and the upper portion of the handguard 40 defines an upper generally planar rail mounting surface 48. When the handguard is secured to the upper receiver 12 by the flange assembly as discussed above, the substantially planar surfaces 46 and 48 are disposed in co-planar relation, thus essentially defining an elongate rail mounting surface having a length that is substantially equal to the combined length of the upper receiver and handguard. An elongate one piece sight mounting rail 50, which may be designed with a cross-sectional geometry in the form of a conventional Picatinny rail, is secured with its lower surface 52 in surface to surface supported engagement with an elongate rail mounting surface 47 that is defined by the co-planar surfaces 46 and 48 of the receiver and handguard. A plurality of retainer members 49 such as Allen screws extend through openings of the elongate one piece sight mounting rail and are threaded into threaded openings of the upper receiver and handguard. The elongate one piece sight mounting rail 50 is of sufficient length to extend substantially the entirety of the flange secured upper receiver 12 and hand-

guard **40** and has sufficient structural integrity to significantly enhance the structural integrity of the assembled upper receiver and handguard unit of the tactical rifle. This feature provides the tactical firearm with considerable strength and resistance to bending or other mechanical distortion, thus enhancing the accuracy of the rifle and making it suitable for long range highly accurate shooting. The elongate one piece sight mounting rail **50** has a plurality of evenly spaced lands **53** and sight location grooves **55** along the length thereof, with the sight location grooves each defining groove bottom surfaces that are preferably located in a common plane having the taper or cant of the rail, though the bottom surfaces of the grooves may be otherwise located without departing from the spirit and scope of the present invention.

[0036] As is mentioned above, it is desirable to provide for mounting of one or more sighting devices at any selected location along the combined length of the upper receiver and handguard. This feature is accomplished by the one-piece sight mounting rail **50**. A single optical sighting device **54** is shown to be mounted to the single sight mounting rail by means of lever actuated releasable clamp releasable clamp mechanisms **56** that are constructed according to the principles set forth in U.S. Pat. No. 7,272,904 of Mark C. LaRue, which patent is incorporated herein by reference for all purposes. It is not intended however to restrict the use of the one-piece sight mounting rail to sight mounts having releasable lever actuated clamp mechanisms since any suitable sight mounting devices may be employed for sight mounting without departing from the spirit and scope of the present invention. The one-piece sight mounting rail **50** is gradually tapered from end to end so that the rear end thereof is of greater thickness dimension as compared with the thickness dimension of the front end portion. This feature is evidenced by the relative spacing of front and rear extended thickness lines shown at t_1 and t_2 in FIG. 3. Though any desired taper of the one-piece sight mounting rail may be employed, for purposes of the preferred embodiment of the present invention the taper or cant that is employed is 20 minutes of angle. Thus, the one-piece sight mounting rail **50** defines an elongate sight mounting structure that is inclined at 20 minutes of angle with respect to the center-line of the bore of the barrel. This feature, together with the considerable unbroken length of the one-piece sight mounting rail permits the mounting of optical sighting devices at any desired location along the combined length of the upper receiver **12** and handguard **40** of the firearm. A rear portion of the one-piece sight mounting rail defines a generally planar surface **45** having a desired elevation for properly positioning a mechanical sighting device, typically referred to as an "iron sight" to enable manual sighting of the firearm when the optical, laser or other sighting devices have been removed from the rail. The mechanical sight mount surface **45** may have an elevation that is lower or higher as compared with the elevation of the lands **53** so that an iron sight mounted thereto will have a proper elevation for manual sighting with respect to a conventional blade type front sight (not shown). The mechanical sight mount seat or platform **45** defines sight location key slot **51**, shown in FIGS. 2 and 3, shown in FIGS. 2 and 3, within which the location key of the iron sight mechanism is received. The mechanical sight mount seat or platform **45** has an elevation that is substantially equal to the elevation of the positioning groove bottom surfaces of the elongate sight mounting rail **50**. Thus, when the optical and other sighting devices have been removed from the sight mounting rail **50** a mechanical or iron sighting

device may be mounted to the mechanical sight mount seat or platform **45** and may be employed for manual sighting of the firearm.

[0037] As mentioned above, when auto-loading tactical firearms are used during rapid fire, especially sustained rapid fire the heat that builds up in the barrel **64**, especially in the region of the cartridge chamber **66** and barrel retainer nut is typically conducted to the handguard due to the contact of the handguard with the barrel retainer nut. Especially since the handguard is typically composed of a lightweight metal such as an aluminum alloy, the handguard can rapidly become excessively heated so that it can be painful to grip with the bare hands of the user. Often times a user of this type of firearm will wear thermal insulating gloves or use a thick cloth or some other protective device to ensure that the user can continue to grip the handguard even when the handguard has become too hot to manually handle. To overcome this undesirable condition the rigid connection that is established by the retained mounting flanges **36** and **38** positions the inside surface **60** of the handguard in spaced and thermally isolated relation with the outer periphery **62** of the barrel nut **58** as shown in FIG. 7. The clearance or annular gap that separates the outer periphery **62** of the barrel nut from the inner surface **60** of the handguard serves as thermal isolation which minimizes heat transfer to the handguard **40**. Thus, the handguard will be protected from excessive heating so that a user can comfortably handle the firearm during all conditions of firing.

[0038] As mentioned above the rear portion of the bolt and bolt carrier assembly of a tactical rifle is typically unsupported during its rearward movement against the buffer and buffer spring that are located in a buffer receptacle within the buttstock of the firearm. For this reason the bolt carrier can be shifted laterally, typically downwardly due to its weight, and can become tilted as it proceeds rearwardly in response to the gas pressure of cartridge firing. When bolt carrier tilting occurs, the rear end portion of the bolt carrier can contact the buttstock structure or a buffer retainer, thus at least partially stalling the rearward movement of the bolt carrier and preventing it from smoothly entering into the buffer chamber and displacing the buffer member against the force of the buffer spring. This bolt carrier tilting condition often causes failure of the extractor of the bolt mechanism to move a cartridge case rearwardly until it engages the ejector and is ejected laterally from the ejection opening of the upper receiver. When this bolt carrier tilting condition occurs an empty cartridge case can remain within the cartridge chamber of the barrel or it can be only partially extracted from the cartridge chamber. The cartridge case can be improperly positioned within the receiver so that it fouls the bolt and bolt carrier assembly and causes a jam, thus preventing the proper feeding of a fresh cartridge from the magazine by the buffer spring energized forwardly moving bolt mechanism. This undesirable bolt tilting condition is overcome according to the principles of the present invention by ensuring that the rear portion of the bolt carrier is positively guided during all phases of its rearward recoil movement and its forward cartridge charging movement.

[0039] A buttstock **66** is mounted to the lower receiver **14** as shown in FIG. 8 and has a buffer tube **68** located therein. A tubular buffer member **70** is movable within the buffer tube and is urged forwardly by a buffer spring **72**. The buffer member **70** defines a substantially planar forward end surface or face **74** that is positioned for engagement by the rear end

portion of a bolt carrier member **76** having a bolt carrier **76** and a bolt member **77** that is moved rearwardly within the upper receiver **12** responsive to the energy of cartridge gas pressure. Cartridge gas pressure is supplied to a bolt actuator mechanism **78** having driving relation with the bolt mechanism by a gas tube **80** that is in communication with a barrel port via a barrel port block **82**. The barrel port block **82** is positioned within the forward portion of the handguard as shown in FIG. 3. The barrel port block **82** may permit cartridge gas pressure communication with the gas tube **80** via a single port of the barrel. Preferably, however, the barrel port block is selector controlled and is capable of permitting selective communication of a single barrel port or two or more barrel ports with the gas tube according to the features set forth in U.S. Provisional Patent Application No. 61/279,817, filed on Oct. 26, 2009 by Mark C. LaRue.

[0040] The rear end portion of the bolt carrier member **76** is supported and guided by an annular guide surface **84** and is thus prevented from becoming tilted as the bolt is driven rearwardly in response to the firing of a cartridge. When the bolt carrier member **76** is at its forward most location within the upper receiver **12** the rear end portion of the bolt mechanism is located within the annular guide surface **84** and is in engagement with the planar front end surface **74** of the buffer member **70**. The rear end portion of the bolt carrier member **76**, when the bolt mechanism is closed and locked, is positioned in guided relation with the internal guide surface **84** and causes slight compression of the buffer spring **72**. Thus, when a cartridge is fired and gas pressure actuates the bolt carrier and bolt mechanism rearwardly, the bolt carrier member is positioned and guided at all times by the internal guide surface. The rear end portion of the bolt carrier member is positively oriented and guided at all times and cannot be tilted laterally as the result of the sudden application of rearward force that is applied thereto when a cartridge is fired. The bolt carrier member **76** can only move linearly as it is forced into the buffer chamber and displaces the buffer member against the force of the buffer spring. The bolt mechanism, therefore, is properly positioned at all times by this anti-tilt control and thus cannot become tilted during its rearward movement. The cartridge case extractor of the bolt member **77** will remain properly positioned at all times to efficiently extract the cartridge case of a fired cartridge and the ejector of the bolt assembly will cause ejection of the spent cartridge case from the ejection opening **86** of the upper receiver **12**.

[0041] In view of the foregoing it is evident that the present invention is one well adapted to attain all of the objects and features hereinabove set forth, together with other objects and features which are inherent in the apparatus disclosed herein.

[0042] As will be readily apparent to those skilled in the art, the present invention may easily be produced in other specific forms without departing from its spirit or essential characteristics. The present embodiment is, therefore, to be considered as merely illustrative and not restrictive, the scope of the invention being indicated by the claims rather than the foregoing description, and all changes which come within the meaning and range of equivalence of the claims are therefore intended to be embraced therein.

I claim:

1. A tactical firearm, comprising:

a receiver member defining a first mounting flange and having a first rail mounting surface;

a handguard member defining a second mounting flange being secured in face to face relation with said first mounting flange; and

flange fastener members securing said first and second mounting flanges in releasable fixed relation with one another.

2. The tactical firearm of claim 1, comprising:

said receiver member defining a first rail mounting surface and said handguard member defining a second rail mounting surface being disposed in co-planar relation with said first rail mounting surface;

a one-piece elongate sight mounting rail extending substantially along the combined length of said receiver member and said handguard member and defining a mounting surface having face to face relation with said first and second rail mounting surfaces, said one-piece elongate sight mounting rail having a cross-sectional mount geometry for receiving clamp type sight mount devices in releasable clamped relation therewith; and rail fastener members securing said one-piece elongate sight mounting rail to said receiver and said handguard.

3. The tactical firearm of claim 2, comprising:

said receiver having a rear end portion and a front end portion;

said handguard having a rear end portion and a front end portion; and

said one-piece elongate sight mounting rail having a rear end located at said rear portion of said receiver and a front end located at said front portion of said handguard and being vertically tapered from a predetermined dimension at said rear end to a dimension less than said predetermined dimension at said front end thereof.

4. The tactical firearm of claim 1, comprising:

a barrel member extending through said handguard member and being mounted to said receiver member;

a barrel retainer nut being threaded to said receiver member and securing said barrel member in oriented and substantially immovable relation with said receiver member; and

said handguard defining an inner surface disposed in spaced relation with said barrel member and said barrel nut and being thermally isolated from metal conducted transfer of heat from said barrel member and said barrel retainer nut to said handguard.

5. The tactical firearm of claim 1, comprising:

a one-piece elongate sight mounting rail being mounted to said receiver and said handguard and having a length substantially equal to the combined length of said receiver and said handguard; and

said one-piece elongate sight mounting rail being tapered along a major portion of the length thereof and defining a predetermined angle of cant for location of sighting devices at any selected position along the length thereof.

6. The tactical firearm of claim 5, comprising:

said one-piece elongate sight mounting rail defining a rear portion located at a rear portion of said receiver and a front portion located at a front portion of said handguard having a greater vertical thickness at said rear portion as compared with the vertical thickness at said front portion thereof.

7. The tactical firearm of claim 5, comprising:

said one-piece elongate sight mounting rail defining a single mechanical sight mount located at said rear portion thereof, said single mechanical sight mount having

an elevation permitting manual sighting of said firearm when optical sighting devices have been removed from said one-piece elongate sight mounting rail.

8. The tactical firearm of claim **5**, comprising:

said one-piece elongate sight mounting rail having a plurality of equally spaced lands and sight positioning grooves located substantially along the length thereof; and

said one-piece elongate sight mounting rail defining a single mechanical sight mount structure being located at the rear portion of said one-piece elongate sight mounting rail and having a sight orienting surface and mechanical sight positioning groove for attachment of a mechanical sighting device thereon.

9. The tactical firearm of claim **1**, comprising:

said receiver member having a bolt chamber located therein;

a bolt carrier having reciprocating movement within said bolt chamber and having a bolt member located therein;

a buttstock being mounted to said receiver member and having a buffer housing therein defining a buffer stop;

a spring urged buffer member being moveable within said buffer housing and having reciprocating movement limited by said buffer stop; and

said bolt carrier having a portion thereof located within said buffer housing and in contact with said buffer member and having guided relation with said buffer stop and preventing tilting of said bolt carrier during rearward movement thereof.

10. The tactical firearm of claim **1**, comprising:

said receiver member having a bolt chamber located therein;

a bolt carrier having reciprocating cartridge autoloading movement within said bolt chamber and having a bolt member located therein, said bolt carrier and bolt member being moved rearwardly within said bolt chamber by cartridge gas pressure resulting from firing of said tactical firearm;

a buffer housing having a bolt carrier guide member;

a spring urged buffer member having rearward movement within said buffer housing responsive to rearward movement of said bolt carrier and having forward movement within said buffer housing by said spring; and

said bolt carrier having a portion thereof in guided relation with said carrier guide member and being guided during rearward and forward reciprocating movement of said bolt carrier and bolt.

11. The tactical firearm of claim **1**, comprising:

said receiver member being defined by an upper receiver defining a bolt chamber and a lower receiver having a buttstock and defining a buffer housing;

a spring urged buffer member being moveable within said buffer chamber; and

a bolt carrier having a bolt member therein and having a rear end portion thereof in constant engagement with said buffer member and in anti-tilt guided relation with said buffer housing, upon rearward movement of said bolt carrier responsive to cartridge firing said bolt carrier causing rearward cushioning movement of said spring urged buffer member and being guided by said buffer housing to prevent tilting thereof during both rearward cartridge firing movement and forward spring urged movement.

12. A tactical firearm, comprising:

a receiver member defining a first mounting flange and having a first rail mounting surface;

a handguard member defining a second mounting flange and having a second rail mounting surface disposed in co-planar relation with said first rail mounting surface, said first and second mounting flanges being mounted in face to face relation and defining a firearm unit of rigid and structurally enhanced character;

flange fastener members securing said first and second mounting flanges in releasable fixed relation with one another;

a one-piece elongate sight mounting rail extending substantially along the combined length of said receiver member and said handguard member and defining a substantially planar mounting surface having face to face relation with said first and second rail mounting surfaces, said one-piece elongate sight mounting rail having a cross-sectional mount geometry for receiving clamp type sight mount devices in releasable clamped relation therewith; and

rail fastener members securing said one-piece elongate sight mounting rail in fixed relation with said receiver and said handguard and further enhancing the rigidity and structurally enhanced character of said firearm unit.

13. The tactical firearm of claim **12**, comprising:

said receiver having a rear end portion and a front end portion;

said handguard having a rear end portion and a front end portion; and

said one-piece elongate sight mounting rail having a rear end located at said rear portion of said receiver and a front end located at said front portion of said handguard and being vertically tapered from a predetermined dimension at said rear end to a dimension less than said predetermined dimension at said front end thereof.

14. The tactical firearm of claim **12**, comprising:

a barrel member extending through and in free-floating relation within said handguard member and having cartridge receiving relation with said receiver member;

a barrel retainer nut being threaded to said receiver member and securing a rear end portion of said barrel member in oriented and substantially immovable relation with said receiver member; and

said handguard defining an inner surface disposed in spaced relation with said barrel member and said barrel nut and being thermally isolated from metal conducted transfer of heat from said barrel member and said barrel retainer nut to said handguard.

15. The tactical firearm of claim **12**, comprising:

a one-piece elongate sight mounting rail being mounted to said receiver and said handguard and having a length substantially equal to the combined length of said receiver and said handguard; and

said one-piece elongate sight mounting rail defining a rear portion located at a rear portion of said receiver and a front portion located at a front portion of said handguard having a greater vertical thickness at said rear portion as compared with the vertical thickness at said front portion thereof and being tapered along the length thereof and defining a predetermined angle of cant for location of sighting devices at any selected position along the length thereof.

- 16.** The tactical firearm of claim **15**, comprising:
said one-piece elongate sight mounting rail defining a single mechanical sight mount located at said rear portion thereof, said single mechanical sight mount having an elevation permitting manual sighting of said firearm when optical sighting devices have been removed from said one-piece elongate sight mounting rail;
a plurality of equally spaced lands and sight positioning grooves being located substantially along the length of said one-piece elongate sight mounting rail having; and
a single mechanical sight mount structure being located at the rear portion of said one-piece elongate sight mounting rail and having a sight orienting surface and mechanical sight positioning groove for attachment of a mechanical sighting device thereon.
- 17.** The tactical firearm of claim **12**, comprising:
said receiver member having a bolt chamber located therein;
a bolt carrier having reciprocating movement within said bolt chamber and having a bolt member located therein;
a buttstock being mounted to said receiver member and having a buffer housing therein defining a buffer stop;
a spring urged buffer member being moveable within said buffer housing and having reciprocating movement limited by said buffer stop; and
said bolt carrier having a portion thereof located within said buffer housing and in contact with said buffer member and having guided relation with said buffer stop and preventing tilting of said bolt carrier during rearward movement thereof.
- 18.** The tactical firearm of claim **12**, comprising:
said receiver member having a bolt chamber located therein;

- a bolt carrier having reciprocating autoloading movement within said bolt chamber and having a bolt member located therein, said bolt carrier and bolt member being moved rearwardly within said bolt chamber by cartridge gas pressure resulting from firing of said tactical firearm;
a buffer housing having a bolt carrier guide member;
a spring urged buffer member having rearward movement within said buffer housing responsive to rearward movement of said bolt carrier and having forward movement within said buffer housing by said spring; and
said bolt carrier having a portion thereof in guided relation with said carrier guide member and being guided during rearward and forward reciprocating movement of said bolt carrier and bolt.
- 19.** The tactical firearm of claim **12**, comprising:
said receiver member being defined by an upper receiver defining a bolt chamber and a lower receiver having a buttstock and defining a buffer housing;
a spring urged buffer member being moveable within said buffer chamber; and
a bolt carrier having a bolt member therein and having a rear end portion thereof in constant engagement with said buffer member and in anti-tilt guided relation with said buffer housing, upon rearward movement of said bolt carrier responsive to cartridge firing said bolt carrier causing rearward cushioning movement of said spring urged buffer member and being guided by said buffer housing to prevent tilting thereof during both rearward cartridge firing movement and forward spring urged movement.

* * * * *