United States Patent

King

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[54] QUICK EMPLACEMENT GUN CARRIAGE MECHANISM

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[73] Assignee: **The United States of America as represented by the Secretary of the Army**

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[52] **U.S. Cl.** ..... **89/40 J**

[51] **Int. Cl.** **F41f 23/20**

[58] **Field of Search** ..... 89/40 R, 40 A, 40 J

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[57] **ABSTRACT**

In order to convert a wheeled gun carriage between fixed emplacement thereof and a mobile towing position, each wheel is mounted to one end of a support arm which is, in turn, angularly pivoted to the side of the gun-support frame in geared connection with a rotatable shaft extending transversely through the frame in position to be rotated by movement of the vehicle utilized to tow the carriage whereby back-up movement of the towing vehicle actuates the support arms to tilt the wheels outwardly of the frame to effect the lowering thereof into fixed emplacement on the ground and whereby subsequent forward movement of the towing vehicle actuates the support arms to return the wheels to the vertical position required to permit the normal towing of the carriage.

15 Claims, 9 Drawing Figures

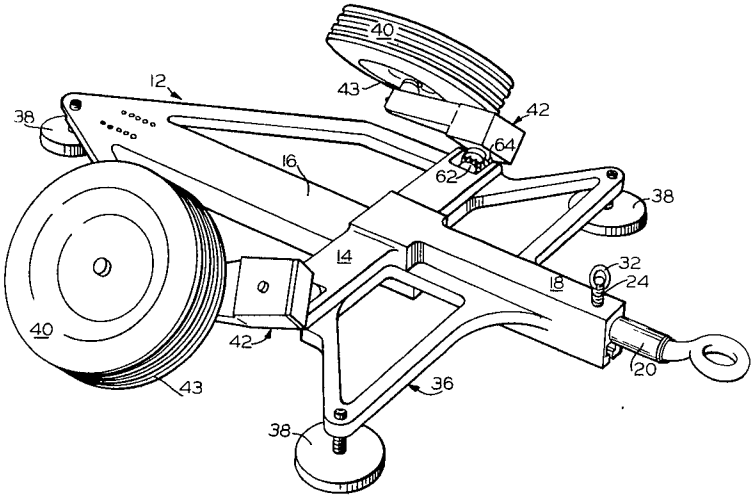

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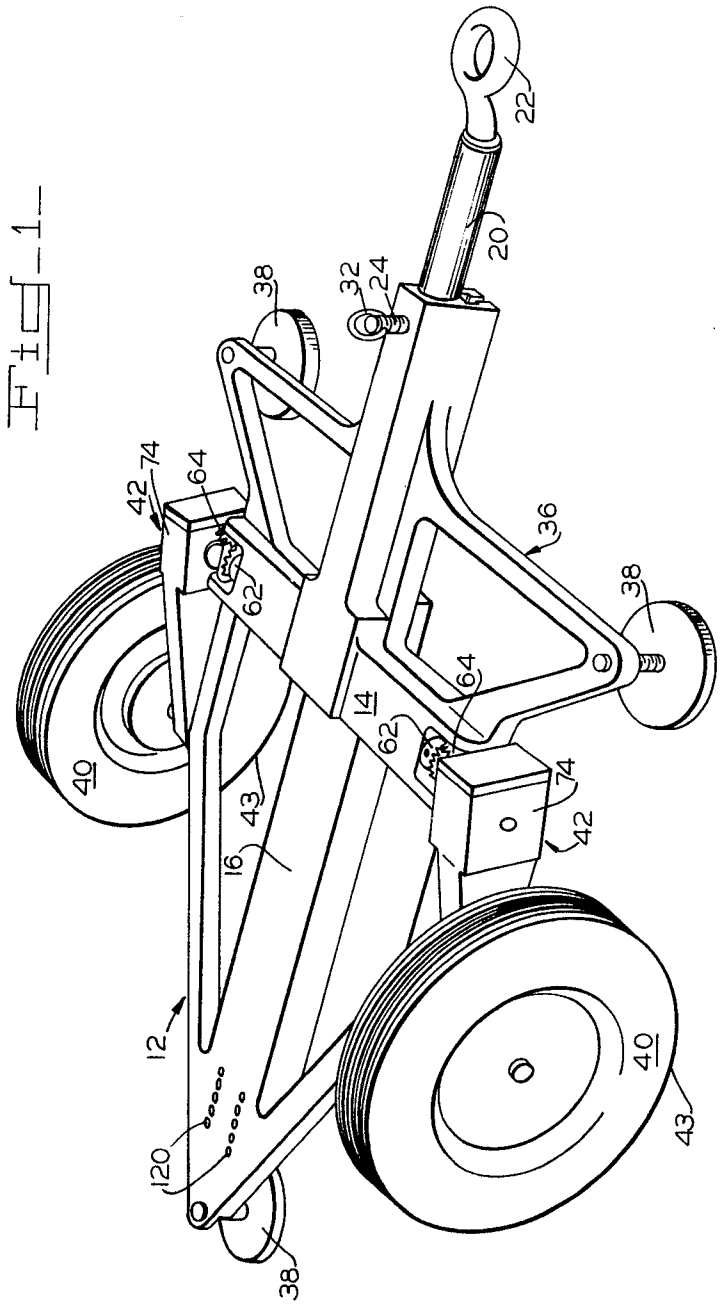
FIG. 1



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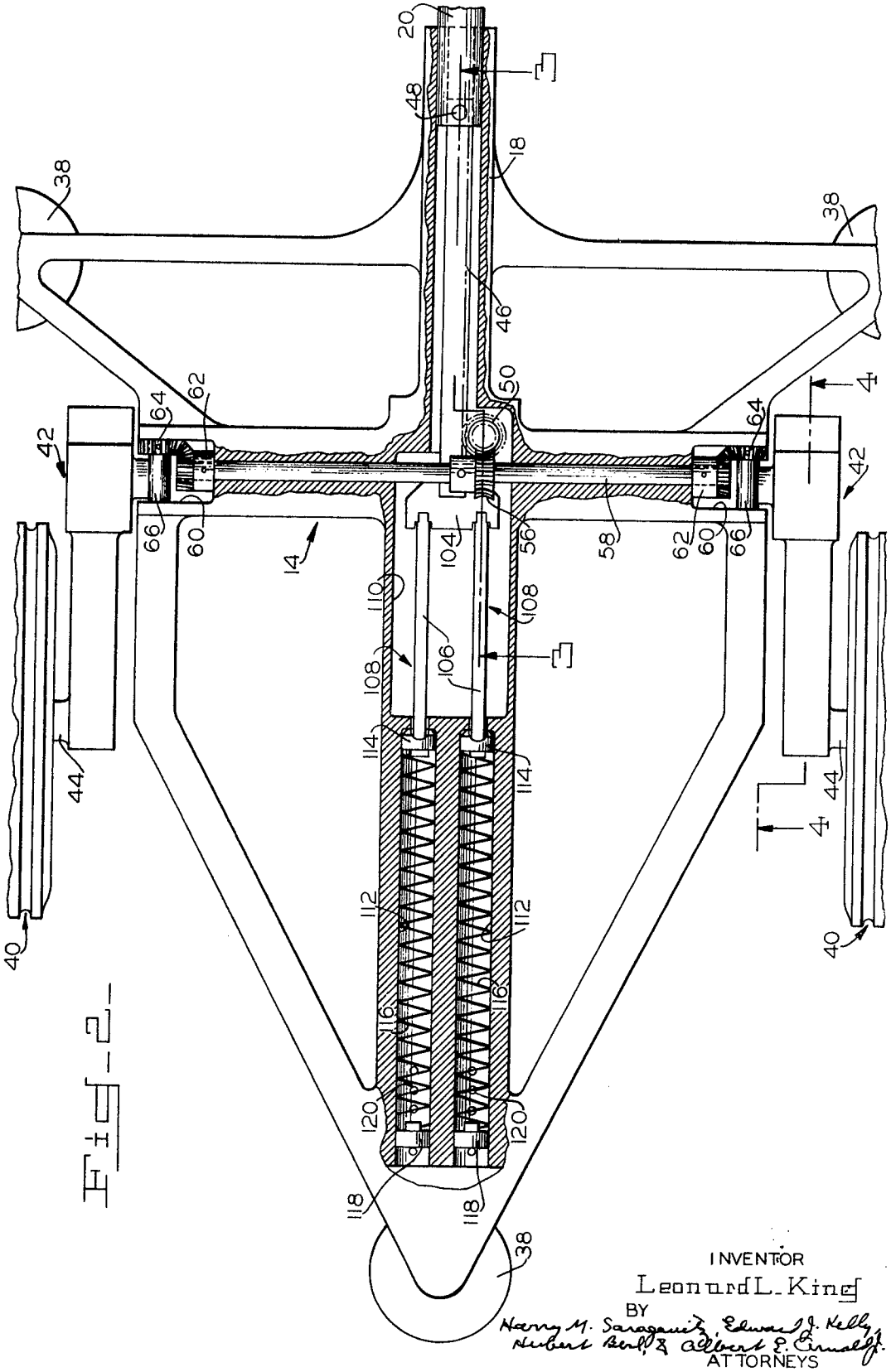

Fig. 2

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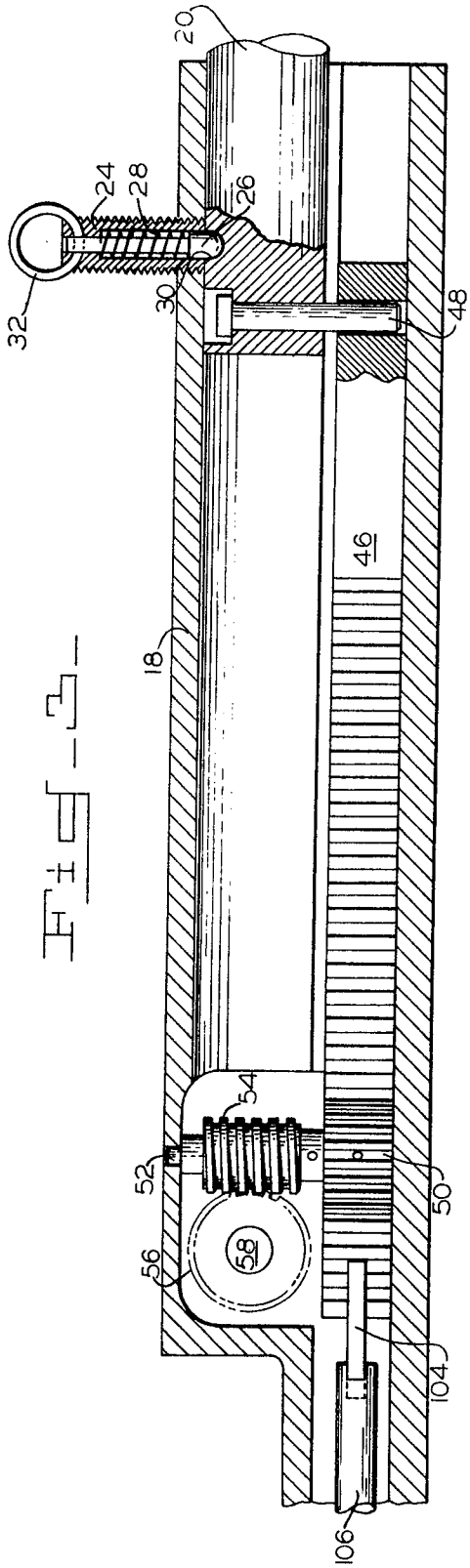

Fig. 3

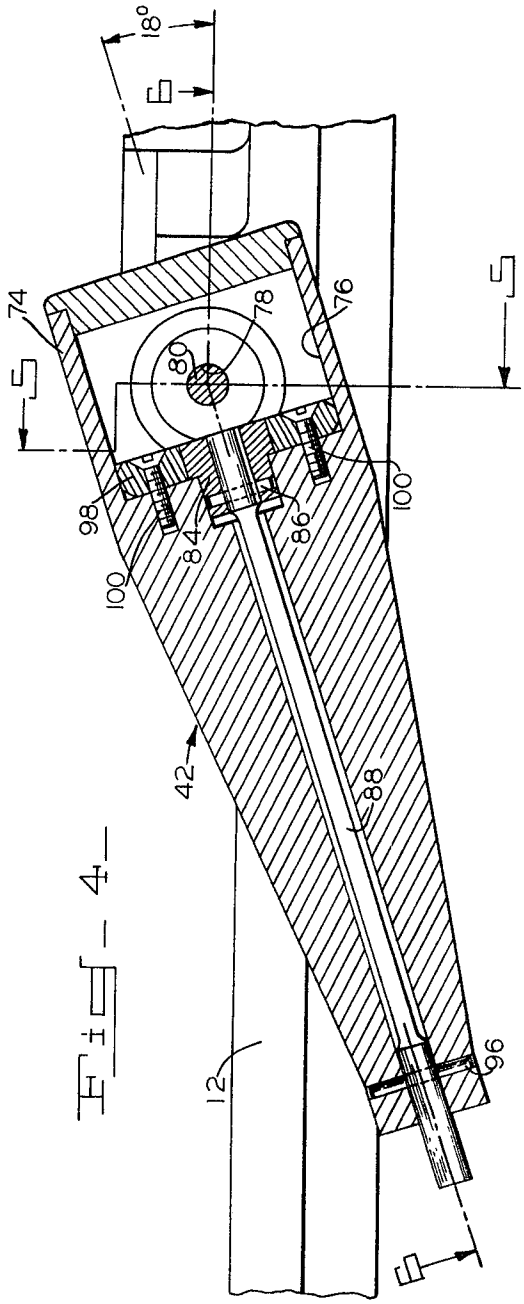

Fig. 4

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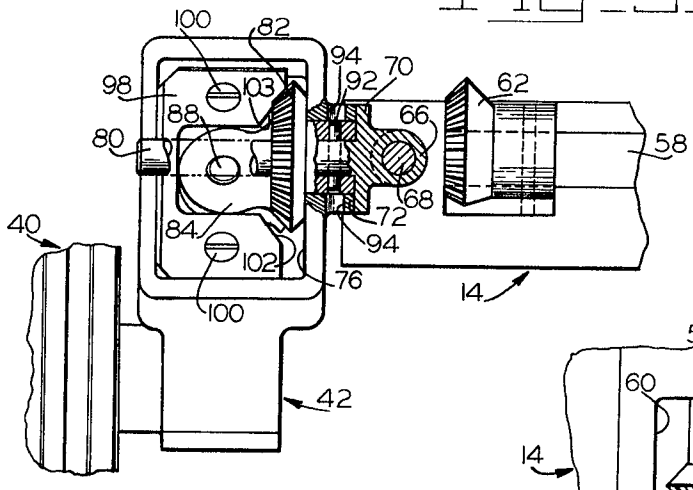
Fig. 5



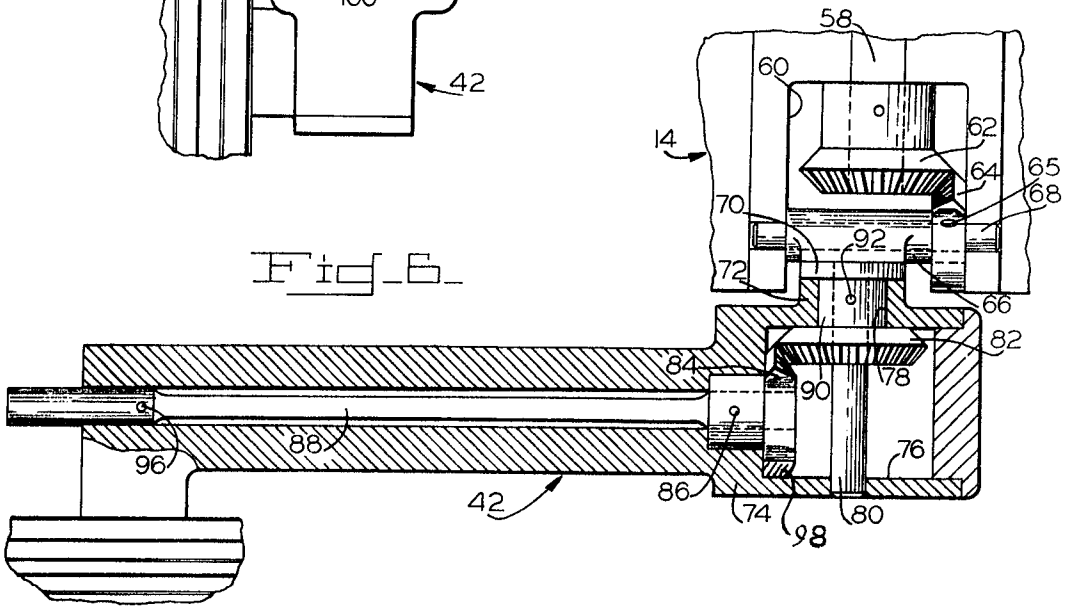


Fig. 6

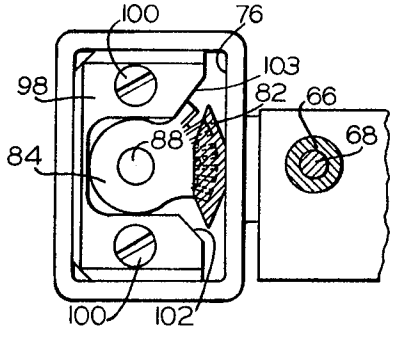


Fig. 8

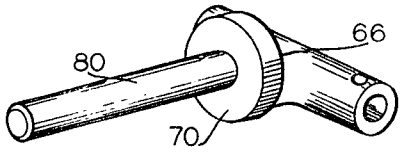


Fig. 9

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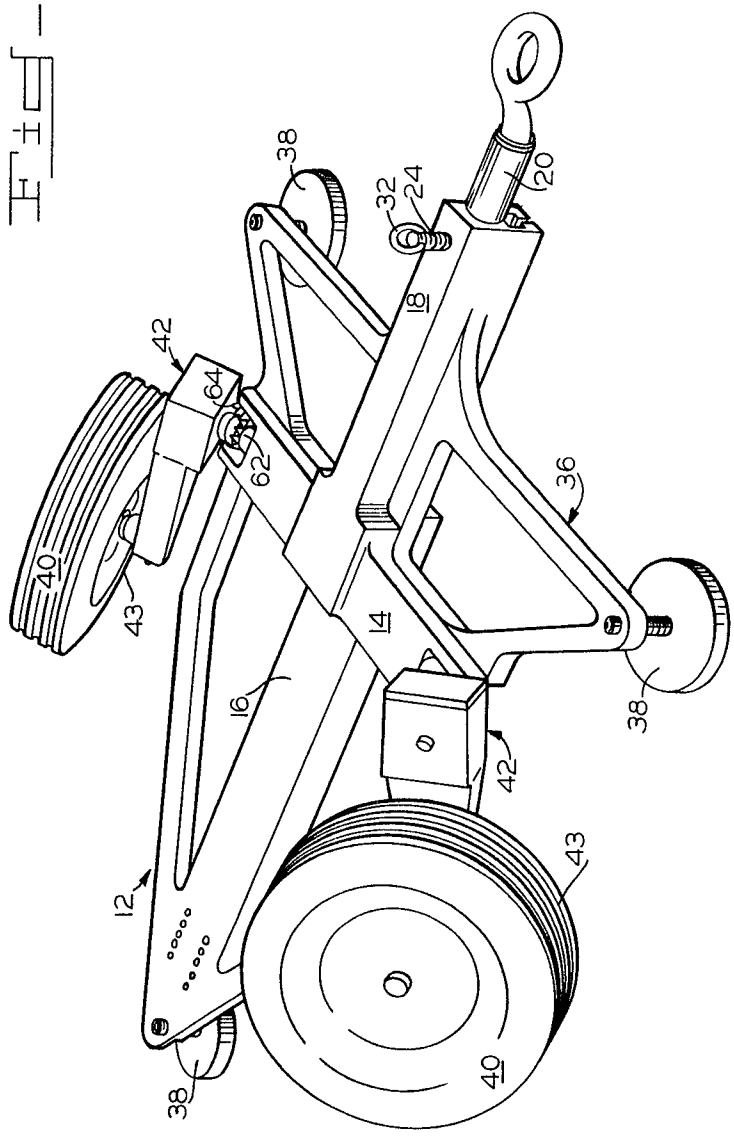
Fig. 7



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QUICK EMPLACEMENT GUN CARRIAGE MECHANISM

BACKGROUND OF THE INVENTION

This invention relates to the emplacement of a mobile gun carriage and is more particularly directed to means for rapidly converting the mobile support for the carriage to a fixed ground support capable of withstanding the recoil forces imparted thereto during the firing of the gun.

In gun carriages wherein the frame utilized to support the gun is mounted between a pair of wheels and consequently must be in a fixed position relative to the ground while the gun is being fired in order to insure the desired accuracy, the necessity for elevating the frame to lift the wheels off the ground and substitute a fixed support base therefor is customarily accomplished by one or more jacks. The dependance on such accessories not only complicates the emplacement of the gun but, more importantly, also detracts from the rapidity with which it can be relocated in the event of enemy action. Furthermore, where the combined weight of the gun and support frame therefor cannot be handled by manually operated jacks, the necessary power is usually provided by relatively bulky generators which require more elaborate maintenance procedures than those which can ordinarily be followed under combat conditions.

Accordingly, it is an object of this invention to provide a simple, rugged, and reliable mobile gun carriage which can be readily converted between a mobile towing position and a fixed firing position far more rapidly than has heretofore been possible.

It is also an object of this invention to provide a relatively large caliber gun with a wheeled carriage which can be rapidly emplaced in a fixed position on the ground without the need for manual or power-operated jacks.

Another object of this invention is to provide a wheeled gun carriage, as aforesaid, wherein the required rapid conversion between mobile and fixed support positions can be readily accomplished by simultaneously tilting both wheels outwardly or inwardly relative to the sides of the frame.

An additional object of the present invention is the provision of a system for emplacing a wheeled gun carriage wherein the weight of the gun and the support frame therefor provides the energy required to tilt the wheels in the direction in which the frame will be lowered into contact with the ground.

Still another object of this invention is to provide a gun carriage, as aforesaid, which can be equilibrated so that the lowering of the gun-support frame into contact with the ground will provide energy which can be stored to participate in the subsequent raising of the frame to the mobile support position.

A further object of the present invention lies in the provision of a mechanical system for fixedly emplacing a mobile gun carriage wherein the lowering and raising movement of the gun supporting frame can be initiated either by the transporter vehicle utilized to tow the carriage or by the personnel assigned to operate the gun.

An important object of this invention is to provide a gun emplacement system, as aforesaid, wherein the rate of change in the angular relationship of the wheels relative to the ground during the tilting movement thereof can be resiliently varied to enhance the lowering and raising of the gun-support frame.

SUMMARY OF THE INVENTION

It has been found that the foregoing objects can best be attained if the tow bar to which the transporter vehicle attaches is slidably disposed in the rear end of the carriage frame in geared connection with a transversely extending rotatable shaft. Each end of the shaft is, in turn, geared to one end of a longitudinal support arm which extends along the side of the frame at at acute angle relative to the ground to terminate in a wheel at the other end thereof. In addition, support arms are respectively attached to opposite sides of the frame so as to pivot about an axis at right angles to the longitudinal axis of the rotatable shaft. Thus, rotation of the shaft in either direction will tilt both wheels about the areas of contact thereof with the ground in opposite directions relative to the sides of the frame. Each support arm also houses a torsion bar in geared connection with the pivot member to which the support arm is mounted. These torsion bars are arranged to be actuated during the lowering and raising of the frame to vary the rate of change in the angular relationship between the wheels and the ground during a portion of the tilting movement thereof. The tow bar is arranged to be releasable locked to the frame and the end extending therein is provided with a follower device for compressing one or more equilibrator springs seated within the interior of the frame.

Thus, once the tow bar is unlocked and pushed inwardly relative to the frame, the interaction of the gears therein will begin to pivot the support arms in the direction required to tilt the wheels outwardly of the sides of the frame whereupon the combined weight of the gun and the support frame will produce the energy required to continue such tilting. When the energy stored in the torsion bars exceeds the vertical component of the load on the wheels, such bars unwind to accelerate the tilting of the wheels and thereby reduce the time required to bring the support pads on the underside of the frame into contact with the ground to complete the fixed emplacement of the carriage. When the frame is to be restored to a mobile towing position, the tow bar is pulled outwardly thereof, either manually or by the transporter vehicle utilized to provide the towing, thereby actuating the gearing to pivot the support arms in the direction required to tilt the wheels inwardly relative to the sides of the frame. During the initial tilting of the wheels, the torsion bars are rewound to resiliently support the weight of the carriage. The continued movement of the transporter vehicle and the action of the equilibrator springs, which were previously compressed during the lowering of the frame, provide the energy required to continue the tilting of the wheels until the frame is fully raised to the towing position thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The exact nature of the invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawings wherein:

FIG. 1 is a perspective view of the gun carriage with the wheels in the upright vertical position required to permit towing by a separate vehicle;

FIG. 2 is an enlarged top plan view of the major portion of the gun-support frame partially broken away to show the structural details of the equilibrator springs and the relationship between the tow bar and the rotatable shaft;

FIG. 3 is a sectional view taken along line 3—3 in FIG. 2 to show the geared connection between the tow bar and the rotatable shaft which extends transversely through the frame;

FIG. 4 is a sectional view taken along line 4—4 in FIG. 2 to show the interior of one of the support arms and the angle at which it is attached to the side of the frame;

FIG. 5 is a sectional view taken along line 5—5 in FIG. 4 to show the gear structure which serves to unload and load the torsion bar in the support arm during the lowering and raising of the frame, the end of the support arm being shown in full for ease in illustration;

FIG. 6 is a sectional view taken along line 6—6 in FIG. 4 to show the details of the connection between the support arm and the adjacent side of the frame;

FIG. 7 is a perspective view similar to that of FIG. 1 but showing the carriage with the wheels tilted to the position required to provide the fixed emplacement thereof on the ground;

FIG. 8 is a fragmentary sectional view through the enlarged end of the support arm similar to that of FIG. 5 but showing the relationship between the gear segment on the torsion bar and the C-shaped stop when the wheels have been fully tilted to provide the fixed emplacement shown in FIG. 7; and

FIG. 9 is a perspective view of the pivot member utilized to connect the support arm to the side of the frame.

DESCRIPTION OF A PREFERRED EMBODIMENT

As shown in FIG. 1 of the drawings wherein similar reference characters have been employed to designate corresponding parts throughout, the gun carriage to which the present invention is applicable essentially comprises a generally triangular frame **12** of isoceles configuration with a base leg **14** of greater structural rigidity than the isoceles legs. The ability of frame **12** to support a gun (not shown) is additionally strengthened by an integral central strut **16** extending between the apex of the isoceles legs and the base leg **14**. Hereinafter, references to directions are to be construed in accordance with the orientation of the gun which is mounted on frame **12** so that the muzzle or forward end thereof extends beyond the apex of the isoceles legs. Thus, base leg **14** is to be considered as located "rearwardly" of the apex of the isoceles legs. A generally rectangular housing **18** extends rearwardly from base leg **14** to axial alignment with strut **16** to slidably receive a tow bar **20** terminating in a ring shaped end **22** arranged to be engaged by the pintle on a transporter vehicle (not shown). In order to lock tow bar **20** against movement relative to housing **18** during the towing of the carriage, a hollow stud **24** (FIG. 3) is threadably inserted in housing **18** in position to seat a locking pin **26** and a spring **28** in abutment therewith for biasing one end of pin **26** into releasable engagement with a mating recess **30** in the periphery of tow bar **20**. A pull ring **32** at the opposite end of locking pin **26** enables the latter to be manually disengaged from tow bar **20** once the towing movement of the carriage has been halted.

Extending rearwardly and outwardly from the ends of base leg **14** is a trapezoidal subframe **36** connected to opposite sides of housing **18**. At each end of subframe **36** and the forward apex of frame **12** is a vertically adjustable support pad **38**. In the mobile position of the carriage, frame **12** is supported between a pair of wheels **40** attached to longitudinally extending support arms **42** respectively geared to the ends of base leg **14** in a manner to be described hereinafter. Wheels **40** are preferably provided with conventional rubber tires **43** and are rotatably mounted on axles **44** (FIG. 2) extending outwardly from the respective sides of support arms **42** adjacent the forward ends thereof. The diameter of wheels **40** is such that frame **12** is supported thereby in a travel position at a height which will prevent support pads **38** from contacting the ground regardless of the unevenness of the terrain over which the gun and carriage are being towed.

A longitudinal rack gear **46** is suitably pinned to the end of tow bar **20** within housing **18**, as indicated at **48** in FIGS. **2** and **3**, and extends into meshing engagement with a pinion gear **50** fixedly secured to one end of a vertical shaft **52** which is, in turn, rotatably mounted within base leg **14** in the area intersected by housing **18**. Shaft **52** also carries a worm gear **54** located above pinion gear **50** in meshing engagement with a worm wheel **56** fixedly mounted on an elongated rotatable shaft **58** extending through base leg **14** from one end thereof to the other.

The opposite ends of base leg **14** are rectangularly recessed, as indicated at **60** in FIG. **2**, to provide space for a miter bevel gear segment **62** fastened to the end of shaft **58** in meshing engagement with a corresponding miter bevel gear segment **64** pinned, as at **65**, to an end of a cylindrical sleeve **66**. The latter is, in turn, mounted on a transverse pin **68** rotatably seated in the sidewalls of recess **60**. Sleeve **66** is also provided with a flange **70** extending integrally outward from the exterior periphery thereof in the direction of the open end of recess **60** to serve as a bearing surface for the end face of a hub **72** protruding from the side of support arm **42** at the end thereof opposite that on which wheel **40** is mounted.

As indicated at **74**, the end of support arm **42** from which hub **72** projects is dimensionally enlarged and is provided with a substantially rectangular opening **76** therein in communication with a central bore **78** therethrough. Extending centrally outward from flange **70** is a rod **80** which passes through hub **72** and rectangular opening **76** into rotatable engagement with the sidewall of the latter. Hub **72** is retained in bearing contact with flange **70** by bevel gear **82** pinned to rod **80** in abutment with the interior wall surface of opening **76** and in meshing engagement with a bevel gear segment **84** which is, in turn, pinned, as at **86**, to one end of a torsion bar **88** extending through support arm **42**. Gear **82** is formed with a hollow cylindrical body **90** which fits into hub **72** over rod **80** and is fastened to the latter by a pin **92** which can be readily inserted into place through suitable axially aligned holes **94** in the walls of hub **72**, as best shown in FIG. **5**. Thus, support arms **42** are respectively attached to the opposite ends of base leg **14** for pivotal movement about an axis parallel to the longitudinal axis of frame **12** and for concurrent pivotal movement in a vertical plane about an axis at right angles to the longitudinal axis of base leg **14**.

The end of torsion bar **88** opposite the geared end thereof is initially pinned to support arm **42** at **96** at a time when the carriage has been lifted sufficiently to raise wheels **40** off the ground. In this position, the inclination of support arm **42** relative to the horizontal is halted by the contact between the upper side of the gear tooth portion of segment **84** and a substantially C-shaped insert **98** fastened within rectangular opening **76**, as by screws **100**. The spaced ends of insert **98** terminate in oppositely facing angular stop surfaces **102** and **103** which straddle the gear tooth portion of segment **84**. Thus, when gear segments **84** are in contact with upper stop surfaces **103**, support arms **42** are inclined at an angle to the horizontal which does not impart any load to torsion bars **88**. However, when wheels **40** are lowered into contact with the ground upon the removal of the lifting force imparted to the carriage, the weight of frame **12** plus the gun thereon will pivot support arms **42** about rods **80** thereby driving gear segments **84** to impart twisting movement to torsion bars **88** until the opposing forces are balanced. At this point, the gear tooth portion of segment **84** is positioned substantially midway of stop surfaces **102** and **103** on insert **98**, as best shown in FIG. **5**, and support arms **42** are inclined at a lesser angle to the horizontal which, in the support of a 4,000-lb. load, has been found to be about 18°.

As shown in FIGS. **2** and **3**, rack gear **46** extends below and beyond shaft **58** into fixed engagement with a follower **104** to the opposite side of which are secured the stem portions **106** of a pair of horizontally spaced pistons **108**. The interior of a portion of strut **16** is hollowed out, as indicated at **110**, to accommodate follower **104** and piston stems **106** while the remainder of strut **16** is provided with a pair of parallel longitudinal holes **112** laterally spaced to slidably receive the head portions **114** of pistons **108**. Each hole **112** seats an equilibrator spring **116** between piston head **114** and a plug **118** which is releasably retained in one of a series of detent openings **120** by means of which springs **116** may be adjusted to provide the degree of bias required to raise frame **12** and the gun thereon to the towing position thereof.

In order to emplace the gun carriage, the transporter vehicle is brought to a halt and locking pin **26** is manually lifted to disengage from tow bar **20** and permit the latter to be pushed into housing **18** in response to back-up movement of the transport vehicle. This movement of tow bar **20** actuates rack gear **46** to initiate rotation of shaft **58** thereby operating miter gear segments **62** and **64** to pivot support arms **42** about pin **68** in a clockwise direction as viewed when looking forwardly from the rear of the carriage. As a result, wheels **40** begin to tilt out of the vertical support position with the portions thereof in rolling contact with the ground moving outwardly away from frame **12** while the diametrically opposite portions of wheels **40** are being moved inwardly thereby causing frame **12** to be lowered toward the ground. During this tilting movement of wheels **40**, the preloaded torsion bars **88** act on support arms **42** to force wheels **40** downwardly against the ground to impart a steering action thereto outwardly of frame **12**. Since the

tilting of wheels **40** and the lowering of frame **12** are mutually interdependent, such steering action serves to promote the rapidity with which frame **12** and the gun thereon can be lowered during the rolling travel imparted to the carriage by the back-up movement of the transporter vehicle. Once the tilting of wheels **40** has been initiated, the weight of the gun and support frame **12** plays a dominant role in providing the energy required to continue such tilting. In view of the angle to the horizontal at which support arms **42** are attached to the ends of base leg **14** of frame **12**, the outward inclination of wheels **40** during the tilting thereof is progressively increased to improve the rapidity with which frame **12** is lowered into contact with the ground. Moreover, as wheels **40** are being tilted, the contact thereof with the ground is progressively shifted from the tread portion of the tires to the crown portion thereof thereby producing a corresponding decrease in the surface area in contact with the ground. When the vertical component of the load being carried by wheels **40** falls below the force produced by the preload on torsion bars **88**, support arms **42** are pivoted about rods **80** to increase the 18° angle thereof relative to the horizontal thereby accelerating the final portion of the tilting movement of wheels to minimize the scuffing and skidding of tires **43** that would otherwise occur during this period of minimum area contact with the ground. As support pads **38** come into contact with the ground to support the weight of the carriage, bevel gear segments **84** contact stop surfaces **103** on inserts **98**, as shown in FIG. **8**, to complete the unwinding of torsion bars **88**. At this point, the crown portions of the tires on wheels **40** are still in contact with the ground. The carriage will be properly emplaced for firing as soon as support pads **38** contact the ground and take the place of wheels **40** in supporting the weight of the gun and frame **12**.

In order to return the carriage to the mobile support position thereof, the transporter vehicle is operated to pull on tow bar **20**. The resulting displacement of rack gear **46** actuates gears **50**, **54** and **56** to rotate shaft **58** which, in turn, actuates gear segments **62** and **64** to initiate the pivoting of support arms **42** about pin **68** in a counterclockwise direction, looking forwardly from the rear of the carriage. Since wheels **40** were left in contact with the ground at the conclusion of the lowering of the carriage, the pivotal movement of support arms **42** about pin **68** immediately begins to tilt wheels **40** and raise frame **12** off the ground thereby minimizing the period during which support pads **38** will be dragged along the ground by the pull imparted to the carriage by the transporter vehicle. As support pads **38** are being lifted off the ground and the weight of frame **12** is being shifted onto wheels **40**, support arms **42** are pivoted about rods **80** to return to the previous inclination thereof relative to the horizontal thereby actuating gear segments **84** to rewind torsion bars **88** to the extent required to balance the weight of the gun and frame **12**. During the subsequent raising of frame **12**, equilibrator springs **116**, which were compressed during the lowering of frame **12**, supplement the pull of the transporter vehicle on tow bar **20** to actuate the various gears and other components involved in tilting wheels **40**.

However, if for some reason the transporter vehicle is not available, the energy provided by springs **116** is sufficient to complete the raising of the gun and frame **12** once the locking relationship between worm gear **54** and wheel **56** has been broken by actuation of rack gear **46** in response to a manual pull on tow bar **20**. In the event such manual actuation is to be utilized, springs **116** are preferably preloaded by positioning plugs **118** in the particular detent opening **120** which will provide the energy required to raise frame **12** to the desired height. Once wheels **40** are fully returned to the upright position required for mobile support of frame **12**, tow bar **20** will reach the position in which locking pin **26** is again in alignment with recess **30** and will automatically engage therewith under the bias of spring **28**. Inasmuch as the return of support arms **42** to the normal 18° inclination required to balance frame **12** and the gun thereon leaves gear segment **84** midway of stop surfaces **102** and **103**, as best shown in FIG. **5**, torsion bars **88** are utilized as the suspension system for frame **12** and are free to absorb any additional load which may be imparted thereto by the vertical movements encountered during the travel thereof over rough and irregular terrain. Stop surface **102** serves to limit the twisting of torsion bars **88** and prevent damage thereto from any overstress during the towing travel of the carriage.

Thus, there is here provided a mobile gun carriage which can be quickly emplaced in a fixed firing position and returned with even greater rapidity to a mobile towing position. In fact, unlike conventional gun carriages, the present invention permits the towing travel thereof to be initiated while the frame is still emplaced on the ground. This is extremely important in the event of surprise enemy action which may require immediate relocation of the gun to another firing site. This desirable rapid conversion of the carriage between an emplaced firing position and a mobile towing position is made possible by the unusual equilibrator spring arrangement which permits the weight of the gun and the support frame therefor to participate in the lowering of the frame to the ground and to provide the major portion of the energy required to raise the frame to the mobile position thereof. Furthermore, the ability to lower and raise the carriage without the need for separate accessory equipment or additional manpower is a highly desirable improvement which will minimize the logistic problems normally encountered under combat conditions. It is also noted that the torsion bar arrangement described herein provides a highly satisfactory suspension system whose operation does not interfere with the required tilting of the wheels.

Although the present invention is explained in accordance with the preferred embodiment shown and described herein, it will also become obvious to persons skilled in the art that other forms thereof as well as changes in the particular forms described, are possible within the spirit and scope of the present invention. Therefore, it is desired that the present invention shall not be limited except insofar as it is made necessary by the prior art and by the spirit of the appended claims.

I claim:

1. In a mobile gun carriage having a frame normally supported between a pair of wheels in position to permit the carriage to be towed by a separate vehicle, the combination of,

a rotatable shaft transversely seated in the frame between the opposite sides thereof,

a pair of support arms, each having a wheel mounted at one end thereof and pivotally attached at the other end thereof to the side of the frame adjacent the end of said rotatable shaft,

a tow bar slidably mounted in the frame for forward and rearward longitudinal displacement,

first gear means for converting longitudinal displacement of said tow bar to rotation of said shaft, and

second gear means for converting rotation of said shaft to pivotal movement of said support arms about an axis parallel to the longitudinal axis of the frame whereby the wheels are simultaneously tilted in opposite directions to lower or raise the frame into and out of fixed engagement with the ground in accordance with the direction in which said tow bar is displaced.

2. The mobile gun carriage of claim **1** wherein said support arms are pivotally attached to the sides of the frame at an angle to the horizontal with the ends to which the wheels are mounted being in a lower plane than the opposite ends thereof whereby the tilting of the wheels is accomplished with a progressive outward displacement thereof relative to the sides of the frame which produces a corresponding increase in the rapidity with which the latter is lowered into contact with the ground.

3. The mobile gun carriage of claim **1** including torsion bar means in each of said support arms arranged to be preloaded by the weight of the frame and the gun thereon to provide resilient suspension therefor during the towing travel thereof.

4. The mobile gun carriage of claim **1** wherein said first gear means comprises,

a rack gear secured to the end of said tow bar within the frame,

a pinion gear rotatably mounted in the frame for meshing engagement with said rack gear,

a worm gear mounted in the frame for synchronous rotation with said pinion gear, and

a worm wheel fixed to said rotatable shaft in meshing engagement with said worm gear.

5. The mobile gun carriage of claim 1 wherein said second gear means comprises,

a bevel gear secured to said rotatable shaft at each end thereof,

a pivot member projecting outwardly from each of said support arms for rotatable engagement in the side of the frame at a location adjacent said bevel gear, and

a bevel gear segment secured to said pivot member for meshing engagement with said bevel gear.

6. A mobile gun carriage convertible to a fixed firing position comprising,

a frame having a rotatable shaft extending transversely between the opposite sides thereof,

a pair of support arms respectively pivoted at one end thereof to opposite sides of said frame adjacent the ends of said shaft,

a wheel mounted to each of said support arms at the other end thereof,

a tow bar slidably disposed in said frame for longitudinal displacement therein,

gear means for converting longitudinal displacement of said tow bar to rotation of said shaft,

a bevel gear secured to each end of said rotatable shaft, and

a bevel gear segment secured to each of said pivoted ends of said support arms in respective meshing engagement with said bevel gears on said shaft for converting the rotation thereof into pivotal movement of said arms about an axis parallel to the longitudinal axis of said frame whereby said wheels are tilted outwardly relative to the sides of said frame to permit the latter to be correspondingly lowered into contact with the ground in response to the weight of said frame and the gun thereon.

7. The mobile gun carriage of claim 6 including preloaded torsion bar means in said support arms for urging the latter to pivot about an axis perpendicular to the longitudinal axis of said frame during the concurrent pivotal movement imparted to said arms by said bevel gears at the ends of said shaft whereby the tilting of said wheels is accelerated when the vertical component of the forces imparted thereto falls below the preload of said torsion bars thereby to minimize the tendency to skid under the external forces applied to the carriage during the displacement of said tow bar.

8. The mobile gun carriage of claim 7 wherein said torsion bar means comprises,

a torsion bar pinned at one end thereof in each of said support arms,

a bevel gear segment secured to the other end of said torsion bar, and

a bevel gear fixedly secured within said support arm in meshing engagement with said bevel gear segment whereby said torsion bar is normally preloaded to the extent required to balance the weight of said frame and gun thereon.

9. A mobile gun carriage convertible between a fixed firing position and a rolling travel position comprising,

a frame having a rotatable shaft extending transversely between the opposite sides thereof,

a pair of support arms each having a wheel at one end thereof, means for pivotally connecting the opposite ends of said support arms to the respective opposite sides of said frame adjacent the ends of said rotatable shaft therein,

a tow bar slidably disposed in one end of said frame for longitudinal displacement in either direction responsive to external forces thereon,

first gear means in said frame for converting longitudinal displacement of said tow bar into corresponding rotation of said transverse shaft,

second gear means between the ends of said shaft and said pivotal connecting means in said support arms for converting rotation of said shaft to pivotal movement of said support arms about an axis parallel to the longitudinal axis of said frame whereby said wheels are simultaneously tilted in opposite directions to permit the lowering and raising of said frame into and out of fixed contact with the ground, and

preloaded torsion bar means for pivoting said support arms at right angles to the pivotal movement imparted thereto by said second gear means whereby said wheels are positively steered in the direction of the tilting thereof to facilitate the raising and lowering of the frame and the gun thereon.

10. The mobile gun carriage of claim 9 including a plurality of equilibrator springs adjustably seated in said frame, and

a follower at the end of said tow bar within said frame operatively connected with said springs for compressing said springs during the lowering of said frame into contact with the ground thereby to provide sufficient energy for raising said frame to the travel position thereof in cooperation with the external forces being applied to said tow bar.

11. The combination defined in claim 9 including,

a detent releasably engageable with said tow bar to prevent displacement thereof,

means on said detent for facilitating manual disengagement thereof from said tow bar, and

spring means for biasing said detent normally into engagement with said tow bar during the longitudinal displacement imparted thereto for returning the carriage to the rolling travel position thereof.

12. The mobile gun carriage of claim 9 wherein each of said pivotal connecting means includes

a pivot member,

a cylindrical portion of said pivot member being rotatably seated in the side of said frame in parallelism with the longitudinal axis thereof in position to be rotated by said second gear means,

a flange portion projecting outwardly from said cylindrical portion and parallel thereto to serve as a bearing surface for said support arm during the pivotal movement imparted thereto by said torsion bar means, and

a rod portion extending outwardly from the center of said flange portion into rotatable engagement with said support arm to serve as an axis for the pivotal movement thereof at right angles to the direction of the pivotal movement imparted thereto by said second gear means.

13. The mobile gun carriage of claim 9 wherein said torsion bar means comprises,

a torsion bar pinned at one end thereof within said support arm adjacent said wheel,

third gear means in said support arm for rotating said torsion bar in response to the pivotal movement of said support arm about an axis at right angles to the pivotal movement imparted thereto by said second gear means, and

stop means for halting the rotation of said torsion bar in one direction to limit the unwinding thereof after said frame has been lowered into contact with the ground and in the opposite direction to limit the additional loading imparted thereto during the rolling travel of the carriage in the event of relative motion between said frame and said support arms.

14. The mobile gun carriage of claim 13 wherein said means for pivotally connecting said support arms to the sides of said frame includes an outwardly projecting rod portion extending through said support arm in rotatable engagement therewith and wherein said third gear means in each of said support arms comprises,

a bevel gear secured to said rod portion, and

a bevel gear segment secured to the free end of said torsion bar in meshing engagement with said bevel gear whereby pivotal movement of said support arm about said rod portion actuates said gear segment to rotate said torsion bar accordingly.

15. The mobile gun carriage of claim 14 including stop means for halting the rotation of said torsion bar comprising,

a C-shaped insert fixedly secured within said support arm to straddle said bevel gear segment, and

a stop surface on each end of said insert disposed in the path of movement of said bevel gear segment.

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