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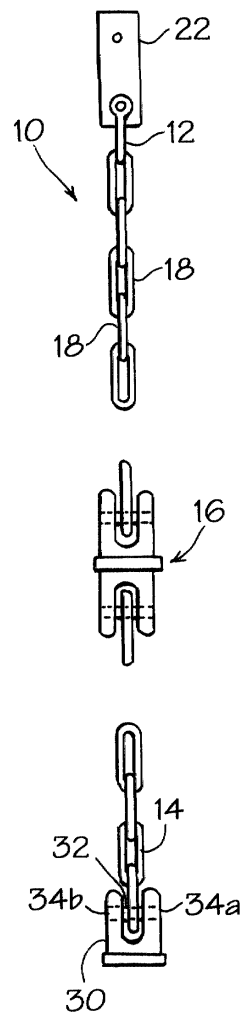
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(54) **Device for clearing terrain**

(57) A flail (10) having a first inner end (12), which is typically mounted on a rotor, a second, free end (14) and a clump weight (16) disposed therebetween. The weight gives rise to a "fly wheel effect" allowing the flail to fly straighter. Furthermore, friction is reduced in the mounting point and less vibration caused in the apparatus.



**FIG 1**

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## Description

[0001] The present invention relates to a flail for clearing terrain, a method of clearing terrain, a kit of parts therefore and a terrain clearance apparatus, sometimes referred to as flailing apparatus.

[0002] Typically, terrain clearance apparatus comprise a rotor to which a plurality of flail members are attached. Such terrain clearance apparatus was used in the second World War, notably on the Normandy beaches for clearing a path through a mine field. The latter apparatus comprised a cylinder of substantial diameter rotatably mounted in front of a tank or other motor driven vehicle, a plurality of flail members, in the form of chain flails, being attached to the surface of the cylinder. In more recent years, a drive shaft of moderate diameter has replaced the large diameter cylinder and a tractor has replaced the tank.

[0003] The object of this type of apparatus is to beat and clear the whole surface of the terrain over which the apparatus is passed. The World War 11 versions were found not to do this, largely because there were insufficient flails to accomplish this object. It was found, however, that merely increasing the number of flails did not solve the problem as the flails became tangled with one another and/or wrapped themselves round the rotor shaft. EP189255 provides a means of alleviating such a problem by providing lugs in at least two separate spirals to which flails are attached. However, such apparatus was found not to beat and clear the whole surface of the terrain over which the apparatus is passed.

[0004] It has been discovered that the flail members do not always fly in a plane perpendicular to the rotational axis of the rotor due to deflections of the flail at ground level, such as that experienced due to rocks or other dense matter, such as hard soil. Once deflected, the flail members continue to fly at an angle which is not perpendicular to the rotational axis of the rotor, leaving furrows in the ground to varying depths and widths depending upon the degree of deflection.

[0005] Furrowing of the ground is undesirable, particularly when clearing a mine field since some mines may remain covered

[0006] Furthermore, it has also been found that such deflections lead to increased wearing of the mounting point by which the flail is attached to the rotor, due to increased friction.

[0007] In addition, such deflections have been found to affect rotor balance, sufficient to cause vibrations which travel through the apparatus and cause damage.

[0008] It is an object of the present invention to provide a means of alleviating such problems.

[0009] In accordance with a first aspect of the present invention there is provided a flail for clearing terrain comprising a first, inner end, adapted to be connected to a mounting point on a rotor, and a second, free end, wherein said flail comprises at least one weight disposed between said first and second ends.

[0010] The weight, which is preferably in the form of a clump weight, does not impart energy to the ground and remains at a constant speed when rotated. This gives rise to a "fly wheel effect" allowing the flails to fly straighter than flails previously known in the art, reducing ground furrowing.

[0011] Furthermore, the "fly wheel effect" reduces friction at the mounting point and vibration in the apparatus.

[0012] In addition, the "fly wheel effect" reduces power consumption improving the efficiency of the apparatus.

[0013] Preferably the weight is disposed towards the second, free end of the flail. This further reduces the effect of deflections due to rocks or dense material.

[0014] The flail may comprise wire cable or a plurality of interconnected chain links.

[0015] More preferably the flail comprises a plurality of interconnected chain links.

[0016] The flail may comprise a flail end tip. The flail end tip will assist ground clearing.

[0017] The weight may be releasably secured within the flail by releasable securing means. This would permit the weight, flail end tip, inner end of the flail and/or the free end of the flail to become serviceable items, allowing them to be easily replaced once worn, without having to cut or weld the components.

[0018] The releasable securing means may comprise pins and/or nuts and bolts.

[0019] The inner end of the flail may be adapted to be connected to a mounting point on a rotor of a terrain clearance apparatus.

[0020] The inner end of the flail may be pivotally mounted between a pair of lugs mounted on the rotor.

[0021] Preferably, the inner end of the flail is mounted to a bar which is pivotally mounted between a pair of lugs mounted on the rotor, such that the bar can effect pivotal movement in a plane perpendicular to the rotational axis of the rotor. This ensures that there is minimal wear on the lugs and chain links of the flail since wear is confined substantially to the metal bar.

[0022] Preferably there is a stop means on the rotor which restricts the range of pivotal movement relative to the lugs available to the bar in a direction counter to the direction of rotation of the rotor. This reduces the likelihood of flails becoming tangled in use.

[0023] Preferably the lugs comprise aligned holes which receive the shank of a bolt, the shank of the bolt forming a pivot for the metal bar coupled to the flail.

[0024] The weight may comprise at least one recess for accommodating the flail therein. Preferably, the weight comprises two recesses.

[0025] The weight preferably comprises at least one pair of aligned apertures which each receive the shank of a pin for releasably securing said weight therebetween. More preferably, the weight comprises two pairs of aligned apertures.

[0026] In accordance with a second aspect of the

present invention there is provided a method of clearing terrain comprising the use of a flail as described hereinabove.

**[0027]** In accordance with a third aspect of the present invention there is provided a kit of parts, for use in clearing terrain, comprising a weight and flail as described hereinabove.

**[0028]** In accordance with a fourth aspect of the present invention there is provided terrain clearance apparatus comprising a plurality of flails as described hereinabove.

**[0029]** Specific embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, wherein:-

Fig. 1 is a plan view of a chain flail with a clump weight mounted thereon;

Fig. 2 is a perspective view of the clump weight; and  
Fig. 3 is a perspective view showing the preferred means by which each flail is pivotally attached to the rotor by means of a pair of lugs.

**[0030]** As illustrated in the figures, the flail 10 of the present invention has a first inner end 12, which is typically mounted on a rotor, a second, free end 14, and disposed therebetween a clump weight 16.

**[0031]** The chain flail 10 includes a plurality of interconnected chain links 18 and is attached to the rotor by means of a pair of lugs 20a, 20b welded for example to the rotor surface. The last link at the inner end of the flail 10 is loosely coupled to one end of a parallel sided metal bar 22 by way of an aperture 24 in said bar. The other end of the bar 22 is pivotally mounted between the pair of lugs 20a, 20b by means of a bolt 26 which extends through aligned apertures in the lugs 20a, 20b and loosely through a further aperture in the bar 22. Lugs 20a, 20b are typically arranged on the rotor such that the bars 22 can only effect a pivotal movement on the bolts 26 in a plane lying perpendicular to the rotational axis of the rotor.

**[0032]** Lugs 20a, 20b are joined together at one side thereof by a plate 28 which is dimensioned and positioned so as to restrict the extent to which the respective metal bar 22 can pivot relative to those lugs in the direction perpendicular to the rotational axis of the rotor.

**[0033]** Free end 14 of the flail 10 carries a flail end tip 30 to assist the flailing action of the flail 10. Flail end tip 30 is pivotally mounted to the last link of the flail's free end 14 by means of a pin 32 which extends between two aligned apertures 34a, 34b in the flail end tip 30. Pin 32 is releasably secured into place by means of interference fit (not illustrated in the figures).

**[0034]** Disposed between said inner and free ends of flail 10 is clump weight 16. Clump weight 16 comprises an elongate metal bar of substantially square or round cross section having first and second distal ends 44a, 44b, the bar being formed by welding two shorter identical metal bars 42a, 42b together, with a coupling piece

43 therebetween, as illustrated, or manufactured as one piece. Two recesses extend from the first and second distal ends, substantially along the clump weight's longitudinal axis, which accommodate the last and first chain link of the inner and free end of the flail respectively. Clump weight 16 is releasably secured between the flail's inner and free end by means of two bolts (not illustrated) which extend through aligned apertures 46a, 46b in said first and second distal ends 44a, 44b and respective last and first chain links of the inner and free end of the flail. The pins are releasably secured in place by means of interference fit (not shown illustrated in the figures).

## Claims

1. A flail for clearing terrain comprising a first, inner end, adapted to be connected to a mounting point on a rotor, and a second, free end, at least one weight being disposed between said first and second ends.
2. A flail as claimed in claim 1, wherein the weight is a clump weight.
3. A flail as claimed in claim 1 or 2, wherein the weight is disposed towards the second, free end of the flail.
4. A flail as claimed in claims 1, 2 or 3, wherein the flail comprises wire cable or a plurality of interconnected chain links.
5. A flail as claimed in claim 4, wherein the flail comprises a plurality of interconnected chain links.
6. A flail as claimed in any previous claim, wherein the flail comprises a flail end tip.
7. A flail as claimed in any previous claim, wherein the weight is releasably secured within the flail by releasable securing means.
8. A flail as claimed in claim 7, wherein the releasable securing means comprises pins and/or nuts and bolts.
9. A flail as claimed in any previous claim, wherein the inner end of the flail is adapted to be connected to a mounting point on a rotor of a terrain clearance apparatus.
10. A flail as claimed in claim 9, wherein the inner end of the flail is pivotally mounted between a pair of lugs mounted on the rotor.
11. A flail as claimed in claim 9, wherein the inner end of the flail is mounted to a bar which is pivotally

mounted between a pair of lugs mounted on the rotor, such that the bar can effect pivotal movement in a plane perpendicular to the rotational axis of the rotor.

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- 12.** A flail as claimed in claim 10 or 11, wherein the rotor comprises a stop means which restricts the range of pivotal movement relative to the lugs available to the bar in a direction counter to the direction of rotation of the rotor. 10
- 13.** A flail as claimed in claim 10, 11 or 12, wherein the lugs comprise aligned holes which receive the shank of a bolt, the shank of the bolt forming a pivot for the metal bar coupled to the flail. 15
- 14.** A flail as claimed in any preceding claim, wherein the weight comprises at least one recess for accommodating the flail therein. 20
- 15.** A flail as claimed in any preceding claim, wherein the weight comprises at least one pair of aligned apertures which receive the shank of a pin for releasably securing said weight therebetween. 25
- 16.** A flail as claimed in claim 15, wherein the weight comprises two pairs of aligned apertures.
- 17.** A flail as claimed in claim 16, wherein the weight comprises two pairs of aligned apertures. 30
- 18.** A method of clearing terrain comprising the use of a flail as described in any previous claim.
- 19.** A kit of parts, for use in clearing terrain, comprising a weight and flail as claimed in any previous claim. 35
- 20.** A terrain clearance apparatus comprising a plurality of flails as claimed in any previous claim. 40

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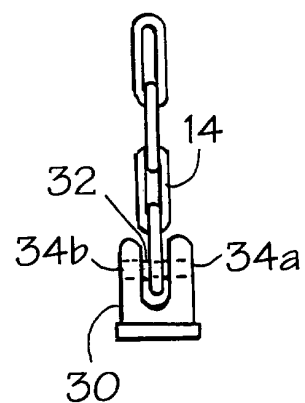
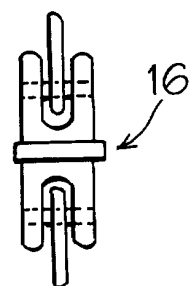
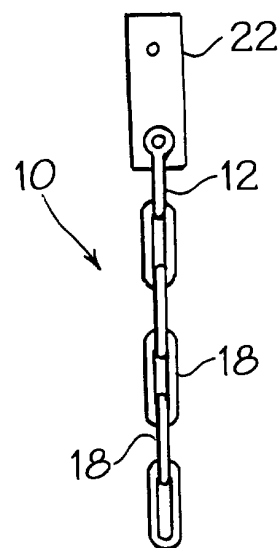
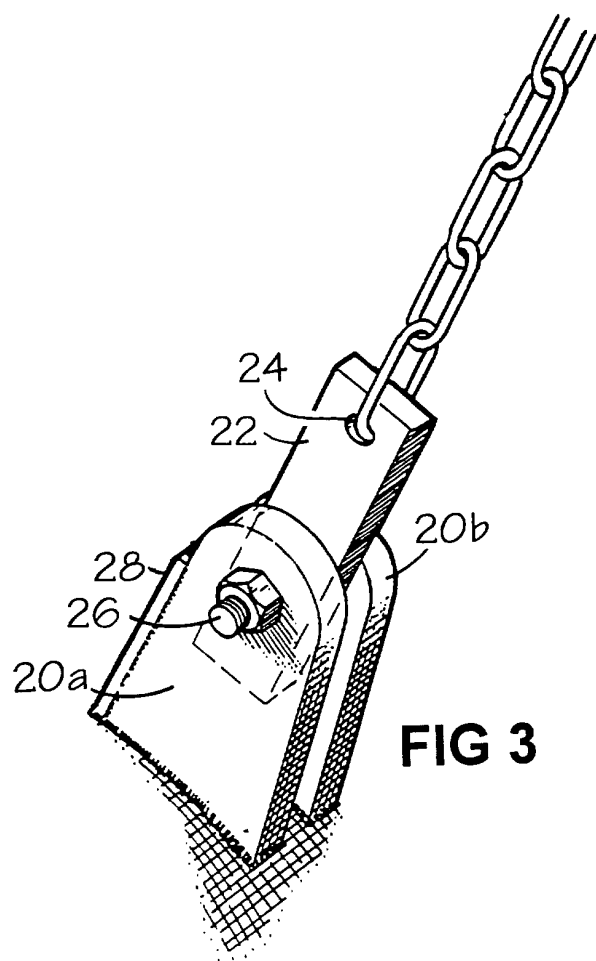
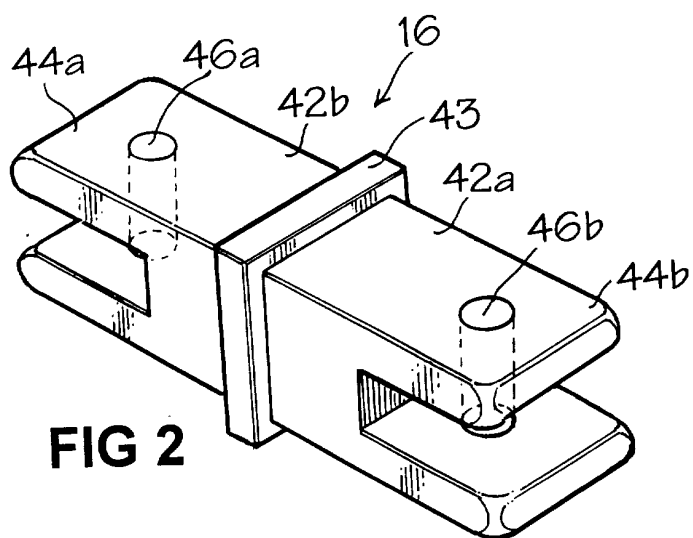


FIG 1





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# EUROPEAN SEARCH REPORT

Application Number  
EP 00 30 5950

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			TECHNICAL FIELDS SEARCHED (Int.CI.7)
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The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>4 December 2000</b>	Examiner <b>Schwengel, D</b>
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 30 5950

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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