United States Patent [19]

Taylor

[11] **3,786,912**

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[54] **LINEAR VIBRATORY FEEDER**

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[73] Assignee: **Automation Devices, Inc.,** Fairview, Pa.

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[21] Appl. No.: **91,494**

[52] **U.S. Cl.** .... **198/220 CC,** 198/220 DC
[51] **Int. Cl.** **B65g 27/00**
[58] **Field of Search** .... 198/220, 220 DC, 220 CC

[56] **References Cited**

UNITED STATES PATENTS

3,322,260	5/1967	Schwenzfeier	198/220 CA
3,053,379	9/1962	Roder	198/220 DB
2,200,116	5/1940	Maguire	198/204
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[57] **ABSTRACT**

A linear vibratory feeder is disclosed in which an action mass is positioned above a reaction mass, both of which are secured to a base by means of leaf type springs. Side plates are secured to the upper or action mass to which the coil is attached. The armature is secured to the underneath portion of the reaction mass, and the coil also mounted beneath the reaction mass to render the centers of gravity of the action and reaction masses substantially coincidental. Means are provided to adjust the gap between the armature and coil, and the action mass center of gravity is ideally located slightly below the center of gravity of the reaction mass to accommodate a track which is mounted atop the action mass.

9 Claims, 5 Drawing Figures

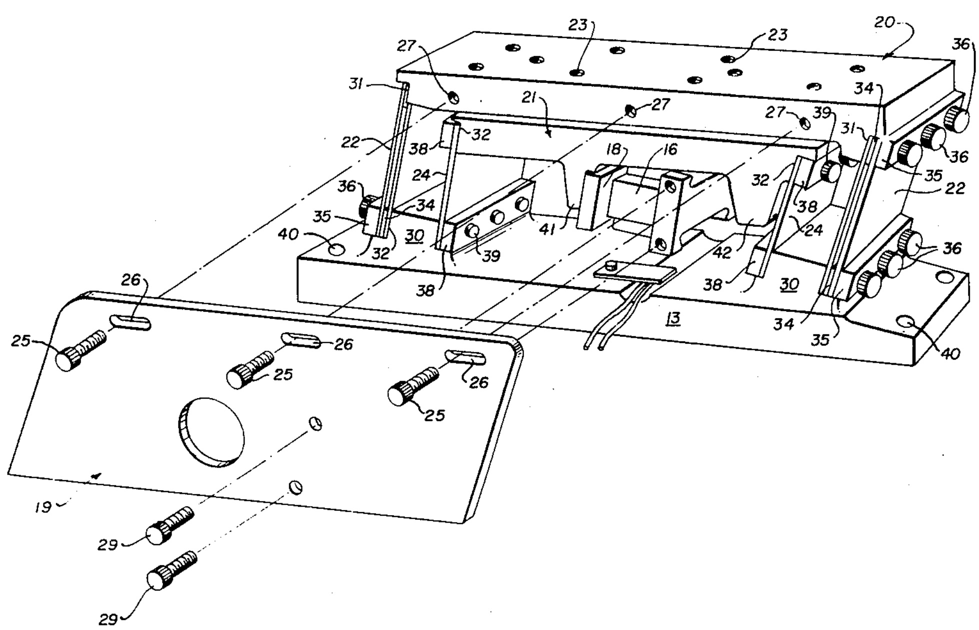


FIG. 1

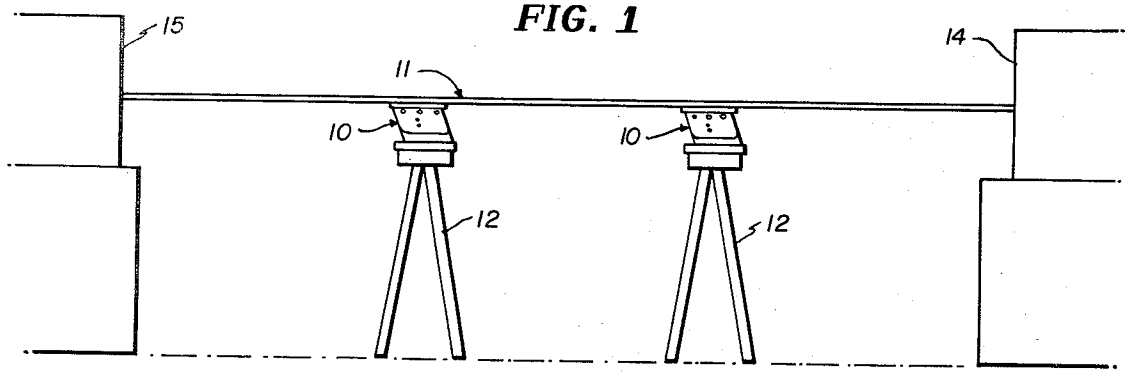


FIG. 2

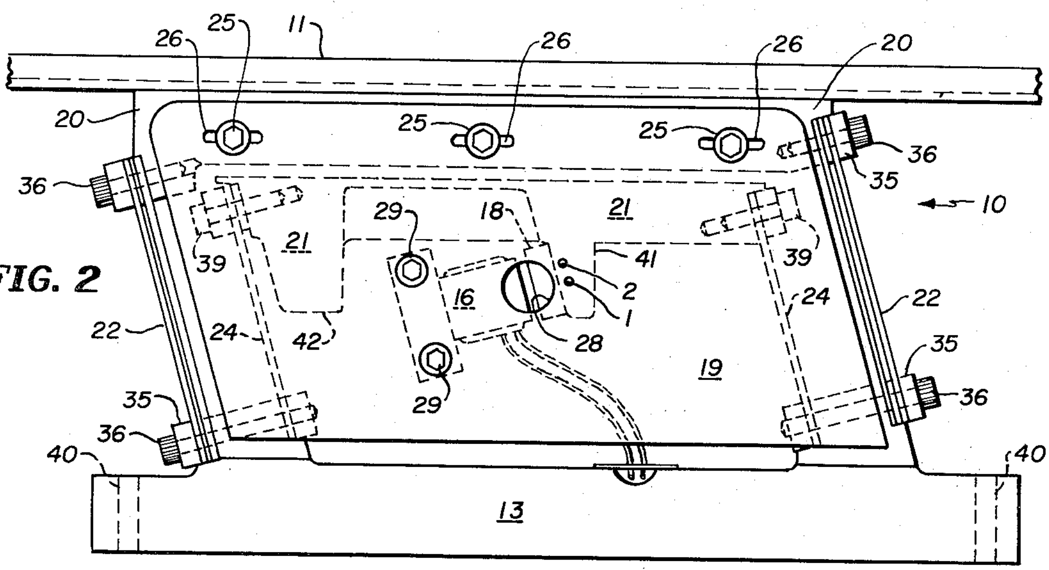
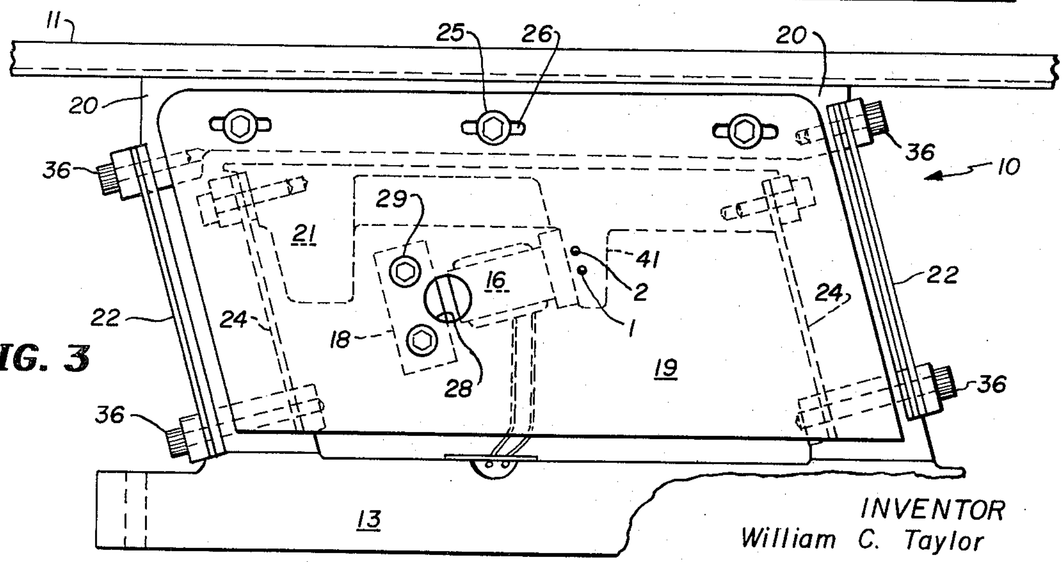


FIG. 3



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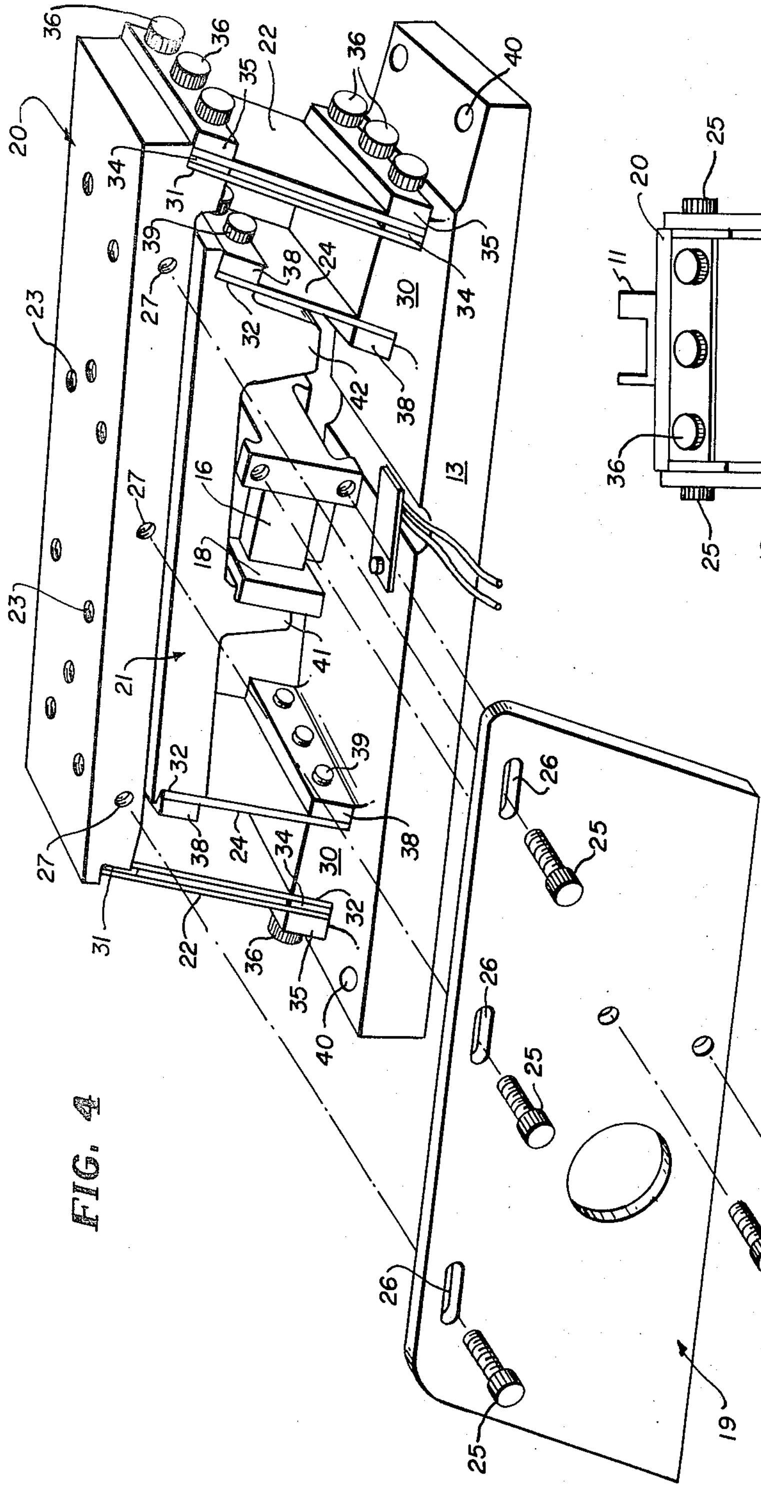

FIG. 4

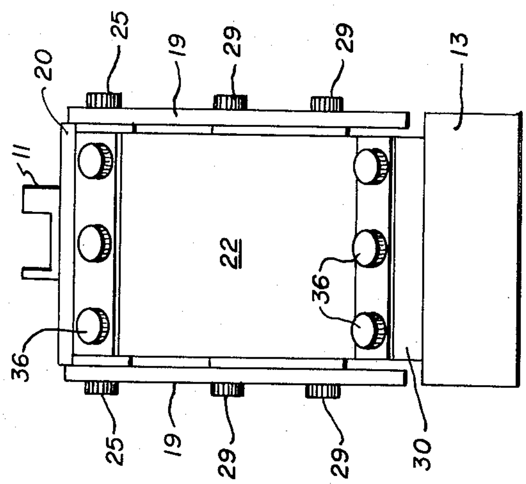

FIG. 5

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LINEAR VIBRATORY FEEDER

FIELD OF INVENTION

The linear vibratory feeder illustrative of the present invention belongs to that class of inline or vibratory feeders such as broadly disclosed in Otto K. Schwenzfeier U.S. Pat. No. 3,322,260. This patented construction has been subsequently modified to provide for coil gap adjustments as disclosed in Floyd E. Smith patent application Ser. No. 792,303 filed Jan. 21, 1969 now abandoned. The basic construction attempts to offset the vibration of the action mass by an equal and opposite vibration of the reaction mass to the end that little or no vibration is transmitted through the base. To assist in tuning where various parts and track weights are involved, the gap between the armature and coil is made adjustable. Nevertheless, despite the implementation of Newton's Third Law of Motion, and the adjustability of the coil gap, it has been found that certain harmonic actions occur which are difficult to isolate and neutralize, but which can stimulate the base of the unit in operation with walking-type motion.

In addition, it has been found with the linear or inline type feeders that several can be positioned with a single track, and to the degree that they can be rendered substantially uniform and identical in operation, track lengths of most any length can be employed for the transfer of small parts from one work station to another. Particularly when temporary tooling is employed such as wooden saw horses and the like, it is important to hold base vibration to an irreducible minimum so that large supports are not required and other adjustments to utilize lengthy tracks.

STATEMENT OF INVENTION

The present invention stems from the discovery that by positioning both the coil and armature beneath the reaction mass of an inline or linear vibratory feeder of the class referred to above, that the centers of gravity of the action and reaction mass, irrespective of weight, can be rendered substantially coincident in operation. This result is achieved by providing a pair of side plates which are secured in adjustable relationship with the action mass, but which depend therefrom in flanking relationship with the reaction mass. The coil or armature is mounted to the two side plates and adjustably opposes the opposite member which is secured to a portion of the bottom of the reaction mass. The action mass springs are positioned outboard of the reaction mass springs, and the action mass is physically longer than the reaction mass. Nevertheless, the result is one of substantially reduced vibration in harmonic motion, and one which will permit several like linear feeders to be secured to a single track, and when operated with a single source of power or control device, operate in substantial uniform action on such a track to make long distance feeding possible. Additionally, the substantially reduced vibration and potential harmonics in the base further render the unit simple to mount to any host machine and, of course, quieter in operation.

DESCRIPTION OF DRAWINGS

A typical diagrammatic installation of a linear feeder pair is shown in

FIG. 1 in which the left and right hand portions show typical machine installations which are connected for the transfer of small parts by means of two vibratories in a single track. The view is in front elevation.

FIG. 2 is a front elevation of a typical illustrative vibratory feeder showing in phantom lines a reaction and portions of the action mass.

FIG. 3 is a front elevation of an alternative embodiment illustrated similarly to that of FIG. 2 showing the coil and armature reversed.

FIG. 4 is a diagrammatic perspective exploded view of the inline feeder illustrative of the present invention.

FIG. 5 is an end view illustrative of the inline vibratory feeder showing the track mounted thereon.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to FIG. 1 it will be seen that a pair of linear vibratory feeders **10** illustrative of the present invention are mounted by means of the mounting holes **40** above supports **12** and operate together with a single track **11** to transfer small parts from a first work station **14** to a second work station **15.** As pointed out in the objects of the invention above, the particular linear vibratory feeder illustrative of the invention transmits a very low quantum of vibration to a support member, and accordingly supports such as wooden horses can be employed for temporary in-plant tooling to transfer parts from one machine to another without an intermediate hopper. It will be appreciated, of course, that other applications include taking parts from bowl type vibratory feeders, and other transfer operations in the assembly and production of various end products.

As shown in FIG. 2, the track **11** is secured atop the action mass **20.** The reaction mass **21** is positioned beneath the action mass **20,** and is supported on the base **13** primarily by means of reaction mass springs **24.** The action mass **20** is supported atop the base **13** by means of action mass springs **22.** The coil **16** is secured by means of coil mounting screws **29** to the side plates **19.** Adjustability is achieved through the adjusting screws **25** which secure the side plates **19** by means of adjustment screw slots **26** to the action mass **20.**

The complete details of construction will be more fully appreciated by observing FIG. 4 in which the single side plate **19** is shown as being removed from attachment to the action mass **20** by means of the adjusting screws **25** which engage the screw slots **26** and finally the threaded mounting holes **27** in the sides of the action mass **20.** Threaded track mounting holes **23** are provided on the upper surface of the action mass **20** to secure a wide variety of configurations of tracks **11.**

As will be observed, the action mass springs **22** are shown as two in number, and separated by means of spring separators **34** at the top and bottom of the action mass springs **22.** Keepers **35** are provided on the outboard portion of the action mass springs **22,** and the same are all secured in place against the action mass spring mounts **31** by means of the action spring screws **36.** A similar mounting is effected at the lower portion of the action mass spring **22** where the same engage the base spring mount **30** which extends upwardly from the base **13** and provides a pair of opposed shoulders at both ends of the unit for the mounting of the action mass springs **22** as well as the reaction mass springs **24.** While two action mass springs **22** are shown, more can be used if additional sparators **34** are provided. This requirement of separation is also applicable to the reaction mass springs **24.**

The reaction mass springs **24** are mounted against the reaction mass spring mount **32** by means of the reaction mass keepers **38** and the reaction mass spring mounting screws **39.** At the upper end portion of the reaction mass springs **24,** similar reaction mass keepers **38** are employed and reaction mass mounting screws **39** are provided to secure the same to the reaction mass spring mount **32.** Suitable threaded holes are bored in the spring mount **30** of the base, the action mass spring mount **31,** and the reaction mass spring mount **32** to accommodate the respective screws.

It will be particularly noted that the reaction mass **21** is provided with an armature mount **41** which extends downwardly and to which the armature **18** is secured. To offset this weight and to hold the centers of gravity in approximate coincidental relationship, a counterweight **42** is provided as an extension of the lower portion of the reaction mass **21.** The net result, as shown in FIG. **2** particularly, is to provide a center of gravity for the action mass **20** which is slightly below the center of gravity for the reaction mass **21** (identified as numbers **1** and **2**) both of which are approximately adjacent the armature **18.** Further as noted in FIG. **2,** the coil gap between the coil **16** and the armature **18** can be visually observed through the coil gap window **28** and adjusted by means of loosening the adjusting screws **25** and moving the side plates **19** with their associated coil **16** (secured to the side plates by coil mounting screws **29**) until the particular gap which is desired has been achieved.

In designing various sizes in units the centers of gravity can be worked out by dividing up the silhouette configuration of the action mass **20** and the reaction mass **21** as well as weighing the parts. Naturally there is no substitute for finally adjusting the prototype to achieve a substantially identical center of gravity, and this can be done by boring holes in the conterweight **42** or the armature mount **41,** or alternatively positioning various weights at adjustable stations on both of the side plates **19.** The net result, however, is to substantially overlap or render coincident the center of gravity of the action mass **1** and the center of gravity of the reaction mass **2,** to the end that in operation substantially all vibration is cancelled out. To further improve operation, rendering the action and reaction masses of substantially the same weight is desirable but does not have the same effect as rendering the action and reaction masses substantially coincident. Further, as pointed out, the action mass center of gravity for a production unit is positioned slightly below that of the reaction mass in the anticipation that it will be raised by the track and the contained parts.

There appears to be no major significance in the selection of materials for the action mass **20** or the reaction mass **21,** although it is highly desirable that the unsupported length of spring of the action mass springs **22** and the unsupported length of the reaction springs **24** be approximately the same in their opposed positions, but the action mass springs **22** and the reaction mass springs **24** need not be of identical length.

As illustrated, a solenoid and armature are shown as the principal source of power or driving means for the linear feeder. It should be pointed out that the power is either alternating current, or pulse direct current. Nevertheless it will be appreciated that air type vibratory drives as well as motor type vibratory drives with an eccentric flywheel may also be employed provided the action mass and the reaction mass are suitably coupled.

ALTERNATIVE EMBODIMENT

As shown in FIG. **3,** where identical reference numerals are employed with the construction shown in FIG. **2,** the armature **18** and the coil **16** have been reversed. The alternative embodiment shown in FIG. **3** positions the coil **18** by means of any suitable mounting structure to the armature mount **41** of the preferred embodiment which, of course, becomes the coil mount of the alternative embodiment illustrated by common reference numeral **41.** Conversely, the coil mounting screws **29** of the preferred embodiment become the armature mounting screws **29** of the alternative embodiment. To render the centers of gravity coincident in the same fashion as shown with the preferred embodiment it may become necessary to increase the weight of the armature **18,** or decrease the weight of the reaction mass **21.** Such modification can be determined by drawing the reaction and action masses as well as anticipating the weight of the armature and coil, and thereafter breaking the system into small rectangles, trapezoids, triangles and the like and integrating the resultant masses and moments into a single center of gravity. After the initial prototype unit is constructed and proven, the balance point between the reaction masses and the action masses can then be actually tested, and thus the centers of gravity determined empirically, and adjusted by adding or decreasing weight where appropriate.

Although several embodiments of the invention have been shown and described in full here, there is no intention to thereby limit the invention to the details of such embodiments. On the contrary, the intention is to cover all modifications, alternative embodiments, usages and equivalents of the linear vibratory feeder as fall within the spirit and scope of the invention, specification, and appended claims.

I claim:

1. In an inline linear vibratory feeder having an action mass for supporting a linear track, a reaction mass for dynamic balance with the action mass, driving means for imparting opposed forces to the action and reaction masses, a base, yieldable means for securing the action and reaction masses to the base with the action mass above the reaction mass, and a pair of side plates secured in parallel flanking relationships to a portion of driving means and one of said masses; the improvement of an organization and proportion of elements to render the centers of gravity of the total action and reaction masses substantially coincident, comprising:

driving means beneath said action and reaction masses,

means for fixedly securing a portion of the driving means to each side plate for positioning beneath the action and reaction masses,

and means for fixedly securing the side plates to the action mass,

thereby coupling the mass of the side plates and a portion of the driving means to the action mass with the entire driving means beneath the action and reaction masses to effect a lowering of the action mass center of gravity to a point substantially coincident with the center of the gravity of the reaction mass.

2. In the inline feeder of claim 1, means for adjustably securing the side plates to the action mass.

3. In the inline feeder of claim 1, said driving means comprising

an armature secured to the side plates and beneath the reaction mass,

and a coil secured to the reaction mass and there beneath.

4. In the inline feeder of claim 1, said driving means comprising

a coil secured to the side plates and beneath the reaction mass,

and an armature secured to the reaction mass and therebeneath.

5. In the inline feeder of claim 3,

said means for securing the side plates to the action mass comprising elongate slots whereby the gap between the coil and the armature may be adjusted by shifting the side plate-coil assembly relative to the action mass.

6. In the inline feeder of claim 4,

said means for securing the side plates to the action mass comprising elongate slots whereby the gap between the armature and the coil may be adjusted by shifting the side plate-coil assembly relative to the action mass.

7. In the inline feeder of claim 3

said reaction mass having a pair of depending opposed members defining a coil clearance area,

one of said depending members serving as one support for the armature.

8. In the inline feeder of claim 4

said reaction mass having a pair of depending opposed members defining a coil clearance area,

one of said depending members serving as one support for the coil.

9. In the inline feeder of claim 1,

said reaction mass center of gravity being above the center of gravity of the action mass by an amount to offset the raising of the action mass center of gravity by the addition of a feeder track.

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