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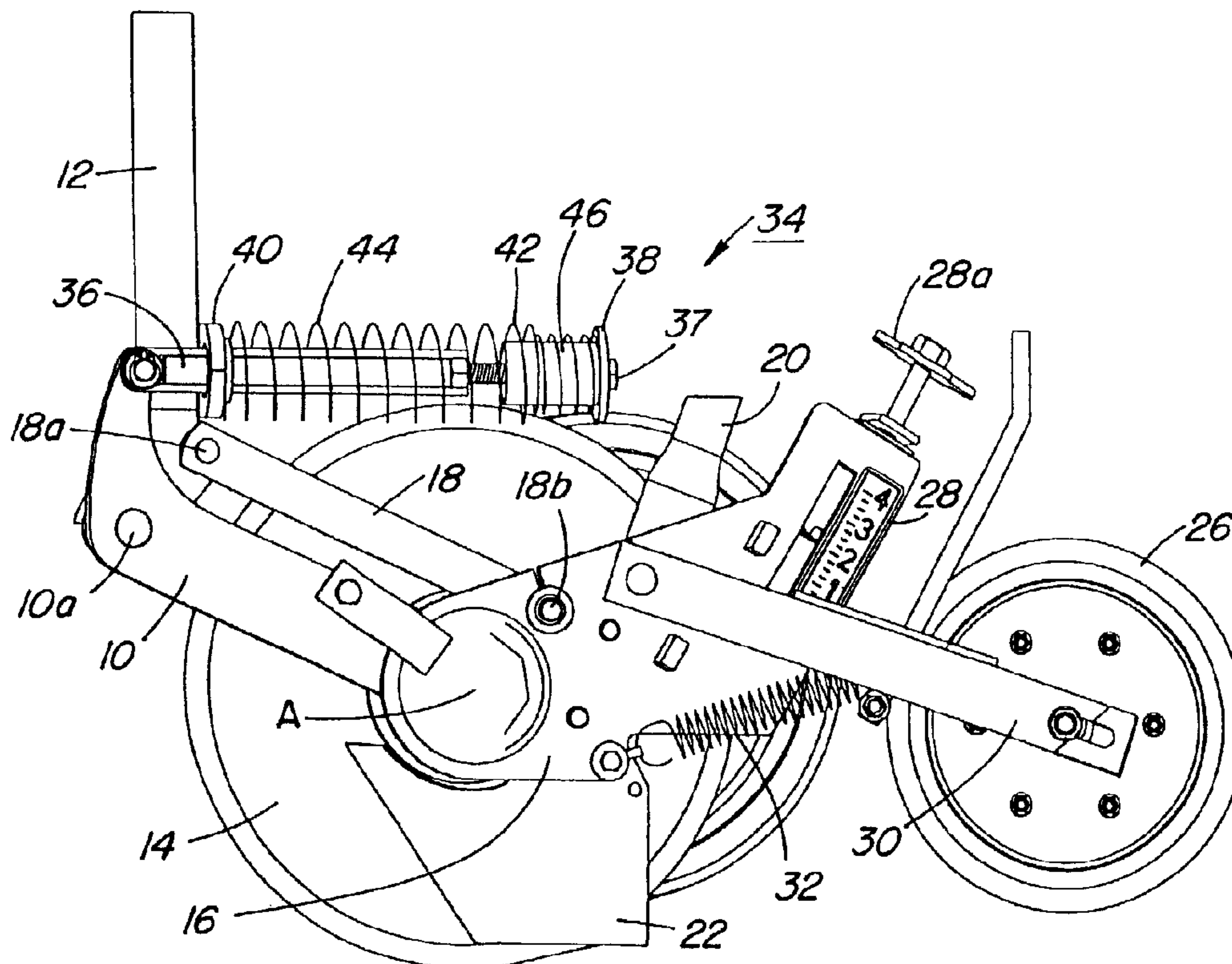
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(54) Titre : SOC A PRESSIONS D'ENFONCEMENT MULTIPLES

(54) Title: GROUND OPENER WITH MULTIPLE RANGE DOWNPRESSURE



(57) Abrégé/Abstract:

A soil opener system is described which is capable of providing multiple ranges of downpressure so as to accommodate the varying field conditions likely to be encountered. The downpressure assembly includes plural springs having different spring constants in series to bias a planting tool toward the ground. Dual or multiple ranges of downpressure are selectable by setting the amount of precompression of the spring assembly. The assembly allows the planting tool to pivot relative to the implement frame to follow contours of the ground while being biased toward the ground. The working position of the tool is maintained by a gauge wheel adjacent a disc furrow opener, which gauge wheel also acts as a disc cleaning mechanism.



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ABSTRACT OF THE DISCLOSURE

A soil opener system is described which is capable of providing multiple ranges of downpressure so as to accommodate the varying field conditions likely to be encountered. The downpressure assembly includes plural springs having different spring constants in series to bias a planting tool toward the ground. Dual or multiple ranges of downpressure are selectable by setting the amount of precompression of the spring assembly. The assembly allows the planting tool to pivot relative to the implement frame to follow contours of the ground while being biased toward the ground. The working position of the tool is maintained by a gauge wheel adjacent a disc furrow opener, which gauge wheel also acts as a disc cleaning mechanism.

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GROUND OPENER WITH MULTIPLE RANGE DOWNPRESSURE

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BACKGROUND OF THE INVENTION

This invention relates to improvements in agricultural ground working equipment, especially disk ground opener units and in particular to improvements in those units employing a downpressure mechanism.

10 There is a need to provide suitable means to effect adjustment of downpressure applied to the disc of a soil opener unit such as is used for the planting of seeds and/or fertilizer. The adjustment should be such as to allow the opener assembly to be set for different soil conditions ranging from soft to firm. Thus, for loose soil conditions it is desirable to apply little downpressure
15 so that the depth gauge wheel is not pressed too deeply into the soil causing a rutting and plowing action and resulting in poor seed depth control. For firm soil conditions it is desirable to have a setting for more downpressure which can be selected for these various firmer soil conditions.

 Deere US Patent 5,727,638 shows an apparatus of this general type but
20 which has a downpressure arrangement which is either engaged, or is not engaged, and which has only one range of operation corresponding to the force produced by a single spring having a single spring constant. In general, a single spring requires a relatively large change to any precompression adjustment provided to give the desired change in biasing force, and the
25 working range displacement tends to be limited. Such an assembly with a single spring also requires an initial large spring length to accommodate the large range of settings required. The large range of settings also involves more operator time and effort.

 There is thus a need to provide a soil opener system capable of providing

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multiple ranges of downpressure so as to accommodate the varying conditions likely to be encountered.

In addition to providing multiple ranges of downpressure, there is a need to provide a downpressure assembly arranged so that downpressure can be set differently between individual opener assemblies on an implement. An implement is commonly supported by wheels which bear much of the weight of the implement and which depress and pack the soil over which they travel. Depending on the desired spacing for which the opener assemblies are set on the implement, it is sometimes necessary for an opener assembly to plant into the soil which has been packed by the implement wheels. It is desirable for such an opener to be able to apply more pressure to the opener disc to penetrate the packed soil to the proper planting depth.

A further consideration is that in the Deere assembly, the biasing element may come out of contact with the opener when it pivots downwardly to areas which are lower than the average soil elevation thus resulting in a loss of downpressure. It is desirable to prevent/avoid this situation.

SUMMARY OF THE INVENTION

The main object of the invention is to alleviate the disadvantages of prior art equipment and practices and to provide equipment at least partially satisfying the needs referred to above.

In one aspect the invention provides a downpressure biasing assembly adapted to be positioned between an implement mount and a ground working tool to bias the tool toward the ground when in operation; said biasing assembly being arranged:

(a) to absorb motion of the tool relative to the implement mount in a first range of motion while providing a relatively lower range of downpressure biasing forces, and

(b) to absorb motion of the tool relative to the implement mount in a

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second range of motion while providing a relatively higher range of downpressure biasing forces.

In a preferred form of the invention said biasing assembly includes first and second springs of different spring constants arranged in series wherein:

5 (a) said first spring is adapted to absorb motion of the tool relative to the implement frame in a first range of motion while providing a relatively lower range of downpressure biasing forces, and

(b) said second spring is adapted to act when said first spring has been compressed to provide a second range of motion while providing a relatively
10 higher range of downpressure biasing forces.

In a preferred embodiment said springs are supported in a precompressed state and an adjustment device is provided for varying or setting the degree of precompression applied to said springs.

The spring constant K_2 of the second spring is preferably sufficiently
15 larger than the spring constant K_1 of the first spring that said second spring is not significantly displaced during the first range of motion, with said adjustment device being settable to precompress said first spring to select the second range wherein the biasing force becomes a function of said second spring.

20 The first and second springs preferably are coil springs and said adjustment device incorporates a screw threaded device enabling the degree of precompression applied to said springs to be adjusted.

In accordance with a further aspect of the invention there is provided an agricultural ground-working implement including an implement mount, a
25 ground working tool, and a downpressure biasing assembly positioned between the implement mount and a ground working tool to bias the tool toward the ground when in operation; said biasing assembly including a spring system providing multiple spring constants and being arranged:

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(a) to absorb motion of the tool relative to the implement mount in a first range of motion while providing a relatively lower range of downpressure biasing forces, and

5 (b) to absorb motion of the tool relative to the implement mount in a second range of motion while providing a relatively higher range of downpressure biasing forces.

The several features of the implement and its biasing system are set forth in the claims appended hereto.

10 In a preferred form of the invention said ground-working tool comprises a ground opener unit including an opener disc pivotally secured to said implement mount by an arm pivotally attached to said mount, said biasing assembly being operatively secured between said mount and said arm to apply said downpressure biasing forces to said disc via said arm.

15 Further according to a preferred form of the invention said ground-working tool further includes a gauge wheel for setting the depth of penetration of the opener disc into the soil. Preferably, said ground-working tool further includes a seed tube for directing seed and/or fertilizer into a furrow cut by said disc, and a resiliently biased packer wheel for thereafter closing said furrow.

20 Thus, in further summary, a preferred embodiment of applicants' invention provides a plurality of springs having different spring constants arranged in series in a downpressure assembly to bias a planting tool toward the ground. Dual or multiple ranges of downpressure are selectable by setting the amount of precompression of the assembly. The assembly allows the planting tool to pivot relative to the implement frame to follow contours of the ground
25 while being biased toward the ground. The working position of the tool is maintained by a gauge wheel adjacent a disc furrow opener which gauge wheel also acts as a disc cleaning mechanism. As noted above, the downpressure

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assembly preferably employs multiple springs providing multiple spring constants to effect a rapid and significantly broad change in pressure settings with a minimal displacement in the precompression setting. Springs with different wire diameters, are preferred since they offer a greater differential
5 between downpressure ranges than can be achieved by varying the spring coil diameter or coil pitch. The spring sections having different wire diameter are typically made as separate pieces due to present practical manufacturing limits.

BRIEF DESCRIPTION OF THE VIEWS OF DRAWINGS

Fig. 1 is a side elevation view of a disc ground opener unit having
10 multiple ranges of downpressure in accordance with an embodiment of the invention;

Fig. 2 is a rear end elevation view thereof;

Fig. 3 is a top plan elevation view thereof;

Fig. 4 is a rear perspective view of the opener disc, arm and bracket
15 assembly;

Fig. 5 is a perspective view of the packer wheel mounting assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figs. 1, 2 and 3 show an opener assembly having the forward end of L-shaped opener arm 10 pivotally mounted to a main mounting arm 12 at pivot
20 point 10a. Mounting arm 12 is adapted to be attached to a main implement frame (not shown) to which are attached a plurality of spaced apart opener assemblies. The trailing end of opener arm 10 pivotally supports a disc furrow opener 14 and an accessory bracket 16, opener 14 having a rotation axis A coincident with the pivot axis between the bracket 16 and arm 10. The
25 accessory bracket 16 is further connected by a pivot link 18 extending between pivot 18a on the lower end of mounting arm 12 and a pivot 18b on accessory bracket 16 so as to form a parallel linkage arrangement with the opener arm 10

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which maintains a constant orientation of the accessory bracket 16 as the opener arm 10 and link 18 pivot relative to the mounting arm 12.

A seed tube 20, disc scraper 22, gauge wheel 24, and packer (closing) wheel 26 are supported on the accessory bracket 16. The gauge wheel 24 is
5 rotatably mounted to depth adjustment mechanism 28 which, in turn, is mounted to accessory bracket 16. Wheel 24 is positioned adjacent one face of the disc opener 14 (Fig.3). The wheel 24 has a resilient shallow tire extending around its perimeter having a lip 24a which engages the adjacent face of the opener disc 14 to clean the latter during rotation in known fashion. The gauge
10 wheel 24 may be adjusted generally vertically relative to bracket 16 by rotating knob 28a to rotate an adjustment screw (not shown) of depth adjustment mechanism 28. Gauge wheel 24 thus acts as an adjustable depth control to limit the penetration of the disc opener 14 into the soil, as the wheel 24 rolls on the surface of the ground.

15 The pivot axis defined by pivot point 10a is angled relative to mounting arm 12 to provide a pivot angle B (see Fig.3). The disc opener 14, gauge wheel 24, arm 10, link 18 etc. are all oriented at angle B to the forward direction of travel T of the opener assembly to effect opening of the soil in generally well known fashion.

20 The packer wheel 26 is pivotally connected to the accessory bracket 16 by way of a rearwardly extended packer arm 30 (Fig. 5), and a coil tension spring 32 is connected between the packer arm 30 and accessory bracket 16 to bias the packer wheel 26 toward the ground to help close the furrow opened by disc 14 after seeds have been implanted therein via the seed tube 20 in known
25 fashion.

A downpressure or biasing assembly 34 according to an embodiment of the invention is connected between the opener arm 10 and the mounting arm 12 to bias the opener arm 10 toward the ground, with the reaction being received

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through the mounting arm 12 through to the main implement frame (not shown). The biasing assembly 34 includes a tension rod 36 having front and rear ends. A rear plate 38 is secured to the rear end of rod 36 and the front end of the tension rod 36 slidably extends through a hole in front plate 40. The front plate 40 is rigidly connected to the mounting arm 12. First and second coil springs 42, 44 are fitted over the tension rod 36 and held between the front and rear plates. The front end of the tension rod 36 is pivotally connected to the opener arm 10 at point 36a spaced from pivot 10a so that pivoting movement of the opener arm 10 causes a displacement of the tension rod 36 through the front plate 40. This changes the distance between the front and rear plates 40, 38 thus effecting a displacement of the coil springs 42,44. The springs resist compressive displacement and constantly bias the opener arm 10 and the complete opener assembly toward the ground.

The first and second springs 42, 44 are arranged in series between the plates 40, 38. The 1st and 2nd springs abut each other with their opposite ends abutting the rear and front plates respectively. A sleeve 46 attached to the rear plate 38 extends through the inside of the first coil spring 42 and partially inside the second coil spring 44 to keep the springs 42, 44 in abutting alignment. The tension rod 36 includes a threaded stud 37 which extends through plate 38 and into a central bore in the forward end portion of tension rod 36 to allow the operator to adjust the effective length of the tension rod 36 by rotating stud 37 to set the precompression loading on the springs 42, 44, thus setting the range of downpressure available for the working range of the planting tool.

In the first working range of motion the assembly, both springs 42, 44 develop the load placed on the biasing assembly 34, but the spring constant K_2 of the 2nd spring 44 is much larger than spring constant K_1 of the 1st spring 42 so the second spring is not significantly displaced during the first range of

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operation. It will however conveniently absorb sufficient motion as to provide for full tripping action over obstacles. A second range of operation can be selected by adjusting and setting the spring precompression by way of adjustment stud 37 at some point at which the 1st spring 42 is fully compressed, in which case the biasing force is a function of only the 2nd spring 44.

An adjustment is thus provided in the biasing assembly 34 to set the amount of precompression in the spring assembly from a minimum pressure setting to a maximum pressure setting. At some point within the range of settings, the 1st spring 42 is fully compressed so that the biasing assembly operates only within the 2nd range of biasing force. A small amount of change to the precompression setting can significantly alter the working range biasing force, yet a large displacement remains available for large tripping motions that may be required in the working range.

Preferred embodiments of the invention have been described and illustrated by way of example. Those skilled in the art will realize that various modifications and changes may be made while still remaining within the spirit and scope of the invention. Hence the invention is not to be limited to the embodiments as described but, rather, the invention encompasses the full range of equivalencies as defined by the appended claims.

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CLAIMS:

1. A downpressure biasing assembly adapted to be positioned between an implement frame and a ground working tool to bias the tool toward the ground when in
5 operation; said biasing assembly including first and second springs of different spring constants arranged in series wherein:

(a) said first spring is adapted to absorb motion of the tool relative to the implement frame in a first range of motion while providing a relatively lower range of downpressure biasing forces, and

10 (b) said second spring is adapted to act when said first spring has been compressed to provide a second range of motion while providing a relatively higher range of downpressure biasing forces.

2. The downpressure biasing assembly of claim 1 wherein said springs are
15 supported in a precompressed state and wherein an adjustment device is provided for varying or setting the degree of precompression applied to said springs.

3. The downpressure biasing assembly of claim 2 wherein the spring constant K_2 of the second spring is sufficiently larger than the spring constant K_1 of the first spring
20 that said second spring is not significantly displaced during the first range of motion, said adjustment device being settable to precompress said first spring to select the second range wherein the biasing force becomes a function of said second spring.

4. The downpressure biasing assembly of claim 2 or 3 wherein said first and
25 second springs are coil springs and said adjustment device incorporates a screw threaded device enabling the degree of precompression applied to said springs to be adjusted.

5. The downpressure biasing assembly of claim 2 or 3 wherein said first and second springs are coil springs and wherein said adjustment device includes a tension rod
30 extending axially through said springs, and a device to transmit the compression force of said springs to said rod, said device having a screw-threaded adjustment thereon for varying the degree of precompression applied to said springs.

6. An agricultural ground-working implement including an implement frame, a ground-working tool and a downpressure biasing assembly positioned between the implement mount and the ground working tool to bias the tool toward the ground when in operation; said biasing assembly including first and second springs of different spring constants arranged in series wherein:

(a) said first spring is adapted to absorb motion of the tool relative to the implement mount in a first range of motion while providing a relatively lower range of downpressure biasing forces, and

(b) said second spring is adapted to act when said first spring has been compressed to provide a second range of motion while providing a relatively higher range of downpressure biasing forces.

7. The ground-working implement of claim 6 wherein said springs are supported in a precompressed state and wherein an adjustment device is provided for varying or setting the degree of precompression applied to said springs.

8. The ground-working implement of claim 7 wherein the spring constant K_2 of the second spring is sufficiently larger than the spring constant K_1 of the first spring that said second spring is not significantly displaced during the first range of motion.

9. The ground-working implement of claim 7 or 8 wherein said first and second springs are coil springs and said adjustment device incorporates a screw threaded device enabling the degree of precompression applied to said springs to be adjusted.

10. The ground-working implement of claim 7 or 8 wherein said first and second springs are coil springs and wherein said adjustment device includes a tension rod extending axially through said springs, and a device to transmit the compression force of said springs to said rod, said device having a screw-threaded adjustment thereon for varying the degree of precompression applied to said springs.

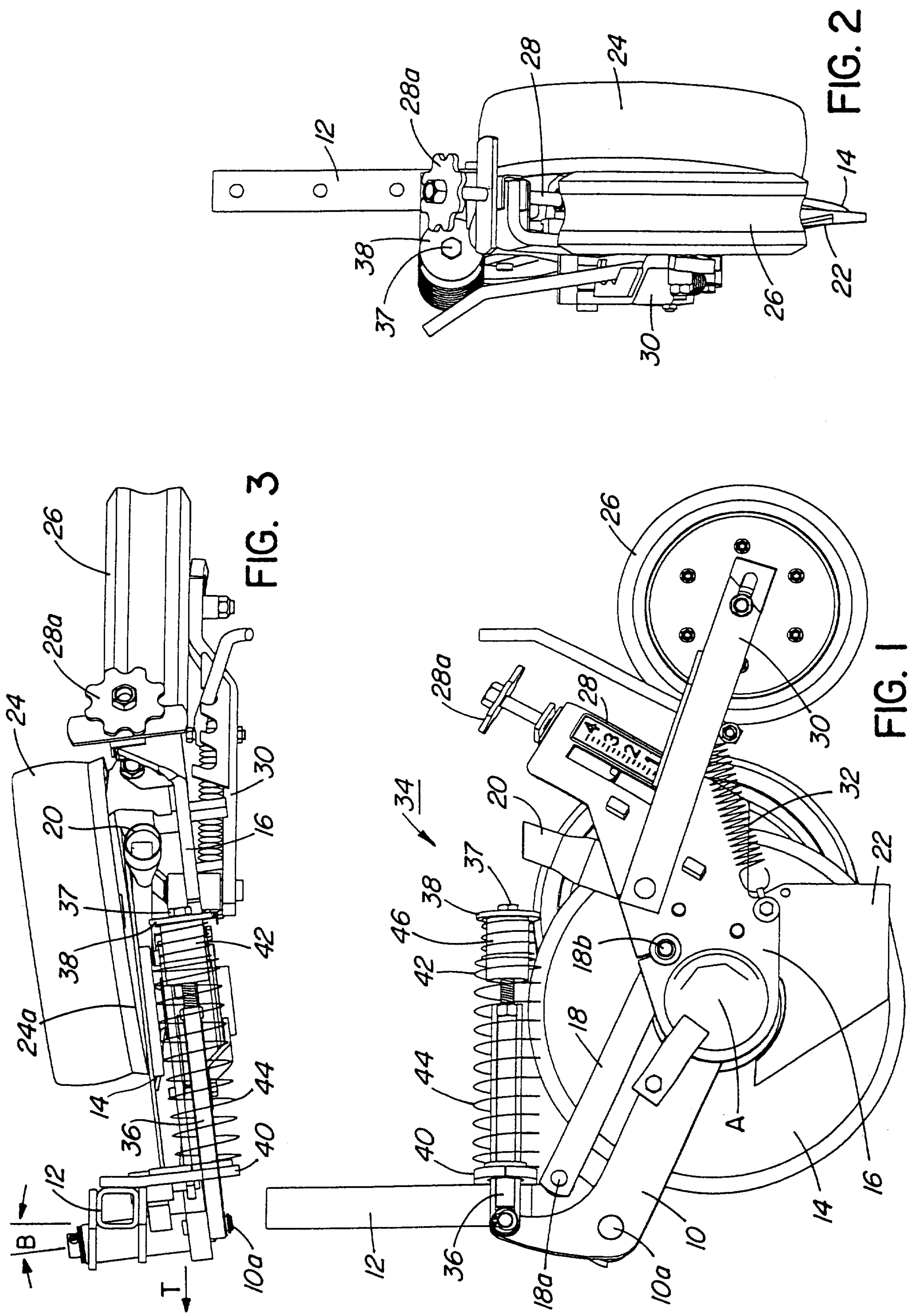
11. The ground-working implement of any one of claims 5-10 wherein said ground-working tool comprises a ground opener unit including an opener disc pivotally secured to said implement mount by an arm pivotally attached to said mount, said biasing

assembly being operatively secured between said mount and said arm to apply said downpressure biasing forces to said disc via said arm.

12. The ground-working implement of claim 11 wherein said ground-working
5 tool further includes a gauge wheel for setting the depth of penetration of the opener disc into the soil.

13. The ground-working implement of claim 12 wherein said ground-working
tool further includes a seed tube for directing seed and/or fertilizer into a furrow cut by
10 said disc, and a resiliently biased packer wheel for thereafter closing said furrow.

14. The ground-working implement of any one of claims 11-13 wherein the
biasing assembly includes a tension rod having one end pivotally connected to said arm
and its opposing end arranged to receive spring compression forces such that said forces
15 are translated into said downpressure biasing forces.



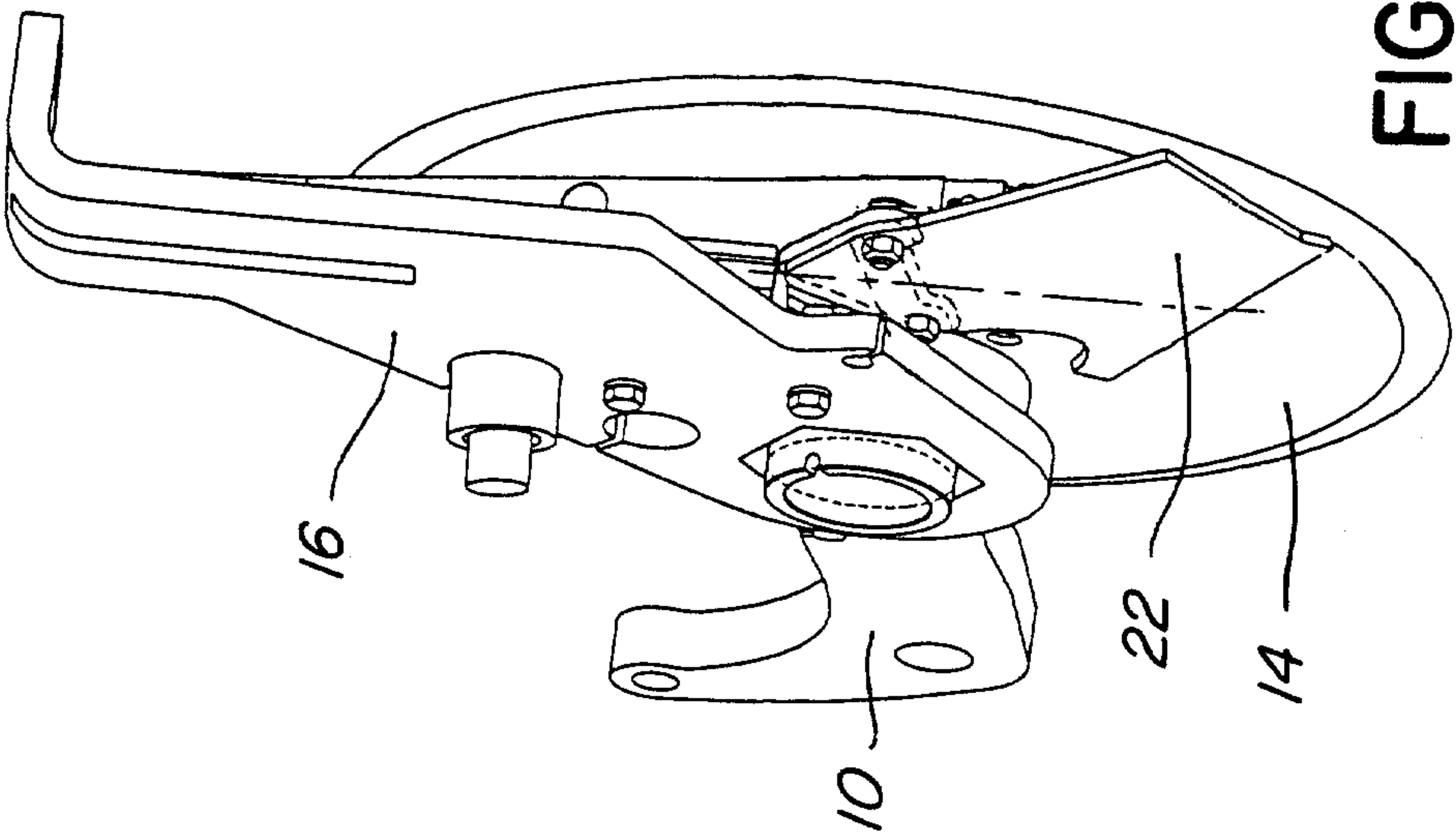


FIG. 4

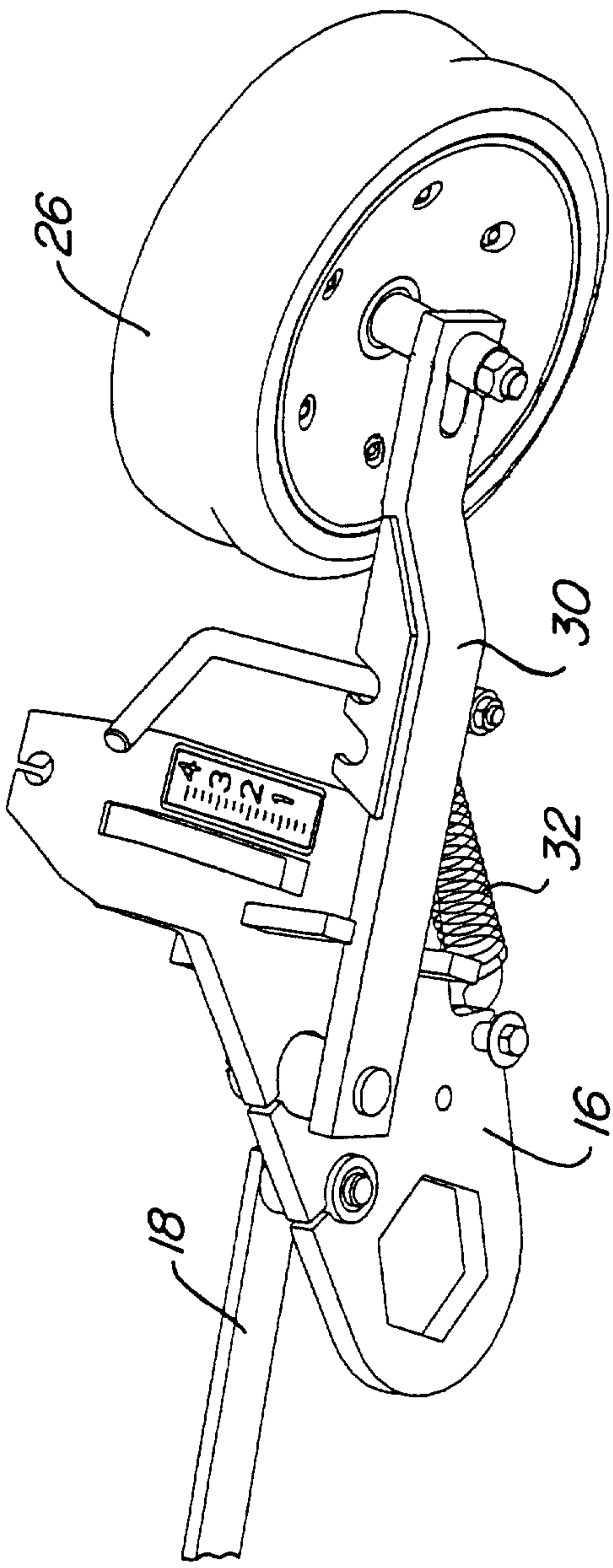


FIG. 5

