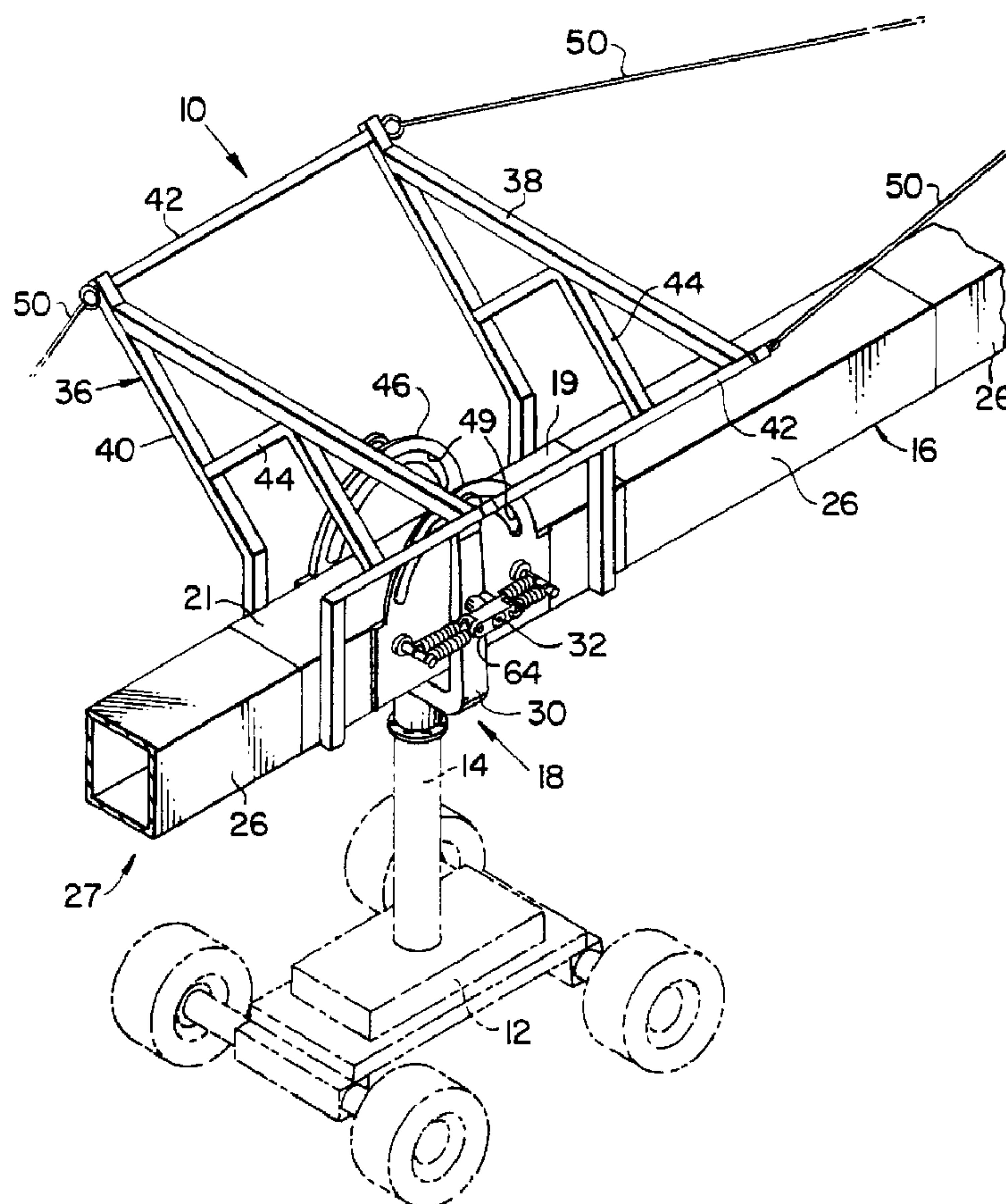




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(54) Titre : BRAS DE GRUE DE CAMERA AVEC SYSTEME D'EQUILIBRAGE
(54) Title: CAMERA CRANE ARM WITH BALANCING SYSTEM



(57) Abrégé/Abstract:

A camera crane (10) has a spring balancing system for better maintaining the crane arm in balance as the crane arm (16) is raised and lowered. A spring link (64) is pivotably attached to a support frame (30) on a pivot axle (32). Spring posts (60, 62) are attached

(57) **Abrégé(suite)/Abstract(continued):**

to the crane arm section (16). Springs (68) extend from the spring link to the spring posts. As the crane arm is raised, the springs exert a counterbalancing force. The spring balancing system can be disengaged by removing a pin (70) extending through the spring link into the support.

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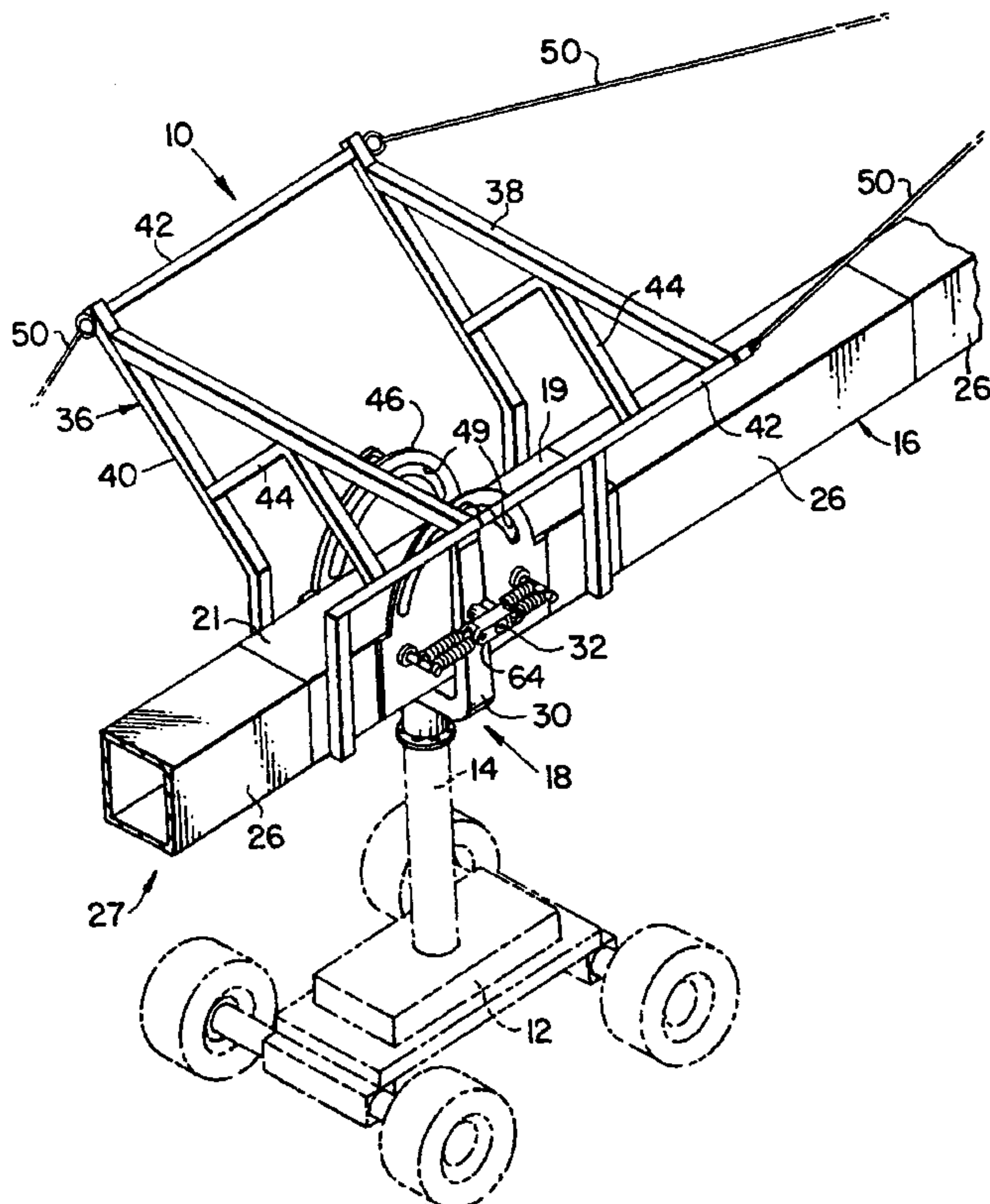
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(54) Title: **CAMERA CRANE ARM WITH BALANCING SYSTEM**



(57) Abstract: A camera crane (10) has a spring balancing system for better maintaining the crane arm in balance as the crane arm (16) is raised and lowered. A spring link (64) is pivotably attached to a support frame (30) on a pivot axle (32). Spring posts (60, 62) are attached to the crane arm section (16). Springs (68) extend from the spring link to the spring posts. As the crane arm is raised, the springs exert a counterbalancing force. The spring balancing system can be disengaged by removing a pin (70) extending through the spring link into the support.

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DESCRIPTION

CAMERA CRANE ARM WITH BALANCING SYSTEM

BACKGROUND OF THE INVENTION

5 The field of the invention is camera cranes.

Camera cranes are used in the production of motion pictures, video, and television programs. Typically, a camera crane arm or boom is pivotably mounted onto a base. A camera is mounted on a camera platform at the front end of the arm. Counterweights on a counterweight platform or bucket at the back end of the arm are added to place the arm
10 into a balanced, or near balanced equilibrium. The base may be a mobile dolly or platform.

The length of the arm is adjusted by adding or removing crane arm segments, which are bolted and/or pinned together to form an integral arm. The camera crane arm is preferably highly rigid, when assembled, to avoid inadvertent deflections of the camera as
15 the camera crane arm is moved. For example, if the camera crane arm is not sufficiently rigid, rapid movements of the camera crane arm (as may be necessary to film a sequence having rapid movements) may result in flexing or whipping of the arm and camera, rendering the filmed sequence unusable. However, while a highly rigid camera crane arm is desirable, at the same time, the arm should be able to be assembled into a long length, to
20 provide an adequate range of lens height, and the arm should be light weight and preferably compact, so that it can be readily stored, shipped, assembled and maneuvered. To make the camera crane arm more rigid, tensioning cables may also be used. Typically, the cables extend from various locations along the arm, to a cable truss extending above the central section of the camera crane arm, which is pivotably mounted on the crane arm
25 base.

While these types of camera cranes have worked well in the past, certain disadvantages remain. Due to the geometry of the camera crane arm, bending deflection of the camera crane arm when loaded, and to the shifting position of the camera crane arm and cable truss, as the arm elevation is changed, the arm cannot be uniformly balanced
30 purely via counterweights. For example, a camera crane arm may be balanced purely with counterweights, when the arm is in the horizontal position. However, as the arm is raised to elevate the camera, the center of gravity of the cable truss shifts rearwardly, bringing

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the arm out of balance and making the arm back-end heavy. Consequently, to return the arm to a horizontal position requires significant upward force at the back end or weight bucket of the arm. This requires the camera crane operators to do significant lifting, and to operate the crane with a higher level of care and skill. In addition, the arm becomes
5 unstable, so that significant braking forces are needed to hold it in position. Hence an improved balancing system is needed.

STATEMENT OF THE INVENTION

To these ends, a camera crane includes a support frame or U-frame. A camera
10 crane center or post section is preferably pivotably mounted to the support frame. A spring balancing system includes a spring link also attached to the support frame. A spring post or other fitting is attached to the crane arm section. At least one spring is attached to both the spring post and to the spring link. With the spring link fixed in position, upward pivoting movement of the camera crane arm, which tends to make the
15 crane arm back-heavy also simultaneously stretches the spring. The spring exerts a counter force which tends to negate the back-heavy condition of the camera crane arm. As a result, the camera crane arm remains more uniformly balanced, not withstanding the variations in forces which occur during changes in elevation of the arm.

Preferably, the spring link can be locked into a fixed position with a quick release
20 pin, so that the spring force exerted by the spring counteracts the other forces tending to make the crane arm back heavy. Releasing the pin allows the spring link to pivot, in response to the spring force, thereby disengaging the spring counterbalancing system.

Spring posts are advantageously provided in front and in back of the spring link. Additional counterbalancing force can be provided by attaching multiple springs onto the
25 spring link and spring posts.

The spring balancing system may be provided on one side, or on both sides of the camera crane arm.

The invention resides as well in sub-combinations of the features described.

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An aspect of the invention provides a camera crane having a crane arm attached to an axle supported on a support frame, and with a length of a front section of the crane arm forward of the axle greater than a length of a
5 back section of the crane arm behind the axle, and with a counterweight platform on the back section of the crane arm, and with a camera platform on the front section of the crane arm, and with a spring link attached to the support frame adjacent to the axle, and with at least one spring post
10 attached to the crane arm, and with at least one spring attached to the at least one spring post and to a first side of the spring link.

Accordingly, it is an object of an embodiment of the invention to provide an improved camera crane arm having
15 a system for better maintaining the camera crane arm in a balanced condition.

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BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, wherein the same reference number denotes the same element, throughout each of the views:

Figure 1 is a perspective view of the present camera crane arm;

5 Figure 2 is a side elevation view of the spring counterbalancing system of the invention;

Figure 3 is a plan view thereof; and

Figure 4 is a section view thereof, taken along line-4 of Figure 3.

10 DETAILED DESCRIPTION OF THE DRAWINGS

Turning now in detail to the drawings, as shown in Figure 1, a camera crane 10 is pivotably mounted on a base post 14 extending upwardly from a mobile base 12, for example, a mobile base as described in U.S. Patent Numbers 5,312,121 or 5,671,932.

15 The crane arm, or arm assembly 16, includes a post or center section 18 pivotably supported (in azimuth and elevation) on the base post 14. Typically, mid-beam sections 26 are attached to each other, and to the front end 19 and back end 21 of the post section 18, to build up the crane arm 16 to the desired length. The front end of the crane arm, which directly affects the available range of the camera lens height, is typically longer than the back end 27 of the crane arm 16. A camera platform is attached to a nose section
20 at the extreme front end of the crane arm 16 and a counterweight platform or bucket is similarly attached at the back end of the crane arm 16, as shown, for example, in U.S. Patent Number 5,781,814. A leveling system is also provided to maintain the camera platform in a level orientation, as the arm is raised or lowered, as also described in U.S. Patent Number 5,781,814.

25 Referring to Figures 1-4, a support, preferably in the configuration of a U-frame 30, is pivotably attached on top of the base post 14. The post section 18 is pivotably mounted on an axle 32 supported by the support 28. The post section 18 includes a center beam 34, which preferably has a square or rectangular cross section. The center beam 34 is mounted on the axle 32 via bearings 52.

30 Referring to Figures 1 and 2, a cable truss is attached to the post section 18. The cable truss 36 includes a forward truss frame 38 and a rear truss frame 40 connected by side links 42. Braces 44 are provided within the forward and rear truss frames 38 and 40,

to strengthen the frames. Cables 50 extend forwardly and rearwardly from the cable truss 36, to other points along the crane arm 16, to stiffen the crane arm.

A pair of drag plates 46 extend upwardly from the center beam 34. A drag knob 48 extends through the support 30 and into an arcuate slot 49 in the drag plate 42. The
5 drag on vertical pivoting movement of the crane arm 16 is adjusted by tightening or loosening the drag knob 48 on each side of the crane arm 16.

Referring to Figures 2 and 3, a spring link 64 is pivotably mounted on a spring link mounting post 66 extending outwardly over the axle 32. A front spring post 60 is attached to the center beam 34 of the post section 18, in front of the spring link mounting post 66.
10 Preferably, a rear spring post 62 is similarly attached to the center beam 34 of the post section 18, behind the spring link mounting post 66, with the front and rear spring posts 60 and 62 equally spaced apart from the spring link mounting post 66. The spring link mounting post 66 extends through the center of the spring link 64. One or more springs 68 is attached to the front spring post 60 and the front end 65 of the spring link 64, while
15 similarly, one or more springs is also attached to the rear spring post 62 and to the back end 67 of the spring link 64.

A quick release pin 70 extends through the spring link 66 into a receiving hole 71 in the support 30, with the spring link 64 in the horizontal position shown in solid lines in Figure 2.

20 In operation, as the front end 19 of the crane arm 16 is raised, the back end 21 of the crane arm 16 becomes back heavy, primarily due to the shifting weight of the cable truss 36, from a neutral or balanced position (when the arm 16 is horizontal) to an unbalanced position, with the center of gravity of the truss 36 shifted to a position behind the axle 32. Ordinarily, the arm 16 would remain back heavy, and require significant
25 lifting force to bring the arm back into a horizontal position, or significant braking force to hold it in position. However, the spring post (60 and/or 62), spring link 64, spring link mounting post 66, and spring 68, and release pin 70, form a spring balancing system 56, which in use, largely counteracts the back heavy effect.

Specifically, referring to Figure 2, with the pin 70 installed, the spring link 64 is
30 locked into the horizontal position shown in solid line, and it cannot pivot. Consequently, as the arm is moved from the horizontal position, shown in solid line, to the elevated position, shown in phantom line, the springs 68 are stretched. The rear spring (connected to the rear spring post 62) is stretched in tension and produces a moment acting clockwise

about the axle 32. Similarly, the front spring (connecting to the front spring post 62) exerts a counterclockwise moment about the axle 32. As a result, the moment created by the shift of the center of gravity of the cable truss 36 to a position behind the axle 32, is largely offset by the moments created by the springs 68.

5 The amount of offsetting force or moments can be adjusted by selecting springs having an appropriate spring constant, and/or by using multiple springs. For applications requiring only a slight counterbalancing force, only a single spring 68 may be needed, attached to either a front or rear post. However, in most applications, both front and rear springs will be preferred and multiple front and rear springs may be used. Although
10 Figure 2 shows the right side of the crane arm 16 and balancing system 56, a duplicate balancing system 56 is advantageously also provided on the left side, as shown in Figure 4. While the springs 68 shown are steel springs, other rubber or elastic spring-like materials may also be used.

 As shown in Figure 3, the front and rear spring posts 60 and 62 are advantageously
15 mounted on bearings 72, so that the posts can pivot slightly, to provide for smooth and quiet arm operation. Similarly, a friction reducing element such as a Delrin ring or bearing 75 is advantageously provided at the ends 65 and 67 of the spring link 64, to avoid slip/stick movement and noise.

 To disengage the balancing system 56, the pin 70 is removed from the support 30.
20 Then, as shown in phantom lines in Figure 2, as the arm 16 pivots about the axle 32, the spring link 64 also pivots. As a result, the distance between the ends of the spring link and the spring posts 60 and 62 remains unchanged, the springs do not stretch and no force is exerted. Consequently, with the pin 70 withdrawn, the arm 16 operates in the conventional manner.

25 In some applications, the pin on one side of the arm may be engaged, while the pin on the other side of the arm is disengaged, to provide an intermediate level of counterbalancing force. The pin 70 is preferably a quick release pin, which may be captive in the spring link 64, so that it is always in position and present to be engaged into the support 30, for use of the balancing system 56.

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CLAIMS:

1. A camera crane having a crane arm attached to an axle supported on a support frame, and with a length of a front section of the crane arm forward of the axle greater
5 than a length of a back section of the crane arm behind the axle, and with a counterweight platform on the back section of the crane arm, and with a camera platform on the front section of the crane arm, and with

a spring link attached to the support frame
10 adjacent to the axle, and with

at least one spring post attached to the crane arm, and with

at least one spring attached to the at least one spring post and to a first side of the spring link.

15 2. The camera crane of claim 1 with the spring link movable to a first position adjacent to the spring post and to a second position spaced apart from the spring post.

3. The camera crane of claim 2 further including a pin extendable through the spring link, to secure the spring
20 link into the first position or into the second position.

4. The camera crane of claim 1 with the spring link pivotably attached to the axle.

5. The camera crane of claim 1 further comprising a pin extendable through the spring link and into the support
25 frame, for locking the spring link into a first position or into a second position angularly offset from the first position.

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6. The camera crane of claim 1 further comprising a cable truss attached to the crane arm and with the cable truss having a center of gravity aligned with the axle.

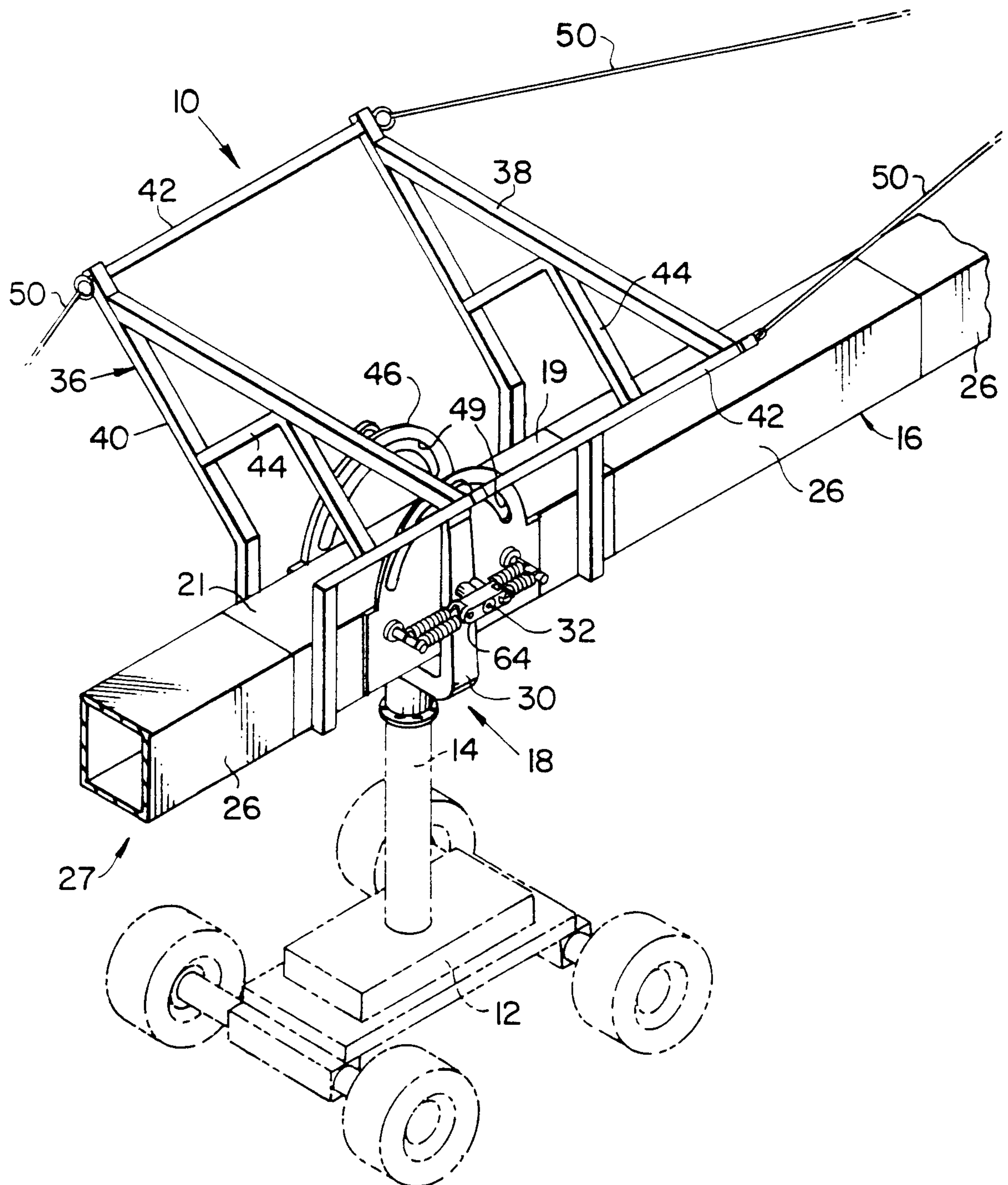
7. The camera crane of claim 1 further comprising a bearing between at least one of the first and second spring posts and the front section of the crane arm.

8. The camera crane of claim 1 with the crane arm having a first spring post on a first side of the axle and a second spring post on a second side of the axle opposite to the first side, and with a first spring attached to the first spring post and to a first end of the spring link, and with a second spring attached to the second spring post and to a second end of the spring link.

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PATENT AGENTS

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Fig. 1

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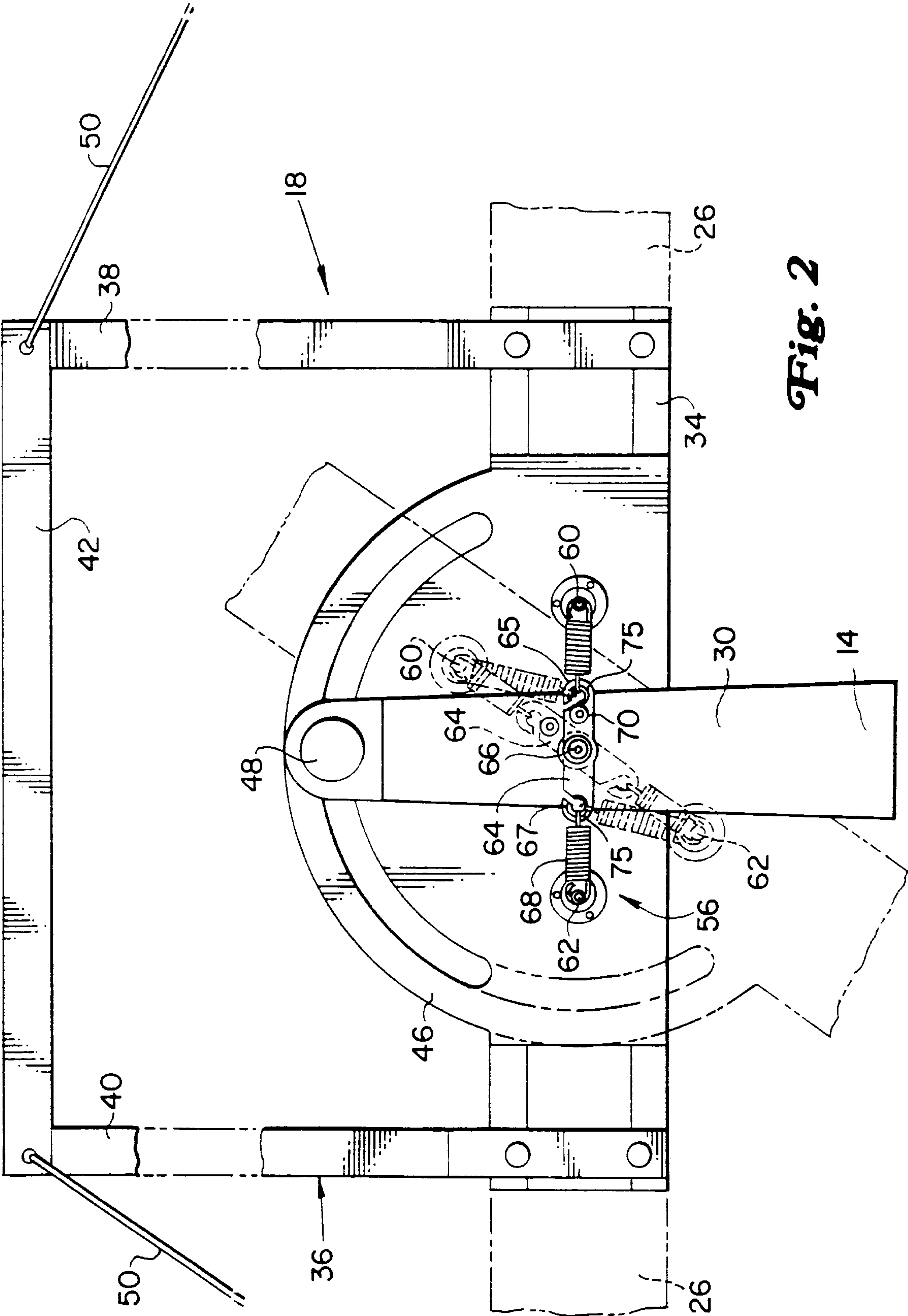


Fig. 2

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