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[54] **DRIVE ARRANGEMENT FOR TELESCOPICALLY ARRANGED ELEMENTS**

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[52] **U.S. Cl.** **173/44,** 64/23, 173/147, 175/321

[51] **Int. Cl.** **E21b 17/00**

[58] **Field of Search** 175/321; 173/43, 173/44, 147; 64/23

[56] **References Cited**

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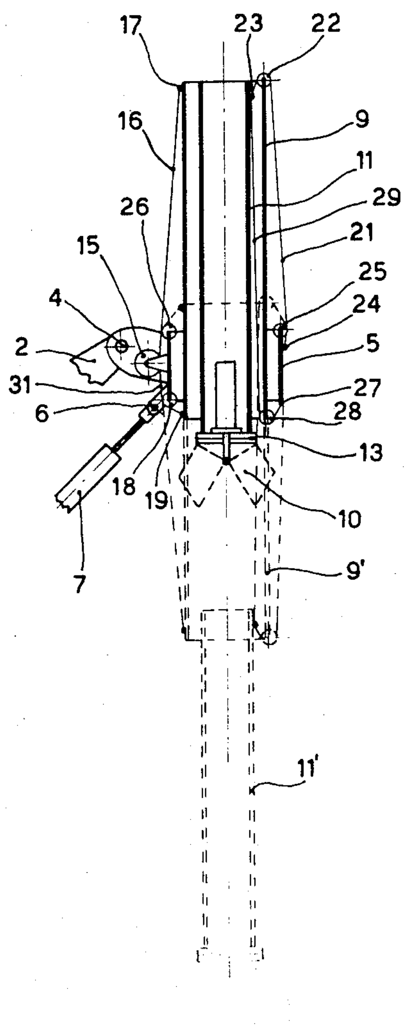
Primary Examiner—Ernest R. Purser
Attorney—Richard K. Stevens, Richard C. Harris and Angelo J. Mele et al.

[57] **ABSTRACT**

The invention relates to a drive arrangement for elements telescopically received one within the other. At least three telescopic elements are required, the intermediate one functioning as a movable pulley wheel for a fixed length cable means fixedly attached at opposite ends thereof to the outer and the inner elements respectively.

5 Claims, 2 Drawing Figures



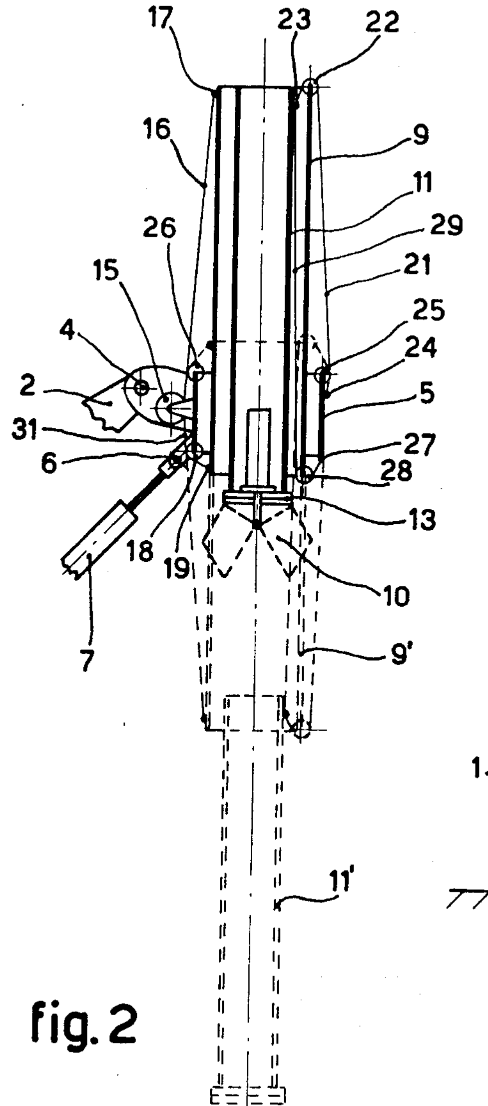

17
23
22
16
9
11
26
29
15
21
4
25
24
2
5
31
27
6
28
13
18
19
10
7
9'
11'

fig. 2

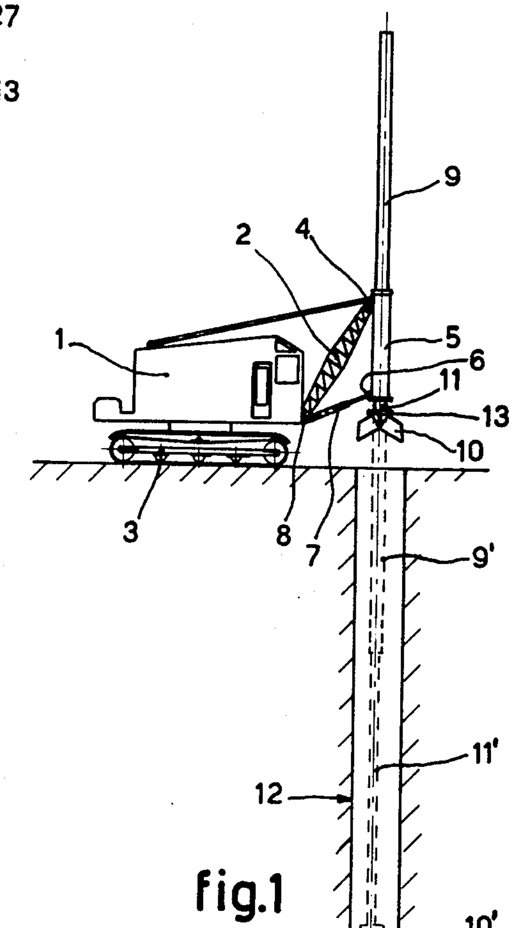

9
2
4
5
1
6
11
13
10
3
8
7
9'
11'
12
10'

fig.1

DRIVE ARRANGEMENT FOR TELESCOPICALLY ARRANGED ELEMENTS

The present invention has, as its subject, improvements to the telescopic columns generally, but has particular utility for machines for making foundations; to be more specific, telescopic columns which operate grabs or drills and which are used in the construction of foundations and are transported on self-propelled means.

Telescopic columns which are employed for this purpose are already known and consist of two, three or more elements, the innermost element alone being normally driven.

These types of telescopic columns act in such a way that the motions of descent and/or ascent are imparted to the innermost column alone, which during the phase of descent draws with it all the other columns until they have reached the end of their run.

During the phase of ascent the innermost column rises alone until the next column outside it strikes against its ascent buffer, after which they both continue the ascent together.

This system of operation has the following inconveniences: shock-absorbers are needed in the ascent buffers; discontinuous power is required of the lifting means and therefore adjustment of pulling force is difficult; there is minimal guidance during descent, from when the outermost column reaches the end of its run; construction is complex; for purposes of strength and to reach worthwhile depths it is necessary to use a noteworthy number of columns solely for guidance purposes; so as to reach a depth of 30 meters three columns plus the guidance sleeve are required; lastly the only force exerted on the grab during the last part of its run is the force exerted by its own weight and by the last column.

As compared with the systems already known, the herein proposed improvements permit the following: elemination of shock absorbers and simplification of the construction of the columns; adjustment, as required and in a constant manner, both of the force to be applied to the grab and of the speed of impact of the grab; maintenance of the guidance of the columns at an optimum value always, with a slight reduction thereof only when they are in the position of full extension; lastly, the ability to reach the same depth with fewer movable shafts, two shafts, for example being enough to reach depths of thirty meters. It can thus be seen how the improvements herein proposed enhance to a notable extent the state of the art already known.

The aforementioned improvements are embodied in the use of: drive means placed on a guidance sleeve which can be adjustably positioned; and also shafts which are subject to guidance but are self-moving, some of them acting as movable pulleys.

More particularly, the invention comprises the following, where two movable shafts are used: a drive unit, which could even be a winch with a drum for winding up two cables in the same direction, is mounted immovably on a guidance sleeve. While the drive means could also consist of one or two double-action or single-action pistons, where a winch is used as the drive means the two ends of the cables are fixed to the ends of the outer movable shaft. Thus, when one cable is slackened off, the other is wound up and vice-versa, and therefor the outer movable shaft which slides within the guidance sleeve can be moved as required within that sleeve, it being enough to activate the winch; clearly, it would be sufficient to use one cable connected to the base of the shaft so as to control the movement of the latter, but if this were done one could only make use of the force of gravity and of the maximum speed which the force of gravity is able to impart; while if two cables are used, it is possible to drive and control the shaft as required.

As mentioned, where two movable shafts are used (although three or more movable shafts could be employed under the mechanics of the system proposed), the inner shaft will be connected to the guidance sleeve by two cables. The two cables are fixedly connected at opposite ends thereof to the guidance sleeve and to the upper end of the second (inner movable) shaft.

In the fully-raised position one cable passes over the upper end of the outer movable shaft while the second passes through the inside of the same shaft; the first cable is then connected to the guidance sleeve while the second turns beneath the same shaft and then also goes on to be connected to the guidance sleeve.

Clearly, one could also have two or more drive wheels and two or more cables where I have only shown one for the sake of simplicity, just as there could clearly be grooved pulleys or other means to prevent wear on the cables in the areas where the cables change direction.

In the fully-raised position, therefore, the position will be that of the two cables which come out of the winch the one which goes upwards will be completely unwound, while the cable which goes downwards will be completely wound up; and of the two cables which connect the guidance sleeve to the inner movable shaft, the cable which passes above the outer movable shaft will be completely outside the same shaft, while the cable which passes below the outer movable shaft will be completely inside the same shaft. In the fully-lowered position the cables will be positioned in the opposite manner.

With such a connecting system, the outer movable shaft functions as a movable pulley, while the cable which connects the inner shaft to the guidance sleeve performs the function of a drive cable of a predetermined fixed length. Therefore, just as with a movable pulley, if the length of the cable is kept fixed and the pulley wheel is moved, the moving end of the cable has to move in parameters double those of the pulley wheel, so in this invention the inner movable shaft which acts as a moving attachment moves to an extent double that of the movement of the outer movable shaft which acts as a movable pulley wheel.

The attached drawing shows, as an example, a preferred, non-limitative embodiment of the invention.

FIG. 1 shows a shovel excavator, driven by cables, and illustrates a telescopic column which, in accordance with the invention comprises two movable telescopic elements plus a guidance sleeve.

FIG. 2 is an enlarged detail view of the telescopic arrangement of FIG. 1.

Referring to the drawing, reference **1** indicates an excavator, which in this case, operates with cables but could also be of a hydraulic-drive type or of other types normally offered commercially. The excavator **1** has an arm **2**, such as of the trellis type, and operates during its movements on the tracks **3**. At the end of the arm **2**, there is hinged at **4** the guidance sleeve **5**, to which at **6** is attached a means **7**, in this case a piston, which by counteraction at 8 serves to determine the axial orientation of sleeve 5 and, thereby of the entire telescopic column.

In place of the means 7, a cable drive could be used, in which case its attachment point would be positioned above the point 4 if movement is to be carried out only towards the outside of the system (i.e., movement away from the excavator); whereas, if movement of the grab is to be both outwards and inwards, then two sets of cables will be attached, one above and the other below the point 4.

If, on the other hand, a piston or similar means are used, movement will be carried out by means of one single counteracting means 7, whose point of application will depend only on the availability of attachments.

Within the guidance sleeve 5 there is housed, an outer movable shaft or columnar element 9 within which is the inner movable shaft or columnar element 11. The column 9 can slide axially within the guidance sleeve 5, and the column 11 can do the same within the column 9. For illustration only, two movable shaft elements are disclosed; however, the invention is equally applicable to telescopic arrangements comprising more than two movable shafts.

The grab 10, which could be replaced with other implements, such as a drill for example, is fixed onto a platform 13 which, in turn, is connected to the innermost column which in this case is column 11.

The platform 13 can be immovable or rotatable. It will be rotatable where it is necessary to use a drill or rotating grab for excavation-erosion work or the like.

Rotation could be provided by a hydraulic motor.

While the shafts 9 and 11 go down, the grab 10 excavates the hole 12, whose depth is determined by the length of the shafts.

With reference to FIG. 2, which shows, the principles of operation of a two-movable shaft telescopic column, the guidance sleeve 5 carries on one side thereof both the drive means, such as a winch, and also the articulated-joint means 4 and the attachment means 6, and on the other side, in a position which is not the only one possible and has been shown only to render the description easy, the fixture means 24 and 27, which could be replaced by one single means, for the cables 21 and 29.

Besides this, one could have on the guidance sleeve 5 some transmission pulleys 18, 25, 26 together with others to suit the directions in which the cables have to run. The cables 16, 21, 29, 31 are here shown, as an example, as being single in number, but they could be more than one in number for each usage and could be differently positioned around the shaft.

The cables 16 and 31 extend in opposite directions from the winch 15, in such a way that, while one is being wound up, the other is being unwound and vice versa. By means of these cables, one can drive the telescopic shaft 9, which is fixed immovably to the cables by the fixture means 17 and 19.

Correspondingly, with the cables 21 and 29, there are on the shaft 9 the transmission pulleys 22 and 28 onto which the above said cables are partly wound.

Said cables, which, are fixed respectively at 24 and 27 are connected to the shaft 11, which is within the

shaft 9, at 23 and, while one cable, 21 to be exact, passes above the shaft 9, the other cable 29 passes below it.

Therefore, if the shaft 9 is lowered by an amount X, while the cables 21 and 29 are connected to fixed points 24 and 27, the shaft 11 is forced to move by an amount 2X at a speed double that at which the first shaft moves.

If one adjusts the speed of descent or the distance to be moved on the first shaft 9, the driven shaft 11 will move in parameters double those used by the first shaft.

Thus is effected the principle of the movable pulley by using, however, a cable of fixed length which is anchored at one end to a movable means.

It is now simple for a man skilled in this field to effect telescopic columns of three or more movable shafts, because it is enough that the middle of any three successive shafts should act as a movable pulley, while the outer shaft acts as a fixed point and the innermost shaft of the three acts as a movable point.

Under this system, the force acting on the grab or on the drill can always be controlled and is always equal to the value desired, since the operator determines and maintains it.

What is claimed is:

1. A telescopic column comprising at least one group of three coaxial members telescopically arranged one within the other, said group comprising an outer, an intermediate and an inner member, the intermediate one of said members being axially slidable within the outer one of said members and the inner one of said members being axially slidable within the intermediate one of said members, a cable means comprising a fixed length cable fixedly attached to the outer and inner ones of said members, respectively, the intermediate one of said members constituting a movable pulley wheel means for said cable, whereby the inner one of said members is constrained to travel axially relative to the outer member double the distance of the intermediate member pursuant to the intermediate member being moved axially relative to the outer member.

2. The column of claim 1, said intermediate member having a cable guide at each of two longitudinally spaced apart points thereon, said cable means comprising respective lengths of said cable fixedly attached to said inner member and extending therefrom in opposite directions to over each of said guides and then to said outer member, said lengths of cable being fixed to said outer member whereby said cable lengths are constant for all telescopic positions of said members relative to each other.

3. The column of claim 1, including a drive means for driving said intermediate member axially relative to said outer member.

4. The column of claim 1, including a guidance means for changing the inclination of the telescopic axis relative to earth.

5. The column of claim 1 applied to an earth boring apparatus and comprising a boring tool attached at one end of said inner member.

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