

[54] **COMPACTOR FOR SOIL AND THE LIKE
WITH IMPROVED VIBRATOR ASSEMBLY**

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[51] **Int. Cl.**..... **E01c 19/34**

[58] **Field of Search**..... **404/133, 117; 74/87**

[56] **References Cited**

UNITED STATES PATENTS

2,778,231	1/1957	DeGail.....	74/87
2,937,537	5/1960	Woll	74/87 X
3,001,458	9/1961	Croucher.....	404/133
3,192,839	7/1965	Vivier.....	404/117
3,279,338	10/1966	Briggs.....	404/133 X
3,618,485	11/1971	Hermann.....	404/117

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[57] **ABSTRACT**

A compactor for soil and the like includes a pair of concentric weights which are disposed to rotate about the same axis and with the weights being disposed concentrically on different radii with respect to the axis. More specifically, one eccentric weight and an associated bevel gear are fixedly mounted to the drive shaft which defines the said axis, while the other weight and its associated bevel gear are freely rotatable thereon. The bevel gears are connected by a pinion which is mounted on a shift ring disposed on one side of the weights, which in turn is freely mounted on the drive shaft and freely rotatable within the vibrator housing. A differential drive means is thus provided.

Means are provided to hold the shift ring in the desired position, and to permit rotation of the ring when a different angle of force is desired. In one embodiment, a locking pin selectively engages abutments on the ring. In another embodiment, an adjustable cable holds the ring in position.

11 Claims, 5 Drawing Figures

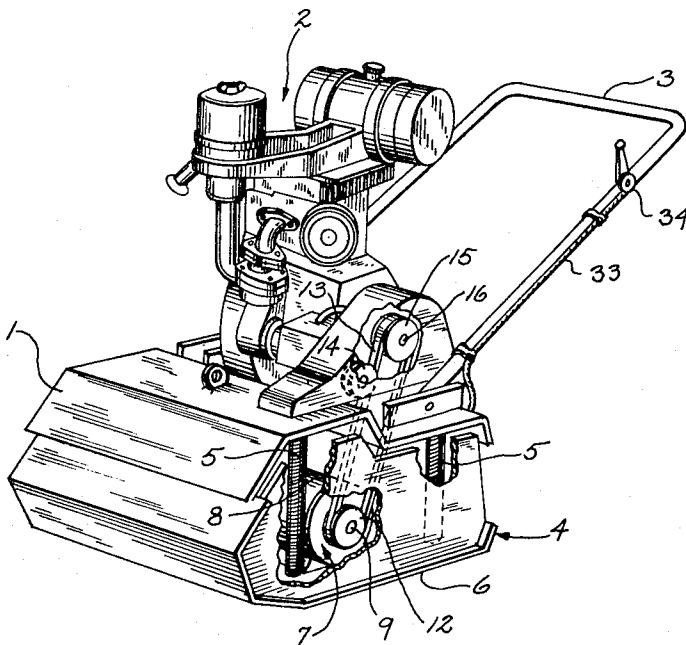


Fig. 1

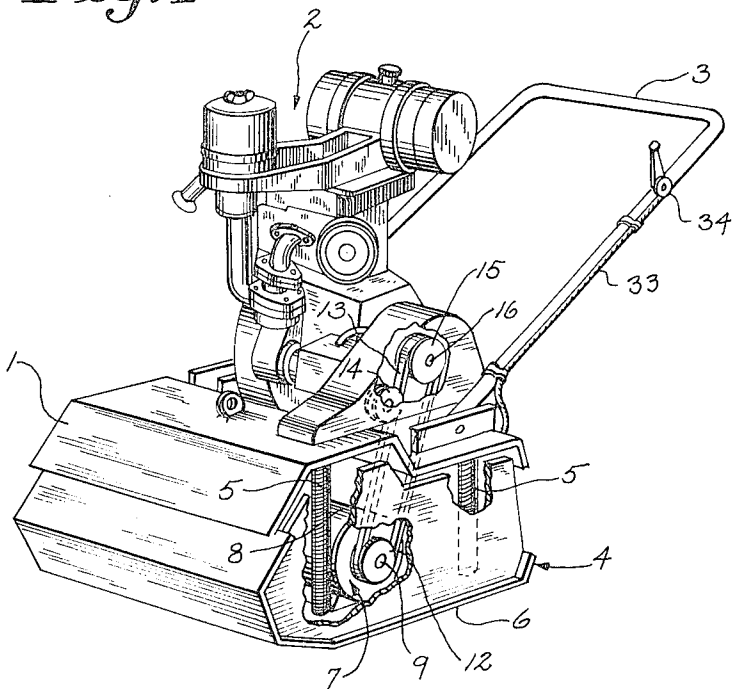
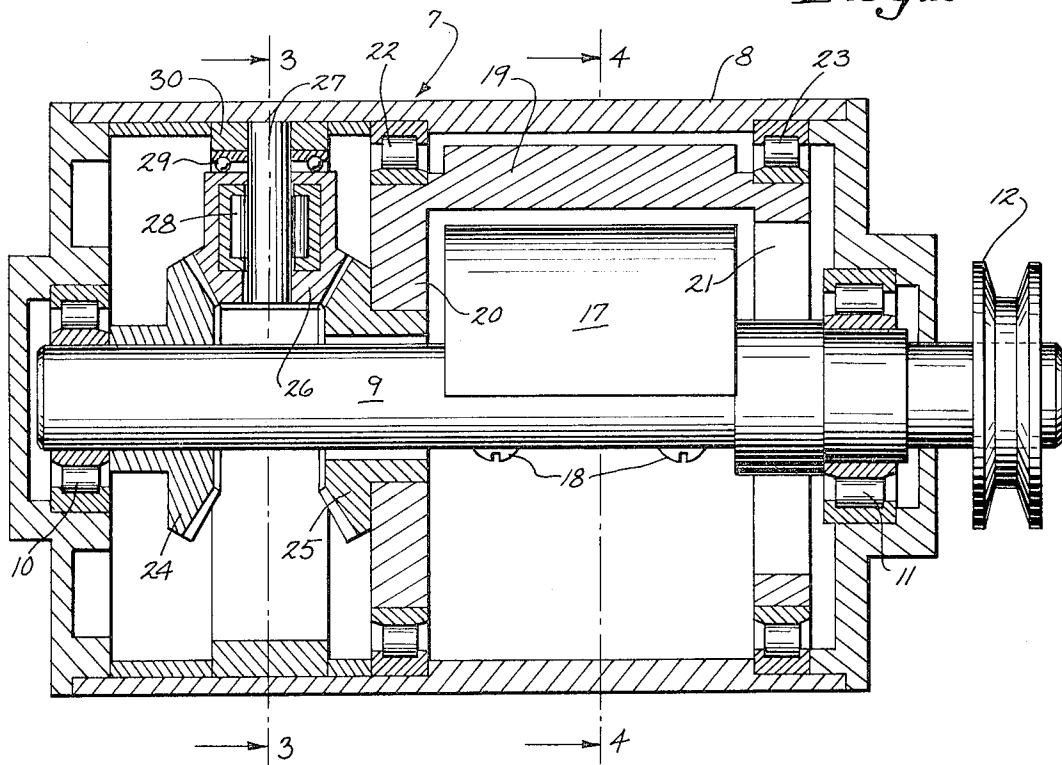
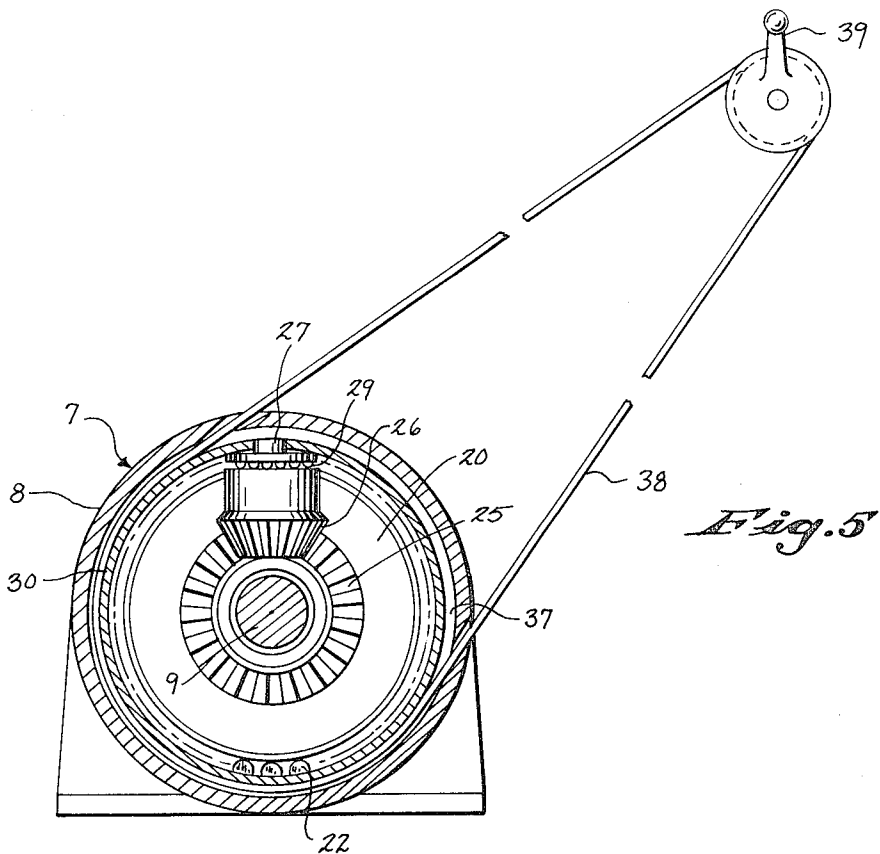
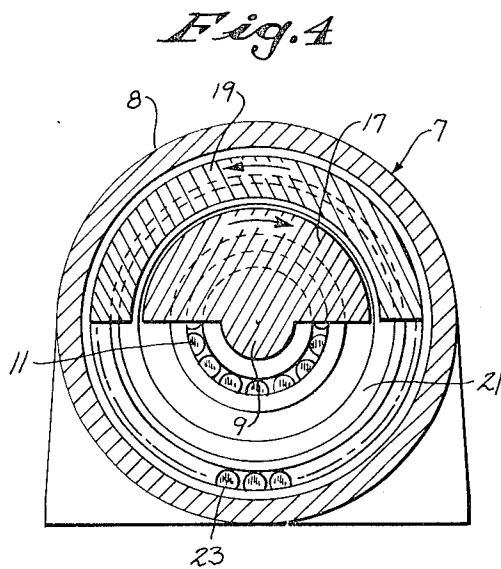
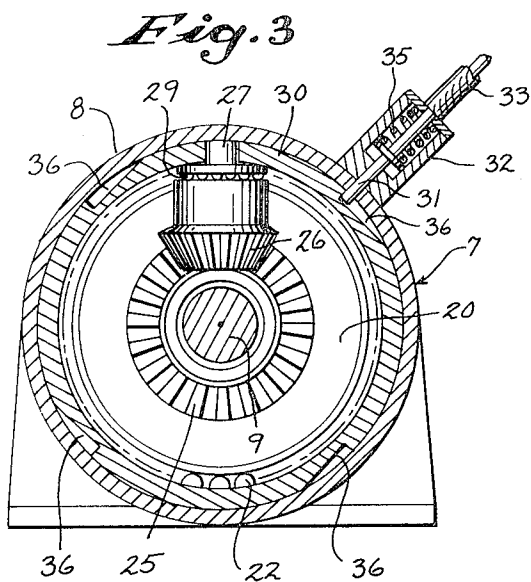


Fig. 2





COMPACTOR FOR SOIL AND THE LIKE WITH IMPROVED VIBRATOR ASSEMBLY

PRIOR ART OF INTEREST

U.S. Pat. No. 3,001,458 Croucher

German Pat. No. 822,979

German Pat. No. 1,255,592

BACKGROUND OF THE INVENTION

This invention relates to a compactor for soil and the like, and which includes a vibrator assembly for the purpose of compacting and preferably also for propelling the compactor in either a forward or reverse direction. The vibrators for such devices have often included eccentric weights which provide a planular reciprocating force, with the plane angle being adjustable to provide the desired action.

In the vibrator of the above-identified German Pat. No. 822,979, two pairs of eccentric weights are mounted at equal distances on two different shafts which are arranged symmetrically on opposite sides of the machine center line, and which are driven in opposite directions by a motor and gear arrangement. Each pair of weights are driven in opposite directions. A disk-like member can be held stationary or rotated by a worm gear to change the respective angles of the weights.

The vibrator of the above-identified U.S. patent utilizes two eccentric weights mounted on two parallel shafts which are driven in opposite directions by a motor and spur gear arrangement. The weights are rotatably mounted in a box which itself can be rotated through a sprocket, chain and pivotable handle to change the resultant angle of the forces involved.

The vibrator of the above-identified German Patent No. 1,255,592 utilizes three parallel shafts. Two shafts are provided with one eccentric weight each, which rotate in opposite directions through a spur gear connection; while the third shaft has two eccentric weights driven in opposite directions. The said third shaft may be adjustably rotated by a worm gear to change the angle of the forces involved.

The vibrators of the known prior devices are subject to a number of disadvantages. They are quite complex, especially in their manner of changing the resultant angle of forces. Their many moving parts are expensive to manufacture. Due to the vibrations to which they are subjected, they have a high rate of wear, and are expensive to repair and maintain. Furthermore, the prior devices are quite bulky, due to the many shafts involved.

SUMMARY OF THE INVENTION

The present invention provides significant improvements over prior devices and substantially reduces the aforementioned disadvantages.

Broadly, a pair of eccentric weights are disposed to rotate about the same axis and with the weights being disposed concentrically on different radii with respect to the axis. More specifically, one eccentric weight and an associated bevel gear are fixedly mounted to the drive shaft which defines the said axis, while the other weight and its associated bevel gear are freely rotatable thereon. The bevel gears are connected by a pinion which is mounted on a shift ring disposed on one side of the weights, which in turn is freely mounted on the

drive shaft and freely rotatable within the vibrator housing. A differential drive means is thus provided.

Means are provided to hold the shift ring in the desired position, and to permit rotation of the ring when a different angle of force is desired. In one embodiment, a locking pin selectively engages abutments on the ring. In another embodiment, an adjustable cable holds the ring in position.

DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the best mode presently contemplated by the inventor for carrying out the invention.

FIG. 1 is a schematic perspective view of a compactor constructed in accordance with the invention, with parts broken away and showing the vibrator drive means and spring suspension;

FIG. 2 is a transverse longitudinal section of the vibrator assembly;

FIG. 3 is a transverse section taken on line 3—3 of FIG. 2;

FIG. 4 is a transverse section taken on line 4—4 of FIG. 2; and

FIG. 5 is a view similar to FIG. 3 and showing another embodiment of holding and shifting means.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 1 of the drawings, the invention is embodied in a vibratory compactor for soil and the like which includes an upper frame portion 1 on which is mounted motive means, such as an engine 2. A handle 3 is suitably mounted to frame portion 1 for manual manipulation of the device. A lower frame portion 4 is suspended from upper portion 1 by spring means 5 or any other suitable device which permits controlled vertical movement between portions 1 and 4.

Lower frame portion 4 includes a flat bottom compactor plate 6 for vibrantly engaging the ground or other surface to be worked on. For this purpose, a vibrator assembly 7 is mounted within lower frame portion 4 and is fixedly secured thereto in any suitable way.

Referring to the embodiment of FIGS. 1-4, vibrator assembly 7 comprises a generally enclosed cylindrical housing 8 having a single drive shaft 9 disposed longitudinally therein and supported by end bearings 10, 11. The outer end of shaft 9 adjacent bearing 11 extends through the housing wall and has a suitable pulley 12 thereon. A suitable drive belt 13 extends over pulley 12, over jockey pulley 14 and over pulley 15 on the output shaft 16 of engine 2, whereby shaft 9 is rotatably driven from the engine.

Drive shaft 9 carries a plurality of eccentric weights arranged concentrically with respect to the shaft axis and to each other. For this purpose, an inner generally D-shaped weight 17 is fixedly secured to shaft 9, as by screws 18. An arcuate generally C-shaped weight 19 is disposed on a radius larger than the outer radius of weight 17; and is provided with transverse end plates 20, 21 which are freely mounted on housing 8 for rotation about shaft 9. Plates 20 and 21 are rotatable within housing 8 on suitable bearings 22, 23.

Weights 17 and 19 are disposed on the longitudinal center line of the machine and are geared together to provide a differential drive and to provide the desired adjustment therebetween. For this purpose, fixed

weight 17 is associated with a bevel gear 24 which is also fixedly mounted on shaft 9; and freely mounted weight 19 is associated with a bevel gear 25 which is mounted on end plate 20 and also freely mounted with respect to shaft 9.

Bevel gears 24 and 25 are joined by a pinion gear 26 which is mounted for rotation on a transverse radially extending shaft 27, as by bearings 28, 29. The outer end of shaft 27 is rigidly fixed to a control member, such as shift ring 30 which is freely rotatable within housing 8 about shaft 9 and disposed on one side of the weights so that the unit is very compact. The construction is such that fixedly mounted bevel gear 24 is on the side of shift ring 30 which is remote from weights 17 and 19, while freely mounted bevel gear is on the side of ring 30 adjacent the weights. When shift ring 30 and pinion 26 are held in position, as will be described, rotation of shaft 9, weight 17 and bevel gear 24 in one direction will cause rotation of bevel gear 25 and weight 19 in the opposite direction. During driving of shaft 9, the positions of counter-rotating weights 17 and 19 will coincide concentrically on the same radius line at a frequency equal to the rate of shaft rotation, and will thus provide a resultant vibratory thrust at a desired angle. This angle is determined by the fixed position of shift ring 30.

The vibrator includes means to adjustably hold shift ring 30 in a selected angular position. This controls the setting of the differential drive means. In the embodiment shown in FIGS. 1-4, the adjustable holding means comprises a releasable radially disposed locking pin 31 mounted on a bracket 32 which is secured to the exterior of vibrator housing 8. Pin 31 is manually controlled through a suitable cable 33 and lever 34 on handle 3, and is normally biased into engagement with the rim of shift ring 30, as by a spring 35. The generally annular periphery or rim of shift ring 30 is provided with a plurality of circumferentially spaced abutments, such as flat-faced notches 36, each of which will cooperatively receive pin 31 to lock ring 30 in place. When it is desired to change the position of ring 30, locking pin 31 is withdrawn while shaft 9 is rotating so that fixed bevel gear 24 will rotate pinion 26 to thereby automatically drive pinion shaft 27 and ring 30 circumferentially. A quick release of lever 34 will assure that pin 31 drops into the next notch.

The usual circumferential setting of shift ring 30 provides a resultant thrust of 45° to the horizontal or grade the compactor is working on, and in the forward direction. When pin 31 is pulled and ring 30 rotates to the next notch, this angle will change. Assuming four notches 36 spaced at 90°, as shown, advancing one notch will cause the position of eccentric weight 19 to shift 180° relative to weight 17 to provide a reverse thrust at 45°. This is because the bevel gearing arrangement provides an over-run of eccentric weight 19 relative to shift ring 30 by a ratio of 2 to 1.

A variety of other thrust angles may be had by varying the number and circumferential positioning of notches 36.

In some instances, it may be desirable to provide an infinite number of angle settings of shift ring 30, as contrasted with the finite setting of FIGS. 1-4. As shown in the embodiment of FIG. 5, a groove 37 is formed in the periphery of ring 30 and which receives a looped cable 38, the other end of which is connected to any suitable rotary control device for shifting the po-

sition, such as a high friction crank 39. This infinite adjustment of ring 30 and the resultant maximum thrust angle, permits gradually changing the speed of forward or reverse, with a complete stop therebetween.

While the invention has been described in connection with a mobile unit, it is contemplated that the inventive concept may be utilized with a non-mobile device and for compacting materials other than soil.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a compactor for soil and the like and with said compactor having a frame and motive means on the frame, a vibrator assembly on said frame and driven by said motive means for producing compacting forces, said vibrator assembly comprising:
 - a. a drive shaft defining an axis and connected to said motive means,
 - b. a pair of eccentric weights disposed to rotate about said axis and with said weights being disposed concentrically on different length radii with respect to said axis,
 - c. the first of said pair of weights being fixed to said shaft and the second of said pair of weights being freely mounted for rotation about said shaft,
 - d. differential drive means for said weights and with said drive means comprising:
 1. a first bevel gear fixed to said shaft for association with said first weight,
 2. a second bevel gear freely mounted for rotation on said shaft for association with said second weight,
 3. and a pinion joining said first and second bevel gears,
 - e. and means for controlling the setting of said differential drive means to thereby control the angle of concentric coincidence of said weights and of the resultant thrust created by said coincidence during operation of said differential drive means, said setting controlling means comprising:
 1. a normally fixed shift member on which said pinion is rotatably mounted,
 2. said shift member being freely mounted for rotation about said shaft.
2. The compactor of claim 1:
 - a. in which said shift member is disposed on one side of both said weights,
 - b. and in which one of said bevel gears is on a side of said shift member remote from said weights and the other of said bevel gears is disposed on the side of said shift member adjacent said weights.
3. In the compactor of claim 1: means to adjustably hold said shift member in a selected angular position relative to said shaft, said holding means comprising:
 - a. a plurality of spaced abutment means disposed on said shift member,
 - b. locking means normally engaging said abutment means to hold said shift member in position during rotation of said shaft and said differential drive means,
 - c. and means to release said locking means from a respective abutment means so that rotation of said shaft and pinion will cause said shift member to au-

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tomatically rotate until another abutment means is engaged by said locking means.

4. The compactor of claim 3 in which:

- a. said shift member has a generally annular periphery,
- b. each said abutment means comprises a notch circumferentially spaced along said periphery,
- c. and said locking means comprises a radially disposed pin biased toward engagement with said notches.

5. In the compactor of claim 1: means to adjustably hold said shift member in a selected angular position relative to said shaft, said holding means comprising:

- a. a looped cable connected to said shift member,
- b. and means to shift the position of said cable to provide infinite angular adjustment of said shift member.

6. The compactor of claim 5 in which:

- a. said shift member has a generally annular periphery having a groove therein,
- b. and said cable is disposed in said groove.

7. In a compactor for soil and the like and with said compactor having a frame and motive means on the frame, a vibrator assembly on said frame and driven by said motive means for producing compacting forces, said vibrator assembly comprising:

- a. a drive shaft defining an axis and connected to said motive means,
- b. a pair of eccentric weights disposed to rotate about said axis and with said weights being disposed concentrically on different length radii with respect to said axis,
- c. the first of said pair of weights being fixed to said shaft and the second of said pair of weights being freely mounted for rotation about said shaft,
- d. differential drive means for said weights and with said drive means including a plurality of gear elements,
- e. and means for controlling the setting of said differential drive means to thereby control the angle of concentric coincidence of said weights and the re-

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sultant thrust created by said coincidence during operation of said differential drive means, said setting controlling means comprising:

1. a normally fixed shift member on which one of said gear elements is mounted,
2. said shift member being freely mounted for rotation about said shaft.

8. In the compactor of claim 7: means to adjustably hold said shift member in a selected angular position relative to said shaft, said holding means comprising:

- a. a plurality of spaced abutment means disposed on said shift member,
- b. locking means normally engaging said abutment means to hold said shift member in position during rotation of said shaft and said differential drive means,
- c. and means to release said locking means from a respective abutment means so that rotation of said shaft and said one gear element will cause said shift member to automatically rotate until another abutment means is engaged by said locking means.

9. The compactor of claim 8 in which:

- a. said shift member has a generally annular periphery,
- b. each said abutment means comprises a notch circumferentially spaced along said periphery,
- c. and said locking means comprises a radially disposed pin biased toward engagement with said notches.

10. In the compactor of claim 7: means to adjustably hold said shift member in a selected angular position relative to said shaft, said holding means comprising:

- a. a looped cable connected to said shift member,
- b. and means to shift the position of said cable to provide infinite angular adjustment of said shift member.

11. The compactor of claim 10 in which:

- a. said shift member has a generally annular periphery having a groove therein,
- b. and said cable is disposed in said groove.

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