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(54) **PROPULSION AND STEERING SYSTEM FOR A BOAT**

(57) **Problem**

The invention seeks an alternative to known foot-powered watercraft which provides the same or similar effects or is more cost-effective.

Solution

The problem is solved by a first toothed belt (11), pivotable steering handles (12), first crown gears (14), a second crown gear (15), and a pivotable propeller assembly (19), wherein each of the handles (12) is coupled to one of the first crown gears (14), the first toothed belt (11) forms a closed loop connecting the first crown gears (14) to the second crown gear (15), and the second crown gear (15) is coupled to the propeller assembly (19).

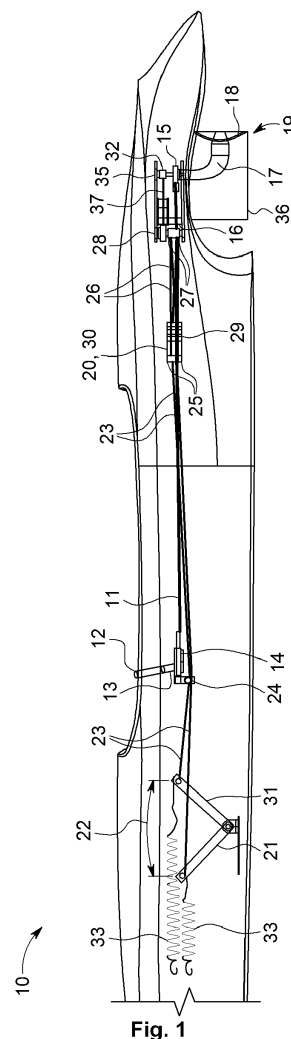


Fig. 1

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Description

Technical Field

[0001] The invention relates to a boat.

Background Art

[0002] In a nautical context, by boat is meant any watercraft of a large range of sizes designed to float, plane, work, or travel on water. Small boats are typically found on inland waterways such as rivers and lakes or in protected coastal areas. The mechanism or system used to generate thrust to move a boat (or ship) across water is generally referred to as marine propulsion. Human propulsion is found mainly on small boats or as auxiliary propulsion on sailboats. Known means of human marine propulsion include push poles, rows, and pedals.

[0003] An example of a watercraft powered by a pedal-driven propeller is given in BROOKS, Alec N., et al. Human-powered Watercraft. Sci. Am., 12/1986, vol.255, no.6, p.120-131.

[0004] US 6210242 B (HOWARD HARRY; HOWARD TARA ANN) 03.04.2001 discloses a pedal-powered watercraft comprising a unitary hull having an upper wall extending from a bow portion to a stern portion of the watercraft and a pair of spaced hollow sponsons located on either side of the upper wall. The upper wall together with inner walls of the sponsons form a tunnel that opens generally downwardly and extends from the bow portion to the stern portion of the watercraft. A deck is connected to the hull and includes an elongate opening that defines a cockpit area for receiving an occupant. A seat is in the cockpit area and a pedal assembly is connected to the hull forwardly of the seat. The pedal assembly includes a pivotal pedal tower and a pair of pedals mounted on the pedal tower. The pedals are operably connected to drive the propeller during pedal rotation.

Summary of invention

[0005] The invention as claimed is hereinafter disclosed in such a way that the technical problem with which it deals can be appreciated and the solution can be understood.

Technical Problem

[0006] A downside of the conventional paddleboat is the height of its crank, which may easily amount to 80 cm and impedes any effective covering or fairing of the bow. This renders the prior-art watercraft essentially unsuitable for use in adverse weather conditions. The invention thus seeks an alternative to known foot-powered watercraft which particularly lends itself to efficient touring.

Solution to Problem

[0007] The problem is solved as per the characterizing portion of Claim 1.

Advantageous effect of invention

[0008] An embodiment of the invention satisfies the market for a canoe-like pedal boat whose highly ergonomic design bridges the gap between watercraft and sports equipment. In contrast to conventional crank mechanisms as are known from bicycle drivetrain systems, such embodiment is based on a save-spacing treadle, allowing drive to be achieved ergonomically and joint-friendly by alternate downward strokes of any arc. Consequently, use of the invention provides for a low-impact high-cardiovascular outdoor workout that remains unimpeded even within the limited confines of the boat's body. To achieve this effect, a boat as per the invention is based on a back-and-forth movement of the pedals, with a sophisticated linkage of cords, belts, and pulleys driving the propeller shaft.

[0009] As a further benefit, the invention dispenses with navigational aids such as paddles or rudder blades. Instead, its propeller assembly may be revolved indefinitely, letting an operator effortlessly command the vessel such as to veer, make headway or sternway, or bring the boat to a sudden stop if needed. A preferred embodiment makes use of a flexible shaft as opposed to, e. g., a bevel gear, which would require elaborate pivot-mounting, lubrication, and sealing. An optional electric assistance may be employed for increased speed, extended range, and relaxed upstream travel.

[0010] Furthermore, an especially advantageous hull design ensures that the boat's propeller assembly is protected by its keel. This way, even for a marine screw measuring 200 mm in diameter, air suction during operation may be effectively prevented. Moreover, given the lack of operating experience that is commonly seen in renters or other casual boaters, the hull imparts high tilt stability to the vessel. To this end, the seating position is as deep as structurally feasible.

[0011] The resulting boat's compact dimensions and low weight allow it to be handled by a single person while two boats can easily be transported atop a car or truck.

Brief description of drawings

[0012]

Figure 1 is a side elevation of the boat.

Figure 2 is a plan view of the boat.

Figure 3 is a detailed plan view of the drivetrain.

Figure 4 is a partial side elevation of the drivetrain.

Description of embodiments

[0013] In synopsis, the figures elucidate both the struc-

tural and functional features of a boat (10).

[0014] Transmission of steering power occurs via what is known as an "endless", that is, continuous first toothed belt (11) arranged in a closed loop. To this end, two steering handles (12) on both sides of the hull are manually swivelled in a rotating motion about their respective vertical axes. A first crown gear (14) is connected to each of them, for ergonomic reasons, via a corresponding angle joint (13). A second crown gear (15) is connected to the drive unit's transmission housing (17) at the same transmission ratio. In its further course, the first toothed belt (11) is guided from the steering handles (12) toward the drive unit via a left deflection cassette (20) and right deflection cassette (30), respectively, the terms "left" and "right" intuitively referring to the movement direction (34 - Figure 2) of the boat (10) as a whole. A first guide roller or idler pulley (16) forming part of the drive unit effectively closes the loop constituted by the first toothed belt (11).

[0015] To propel the boat (10), the left crankarm (21) and right crankarm (31) are set in reciprocating motion by treading the pedals (22) mounted thereupon, which in the present embodiment allow for pedal travel of up to 400 mm. As is best seen in Figure 2, an aramid cord (23) - here, exhibiting a strength of 4 mm - is attached to the axis of the right pedal (22), which, for purposes of the following discussion of the cord's path along the hull, will serve as point of origin. Directing attention back to Figure 1, a second idler pulley (24) forms a first waypoint on this path and defines the height at which the cord (23) runs along the right side of the boat (10). Correspondingly, a third idler pulley (25 - Figure 3) on the right deflection cassette (30) guides the cord (23) in a horizontal plane toward the coaxial first drive pulleys (27 - Figure 4) on the drive unit's jackshaft (28). Within this segment of the linkage, that is, beyond the right deflection cassette (30) up to the drive unit, the cord (23) is functionally replaced by a second toothed belt (26).

[0016] Designed as one-way overrunning or free-wheeling clutches based on a pinch or clamping roll, the first drive pulleys (27) engage with the intermediate jackshaft (28) only in one shared direction of rotation, which appears counter-clockwise in the plan view of Figure 3. Where it reaches these first drive pulleys (27), the second toothed belt (26) first loops around the upper drive pulley (27) such that its toothed face engages that pulley. Thereupon, the second toothed belt (26) twists - when viewed from the jackshaft (28) - counter-clockwise by a 90° angle and loops downward around a horizontally mounted fourth idler pulley (29) on the left deflection cassette (20) with its plain and untoothed contact face, as may be taken from Figure 4. From here, the second toothed belt (26) is guided back toward the first drive pulleys (27), twisting - when viewed from the deflection cassette (20) - counter-clockwise by another 90° such that its toothed face now engages the lower of the first drive pulleys (27). Upon looping back around that pulley, the second toothed belt (26) is effectively replaced by a cord (23) attached to the left pedal (22).

[0017] As may be gathered from these structural features, the left and right cords (23) and second toothed belt (26) in their entirety form a linkage that interconnects the pedals (22) such that by pushing the left pedal downward, the right pedal is pulled upward and vice versa, yet - by means of the one-way first drive pulleys (27) - always driving the jackshaft (28) in the same direction of rotation. Both pedals (22) are biased toward the principal movement direction (34) of the boat (10) through resilient elements such as springs (33), thus tightening the cords (23) and second toothed belt (26) and preventing them from slipping or jumping off their pulleys (24, 25, 27, 29). Also, in the configuration of Figure 2 where the left pedal (22) is fully depressed, any mechanical energy stored by the stretched right spring (33) will naturally be recovered as it supports the subsequent downward motion of the right pedal (22), and vice versa.

[0018] Finally returning attention to the terminal section of the powertrain, the jackshaft (28) drives the propeller shaft (35) via a third toothed belt (37) at a transmission ratio of 2:1. To accommodate the 90° angle enclosed between the axes of the second drive pulley (32) and actual screw (18), the propeller shaft (35) takes the form of a flexible shaft.

Industrial applicability

[0019] The invention is applicable, inter alia, throughout the leisure, recreational boating, and sporting goods manufacturing industries.

Reference signs list

[0020]

10	Boat
11	First toothed belt
12	Steering handles
13	Angle joints
14	First crown gears
15	Second crown gear
16	First idler pulley
17	Transmission housing
18	Marine screw
19	Propeller assembly
20	Left deflection cassette
21	Left crankarm
22	Pedals
23	Cords
24	Second idler pulleys
25	Third idler pulleys
26	Second toothed belt
27	First drive pulleys
28	Jackshaft
29	Fourth idler pulley
30	Right deflection cassette
31	Right crankarm
32	Second drive pulley

- 33 Springs
- 34 Principal movement direction
- 35 Propeller shaft
- 36 Cage
- 37 Third toothed belt

Citation list

[0021] The following documents are cited hereinbefore.

Patent literature

[0022] US 6210242 B (HOWARD HARRY; HOWARD TARA ANN) 03.04.2001

Non-patent literature

[0023] BROOKS, Alec N., et al. Human-powered Watercraft . Sci. Am.. 12/1986, vol.255, no.6, p.120-131.

Claims

1. Boat (10) having
a first toothed belt (11), pivotable steering handles (12), first crown gears (14), a second crown gear (15), and a pivotable propeller assembly (19), **characterized in that**
each of the handles (12) is coupled to one of the first crown gears (14), the first toothed belt (11) forms a closed loop connecting the first crown gears (14) to the second crown gear (15), and
the second crown gear (15) is coupled to the propeller assembly (19).
2. Boat (10) as per Claim 1, further having angle joints (13) that couple the handles (12) to the first crown gears (14).
3. Boat (10) as per Claim 1 or Claim 2, further having a first idler pulley (16) that guides the first toothed belt (11) betwixt the first crown gears (14).
4. Boat (10) as per any of the preceding claims wherein the propeller assembly (19) comprises a marine screw (18) and a transmission housing (17) bearing the second crown gear (15).
5. Boat (10) as per any of the preceding claims, further having
a left deflection cassette (20) and a right deflection cassette (30), the deflection cassettes (20, 30) guiding the first toothed belt (11) betwixt the first crown gears (14) and the second crown gear (15).
6. Boat (10) as per Claim 5, further having
a left crankarm (21) and right crankarm (31), each

bearing a pedal (22).

7. Boat (10) as per Claim 6, further having
a linkage (23, 26) mutually connecting the pedals (22).
8. Boat (10) as per Claim 7 wherein
the linkage (23, 26) comprises cords (23) such as of aramid, each of the cords (23) being attached to one of the pedals (22), and a second toothed belt (26) mutually connecting the cords (23).
9. Boat (10) as per Claim 8, further having
second idler pulleys (24) defining a height of the cords (23) relative to the boat (10).
10. Boat (10) as per Claim 8 or Claim 9, further having
third idler pulleys (25) guiding the cords (23) in a horizontal plane relative to the boat (10).
11. Boat (10) as per any of Claim 8 through Claim 10, further having
a jackshaft (28) bearing first drive pulleys (27) engaged by the second toothed belt (26).
12. Boat (10) as per Claim 11, further having
a fourth idler pulley (29) mounted at a right angle to the jackshaft (28), wherein the second toothed belt (26) loops around the fourth idler pulley (29) and engages the first drive pulleys (27) bilaterally thereof.
13. Boat (10) as per Claim 11 or Claim 12 wherein
the first drive pulleys (27) are overrunning in a concurrent direction.
14. Boat (10) as per any of Claim 11 through Claim 13, further having
a second drive pulley (32), a propeller shaft (35) coupling the second drive pulley (32) to the propeller assembly (19), and a third toothed belt (37) connecting the jackshaft (28) to the second drive pulley (32).
15. Boat (10) as per any of Claim 6 through Claim 14, further having
resilient elements such as springs (33) biasing the pedals (22) toward a principal movement direction (34) of the boat (10).

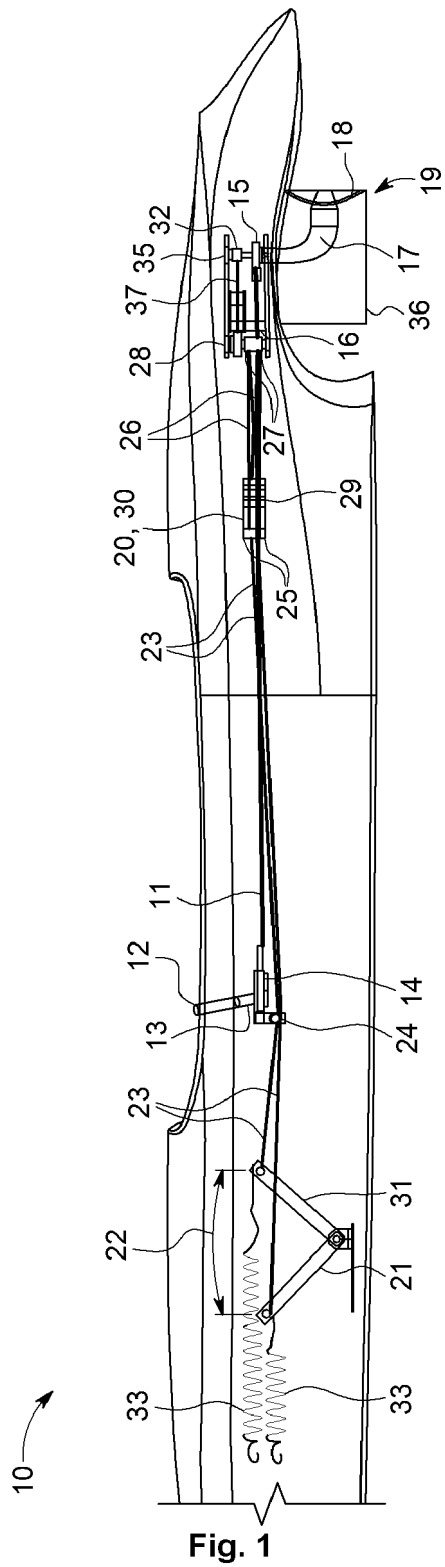


Fig. 1

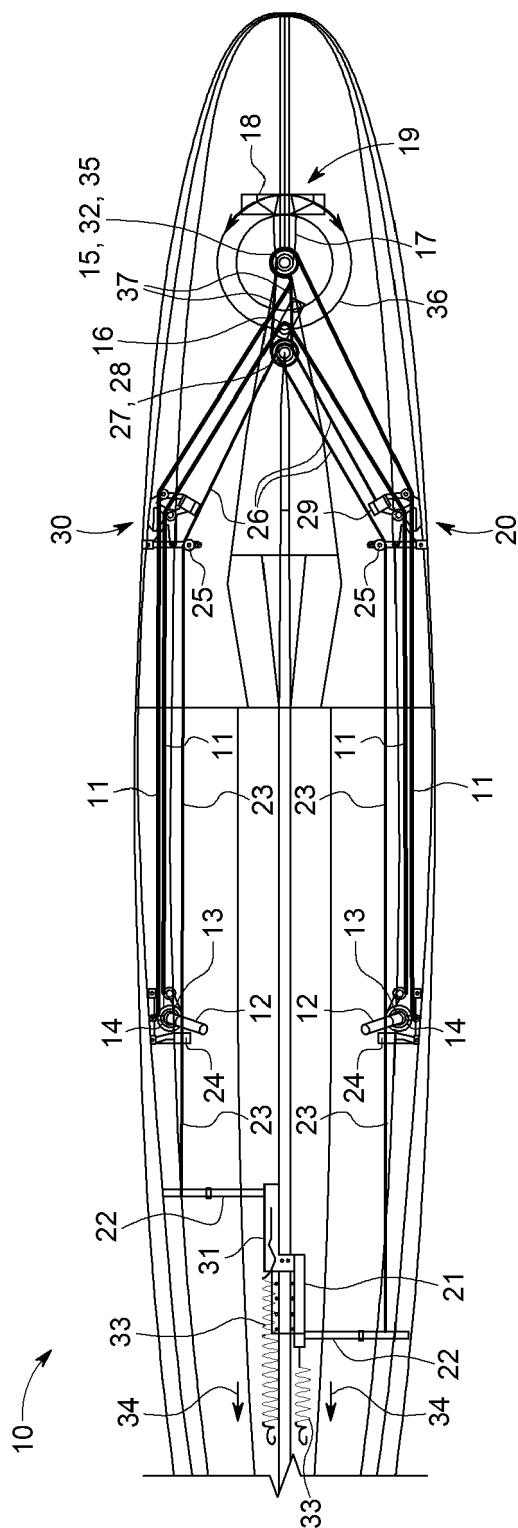


Fig. 2

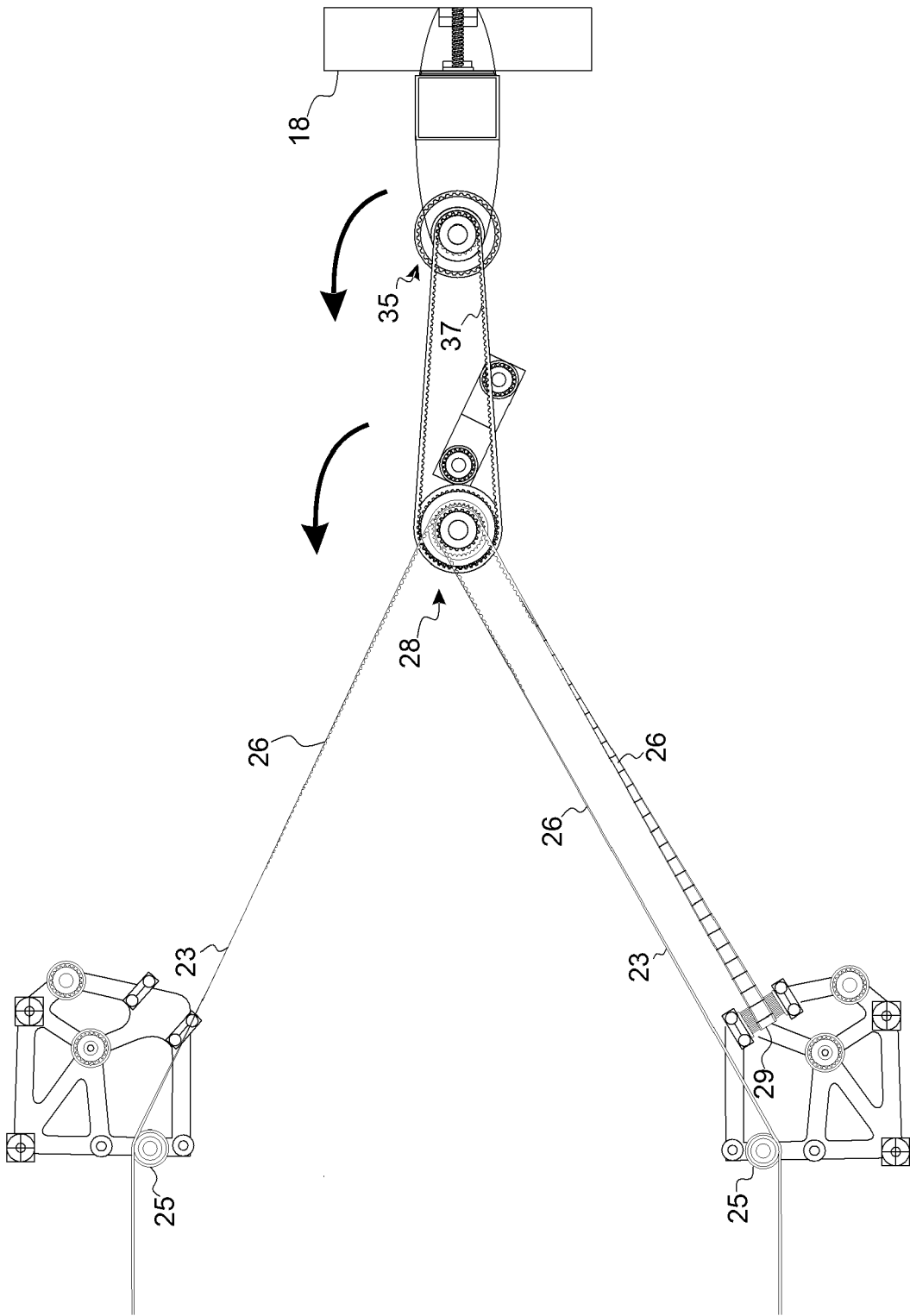


Fig. 3

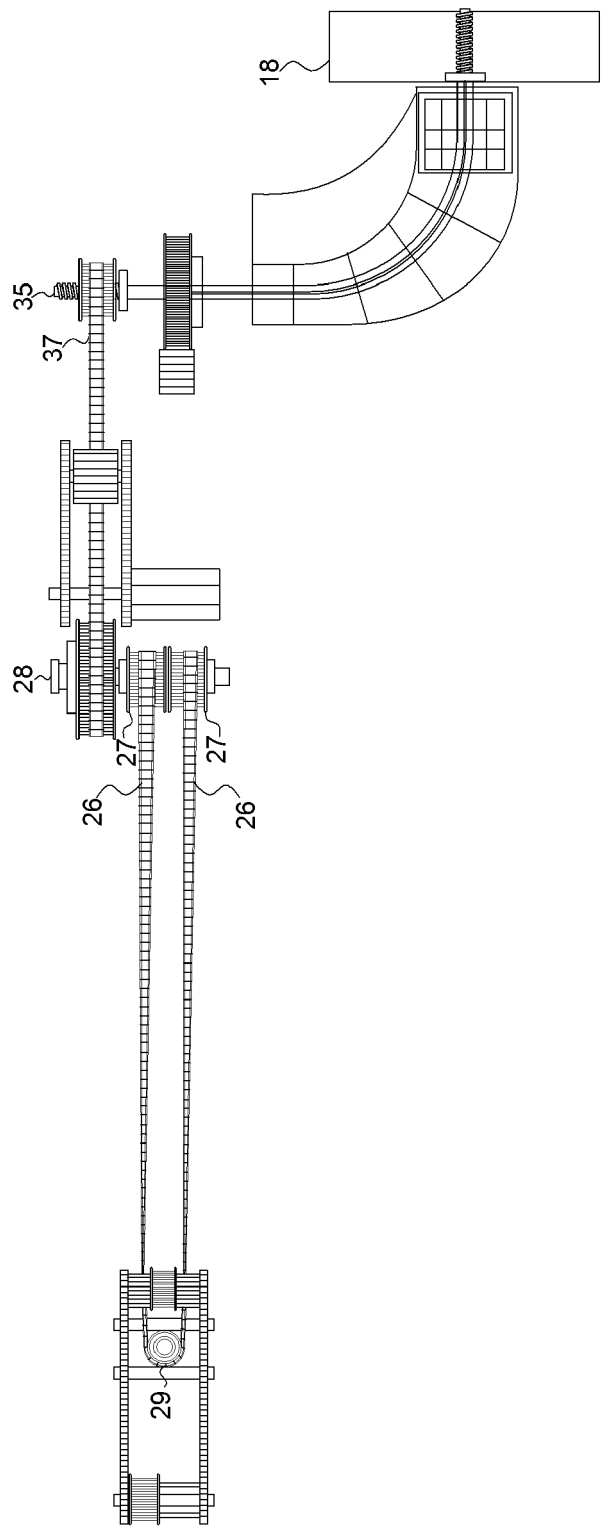


Fig. 4



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Application Number
EP 18 15 1110

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 11 June 2018	Examiner Mauriès, Laurent
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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