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(54) Title: STRETCHING MACHINE FOR NON-FERROUS METAL PROFILES

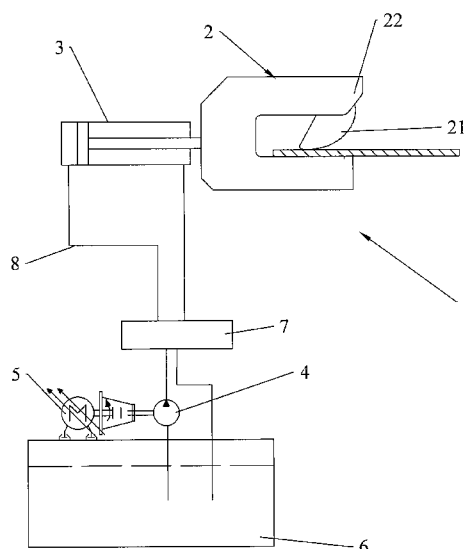


FIG.1

(57) Abstract: A stretching machine (1) is described for non-ferrous profiles, comprising a head (2) provided with a body (22) and a clamp (21), hydraulic cylinders (3), at least one pump (4), at least one electric motor (5), a liquid tank (6), at least one electro-dis-tributor (7) and a hydraulic circuit (8). Said stretching machine comprises at least one internal gear pump (4).



“Stretching machine for non-ferrous metal profiles”.

* * * *

The present invention refers to a stretching machine for non-ferrous metal profiles.

5 Stretching machines for non-ferrous profiles are machines designed to permanently extend an extruded profile by applying a force parallel to the main axis, so as to give it a desired permanent straightness.

 The process for producing non-ferrous profiles includes heating a billet which is then pressed by means of a die which gives it the desired
10 shape. The profile obtained is then cooled. During the cooling process, the profile may encounter a series of morphological modifications due to the different cooling speed of its various parts. The stretching of the extruded profile has the object of eliminating warpage, curvature and undulation of the profile which may be determined by the different cooling speed of its
15 various parts.

 The stretching machine for non-ferrous profiles usually comprises two functional units: a head and a tail, provided with clamps for attaching each end of the profile to be stretched. The former normally covers the function of extending the profile to be stretched, even though it is not
20 excluded that both the head and tail can carry out the stretching function. The head of the stretching machine is driven by a hydraulic power unit, the pump of which drives the main stretching cylinder.

 Normally, the types of pumps used are vane or piston pumps and the flow rate change is obtained by means of a proportional valve which, when
25 programmed, allows to obtain acceleration and deceleration ramps at the beginning and at the end of the stretching. Moreover, further moving parts with small size cylinders (clamp, vanes, strips, etc) are positioned on the head and tail, for the operation of these parts a further auxiliary pump is usually required.

30 US 6018970 A describes a stretching machine for metal sheets

comprising two jaws adapted to be placed at the ends of the sheet to be stretched. Each jaw comprises friction elements to lock the metal sheet.

FR 2216033A1 describes a machine for measuring the extension of the profile bars. Said machine comprises two heads adapted to mechanically lock the profile and adapted to slide in opposite directions.

US 2015/135701 describes the use of a pump on an actuator of the linear type, in particular an external gear pump is described, which comprises two rotary elements externally provided with teeth.

DE 10005779A1 describes work equipment, such as for example a lift truck, comprising hydraulic drives. The hydraulic circuits of said work equipment include the employment of gear pumps.

Disadvantageously, the pumps used on classic stretching machines are piston pumps, such pumps have a noise above 85 dB, imposing the employer to seclude the pumps in specific production sectors and to provide the employees with individual and collective protection devices.

Another disadvantage is given by the fact that the main pump of the stretching machine is always powered in rotation in the time interval comprised between two working cycles, independently of the working frequency. When it is required to activate the cycle, suitable valves divert the oil from the recirculation towards the main stretching cylinder.

Disadvantageously, the permanent rotation of the pump generates an incessant noise around the region of the hydraulic power unit, which noise is higher than the values established by the Italian law and requires precise counter-measures be adopted for the hearing protection of the personnel working or transiting in such area.

A further disadvantage is given by the continuous rotation of the stretching pump which generates an energy expenditure. The constant rotation of the pump between two consecutive working cycles provokes the overheating of the hydraulic fluid which must be cooled by means of a heat exchanger.

Disadvantageously, the secondary movement of the accessories requires a motor and at least one auxiliary pump, thereby increasing the total energy demand of the stretching machine.

5 A further disadvantage is given by the permanent rotation of the stretching pump between two consecutive working cycles which causes a rapid decay of the hydraulic fluid.

Another disadvantage is given by the need to employ multiple pumps on a stretching machine, usually, pumps of different type. This obliges one to maintain in stock more spare parts for the different pumps.

10 It is the object of the present invention to have a stretching machine for non-ferrous material profiles with lower noise than the stretching machines already on the market.

It is a further object to have a stretching machine for non-ferrous material profiles with small energy consumption as compared to the normal stretching machines.

15 It is another object to obtain a stretching machine for non-ferrous material profiles with lower production costs than the stretching machines on the market.

It is a still further object to have a stretching machine for non-ferrous material profiles with ordinary and extraordinary maintenance costs lower than those of the stretching machines on the market. In accordance with the invention, such an object is achieved by a stretching machine for non-ferrous profiles as described in claim 1.

20 These and other features of the present invention will become more apparent from the following detailed description of the practical embodiment shown by way of a non limiting example in the accompanying drawings, in which:

Figure 1 shows an operating diagram of a stretching machine for non-ferrous profiles according to the present invention;

25 Figure 2 shows a side sectional view of a head of the stretching

machine;

Figure 3 shows a side sectional view of an internal gear pump;

Figure 4 shows a front view of the internal gear pump;

Figure 1 shows a head 2 of a stretching machine 1 for non-ferrous
5 profiles comprising a body 22, a clamp 21, hydraulic cylinders 3 and 31, an
internal gear pump 4, an electric motor 5, a liquid tank 6, an electro-
distributor 7 and a hydraulic circuit 8.

In the invention described, the hydraulic circuit uses a single pump
model 4 on stretching machine 1, or all movements of stretching machine 1
10 and all the main functions thereof are carried out exclusively by internal gear
pump 4.

Cylinder 3 receives the hydraulic fluid from internal gear pump 4 by
means of hydraulic circuit 8 and is adapted to control the horizontal
movements of at least one of the heads 2 of stretching machine 1.

15 Clamp 21 of head 2 is adapted to be driven under the effect of a
hydraulic fluid maintained under pressure within hydraulic circuit 8 by
internal gear pumps 4 controlled in turn by electric motor 5. Once the
internal gear pump 4 has been actuated, the hydraulic fluid sets the second
cylinder 31 under pressure setting in turn clamp 21 in motion (Figure 1).

20 In particular, as shown in Figure 2, the inflow of the hydraulic fluid in
the second cylinder 31 is adapted to cause the lifting of clamp 21 while the
reduction of the pressure of the hydraulic fluid causes the lowering of clamp
21 against base 221 of body 22 of head 2. Due to the seal of hydraulic circuit
8, the pressure of the hydraulic fluid maintains clamp 21 lowered towards
25 base 221 of body 22, generating a friction between clamp 21 and the base
221 of the body 22. Clamp 21, driven by the second cylinder 31, is adapted
to lock a metal profile between the same clamp 21 and the base 221 of the
body 22 of said head 2.

Therefore, internal gear pumps 4 not only control the horizontal
30 movement of head 2 by means of cylinder 3, but also the drive of the clamp

21 of head 2 by means of the second cylinder 31.

The internal gear pump 4 is controlled in turn by motor 5 which regulates the rotary movement thereof thus determining the RPM (revolutions per minute) to be maintained. Therefore, the internal gear pump 4 has a fixed displacement/flow rate, the flow rate change is achieved due to the change in the rotation speed of motor 5.

Motor 5 is a conventional four-pole, three-phase asynchronous motor, comprising a forced ventilation system. Electric motor 5 is designed to be connected to a frequency variator, so as to ensure a much higher performance than the conventional asynchronous electric motors.

Internal gear pump 4 is normally stopped in a situation of non-use of stretching machine 1 and is silent. At the precise moment when a movement of stretching machine 1 is required, the internal gear pump 4 is automatically set in motion reaching the number of revolutions needed to ensure proper oil flow required for the required operation. The oil is forced into hydraulic circuit 8 by means of electro-distributor 7. When the movement is completed, motor 5 immediately reduces the rotation until it turns off. The maximum noise of the internal gear pump 4 measured at maximum speed is lower than 80 dB. The type of internal gear pump 4 used allows the exclusion of any auxiliary pump.

The internal gear pump 4 is directly connected to motor 5 by means of a flexible coupling.

The internal gear pump 4 (Figures 3 and 4) comprises a fastening flange 451, a hydrodynamic support pinion shaft 454, a housing 452, a cover 453 with a through shaft, a hollow wheel 4511, plain bearings 456, axial plates 457, a stop pin 459 and a radial compensation segment 4514.

The pinion shaft 454 is adapted to be coupled to the hollow toothed wheel 4511 by means of the teeth 4519 which radially protrude outside said pinion shaft 454. Said teeth 4519 are adapted to mesh with teeth 4518 protruding towards the interior of the hollow toothed wheel 4511, thus

causing the latter to rotate. During the rotation, the radial forces exerted on the toothed wheel 4511 under pressure are largely absorbed by the hydrostatic bearing 450. Moreover, the pinion shaft 454 is supported by a radial slide bearing 4515 hydrodynamically lubricated.

5 The space between the teeth 4513 of the hollow toothed wheel 4511 of the internal gear pump 4 is adapted to draw the fluids, for example oil. During the rotation of the hollow toothed wheel 4511, the liquid enters into the cavities formed between the teeth 4513: when the space between the teeth 4513 is reduced, the volume is reduced and the liquid is forced outside
10 through an outlet channel 4517.

Internal gear pump 4 is mounted directly inside the liquid tank so as to reduce the sound more.

Using internal gear pumps advantageously allows to achieve the yield standards of the piston pumps but with lower costs in terms of cost of the pump itself, consumption of the gear pumps, and maintenance of the gear
15 pumps.

A further advantage is given by the fact that the pump remains turned off between a working cycle and the next one, generating an appreciable energy saving. The lower use of the hydraulic fluid, due to the targeted
20 powering of the pump exclusively limited to the precise number of revolutions (oil flow rate) required by the work, minimizes the electrical consumption of the motor and the overheating of the hydraulic fluid which will require, in this case, a heat exchanger of a smaller size and therefore with lower energy consumption.

25 A further advantage is given by the reduced noise of the gear pumps as compared to the piston pumps, this allows the manufacturer to mount the pumps close to the stretching machine.

Another advantage is given by the fact that the hydraulic system has been developed so that the main pump may exclude and carry out the
30 functions previously carried out by the auxiliary pumps; this allows to

reduce considerably the extraordinary production halts of the stretching machine due to a pump out of service.

5 An additional advantage comes from the employment of a single type of pump, this allows to reduce the maintenance costs and to store only the spare parts for the internal gear pumps in stock.

 A further advantage is given by the robustness of the internal gear pumps, they require indeed little maintenance while further reducing the costs.

CLAIMS

1. A stretching machine (1) for non-ferrous profiles comprising a head (2) provided with a body (22) and a clamp (21), hydraulic cylinders (3, 31), at least one pump (4), at least one electric motor (5), a liquid tank (6), at least one electro-distributor (7) and a hydraulic circuit (8), characterized in that said pump (4) is an internal gear pump comprising a pinion shaft (454) provided with teeth (4519) placed radially outside said pinion shaft (454) and a hollow toothed wheel (4511) comprising teeth (4518) protruding towards the interior of said hollow toothed wheel (4511), said pinion shaft (454) is adapted to drive the rotation of said hollow toothed wheel (4511) meshing the teeth (4519) of the pinion shaft (454) with the teeth (4518) of the hollow toothed wheel (4511).

2. A stretching machine (1) for non-ferrous profiles according to claim 1, characterized in that the internal gear pump (4) has fixed flow rate, the flow rate change of the internal gear pump (4) is achieved by varying the rotation speed of the motor (5).

3. A stretching machine (1) for non-ferrous metal profiles according to claim 1 or 2, characterized in that a first hydraulic cylinder (3) is adapted to control the horizontal movements of the head (2) while a second hydraulic cylinder (31) is adapted to control the movements of the clamp (21) of said head (2) of the stretching machine (1).

4. A stretching machine (1) for non-ferrous metal profiles according to claims 1 to 3, characterized in that the clamp (21) of the head (2) is adapted to lock a metal profile, generating a friction between said clamp (21) and a base (221) of the body (22) of the head (2).

5. A stretching machine (1) for non-ferrous metal profiles according to claim 4, characterized in that the inflow of the hydraulic fluid in the second cylinder (31) is adapted to cause the lifting of the clamp (21) while the reduction of the pressure of the hydraulic fluid causes the lowering of the clamp (21) against the base (221) of the body (22) of the head (2), the seal of

the hydraulic circuit (8), the pressure of the hydraulic fluid maintaining the clamp (21) lowered towards the base (221) of the body (22) generating a friction between the clamp (21) and the base (221) of the body (22).

5 6. A stretching machine (1) for non-ferrous profiles according to claim 1, characterized in that the motor (5) is connected directly to the pump (4) by means of a flexible coupling.

7. A stretching machine (1) for non-ferrous profiles according to any one of the preceding claims, characterized in that the pump (4) is mounted inside a fluid tank of the stretching machine (1).

10 8. A stretching machine (1) for non-ferrous profiles according to any one of the preceding claims, characterized in that the pump (4) is positioned in the same room as the stretching machine (1).

15 9. A stretching machine (1) for non-ferrous profiles according to any one of the preceding claims, characterized in that the motor (5) is a four-pole, three-phase asynchronous motor.

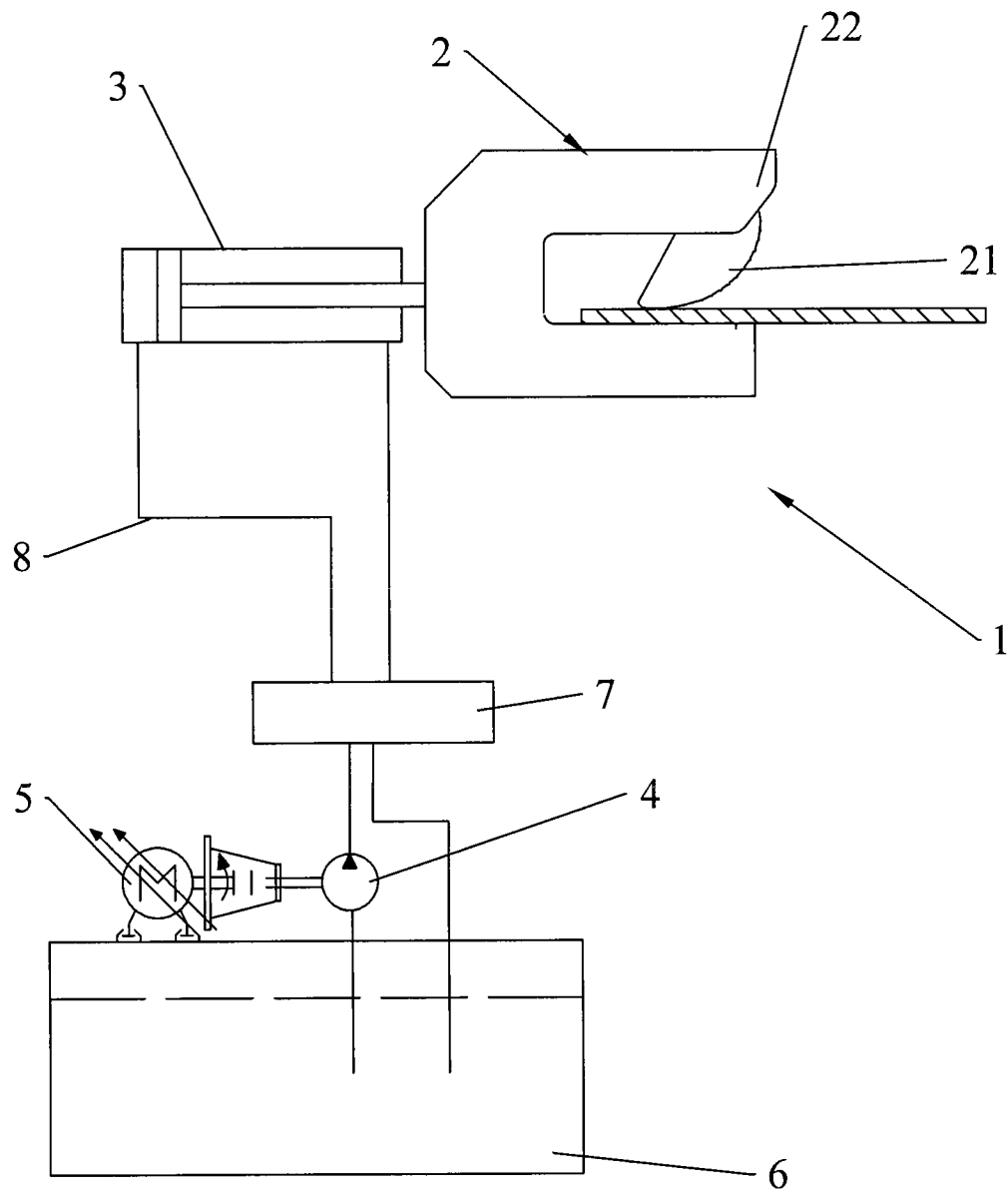


FIG.1

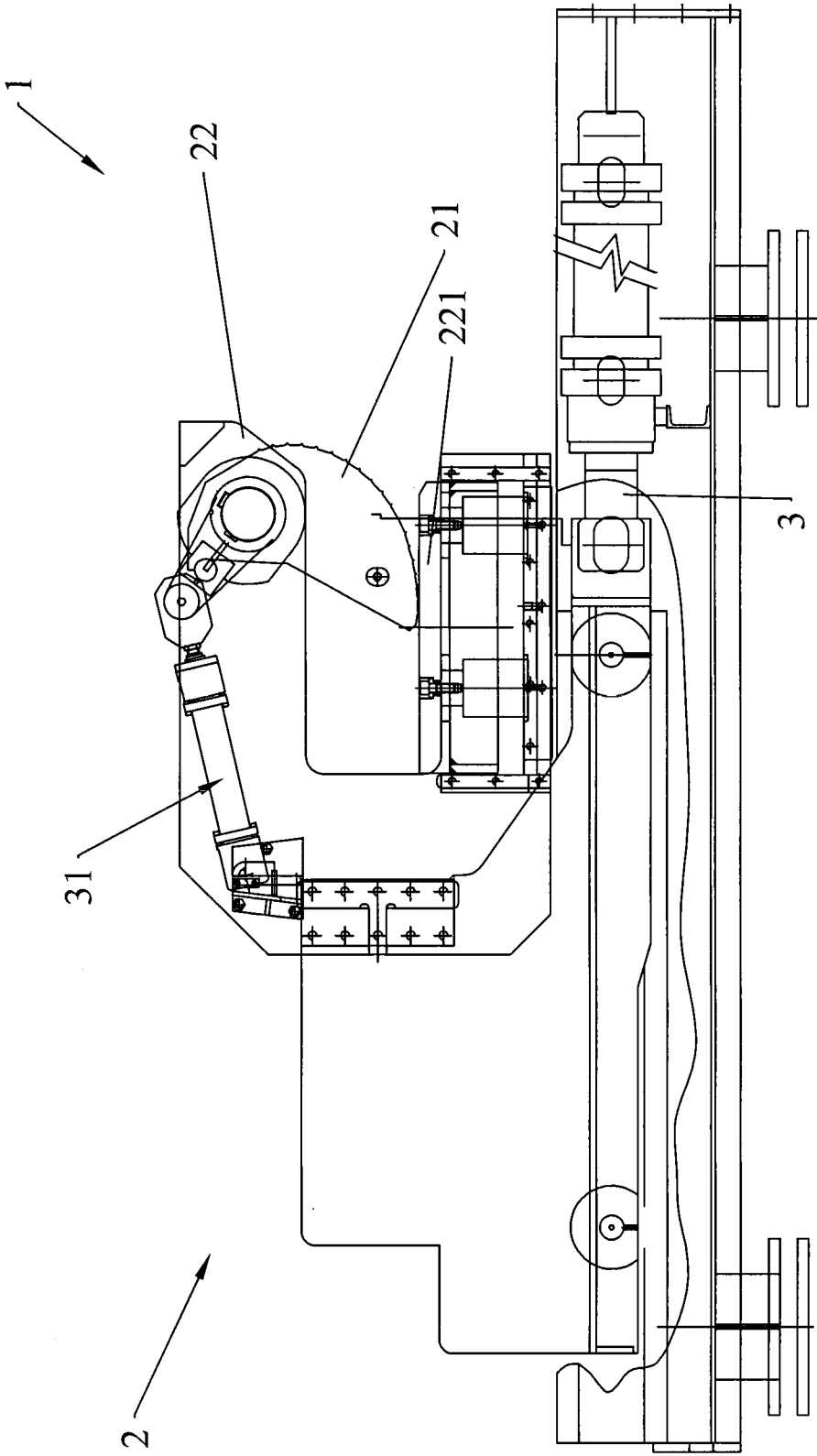


FIG.2

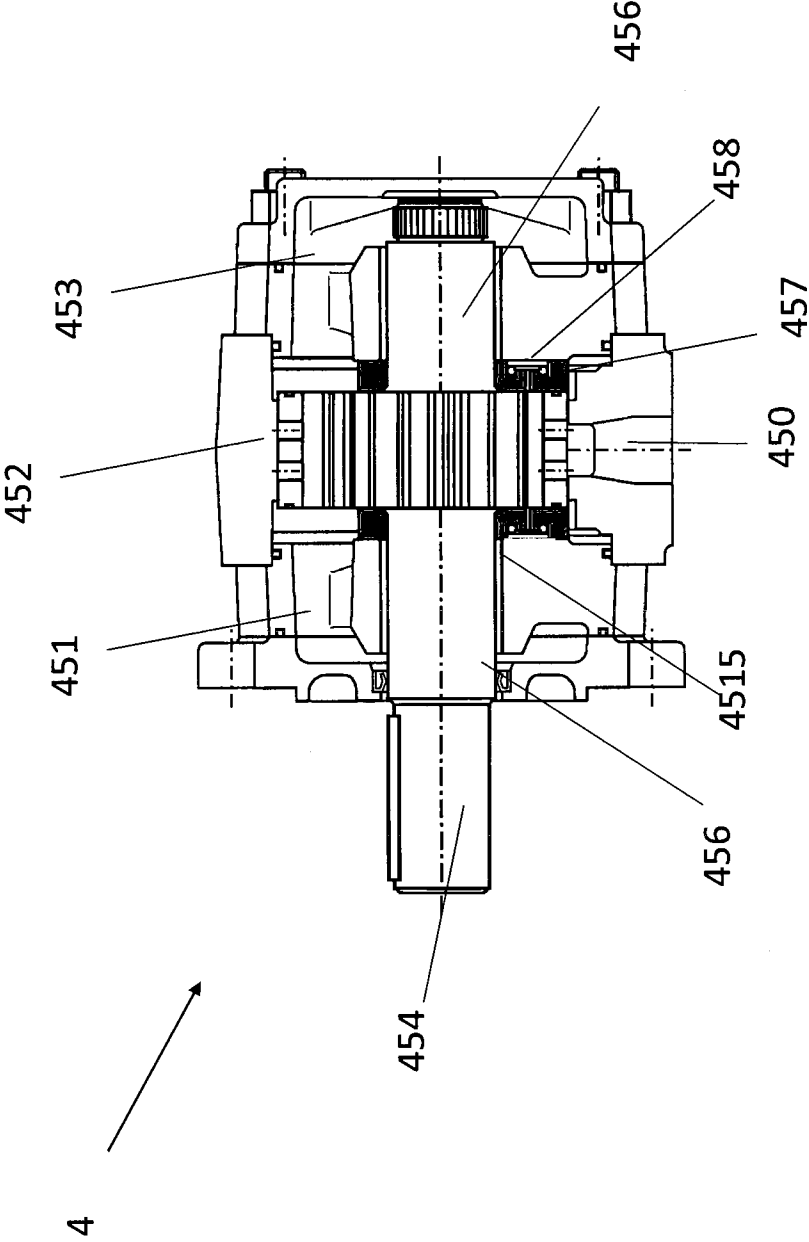


Fig.3

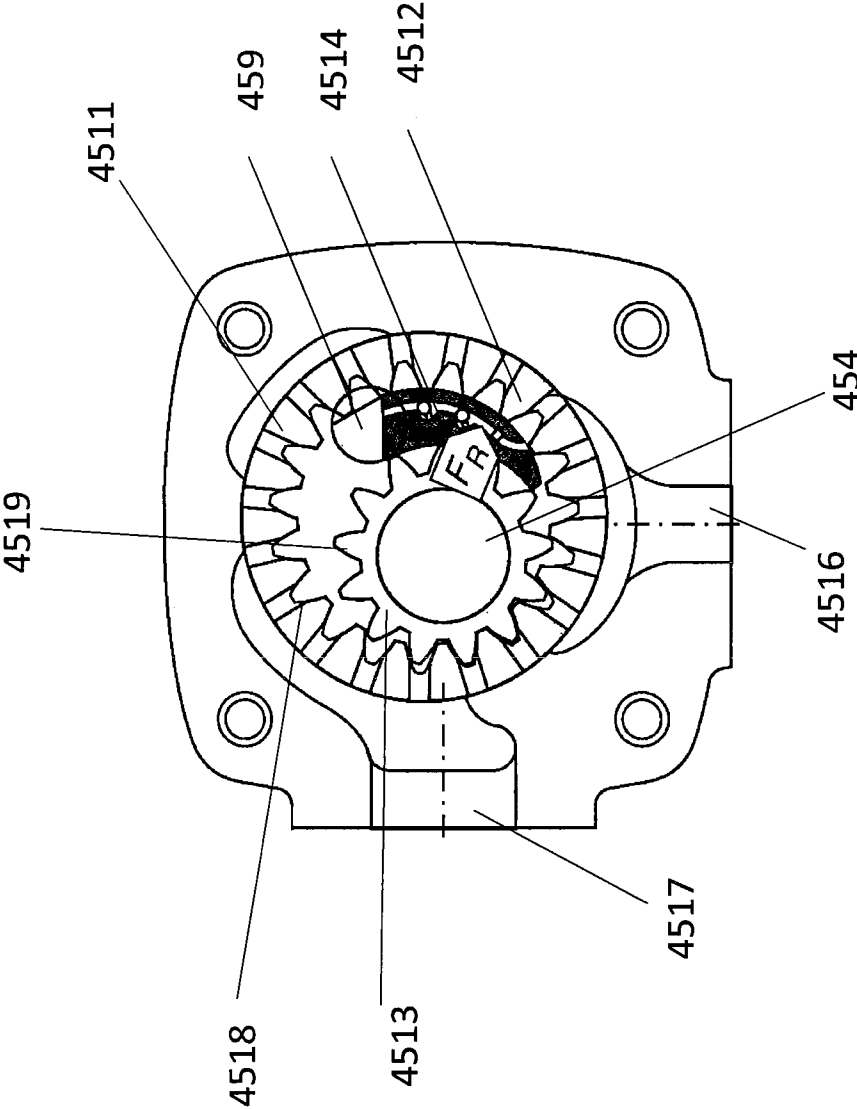


Fig. 4