



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 178 222 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.02.2002 Bulletin 2002/06

(51) Int Cl.7: **F15B 13/06, F15B 11/17**

(21) Application number: **01116758.2**

(22) Date of filing: **19.07.2001**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventors:
• **Musiani, Massimo**
40061 Minerbio (Prov.of Bologna) (IT)
• **Bulgarelli, Claudio**
41100 Modena (IT)

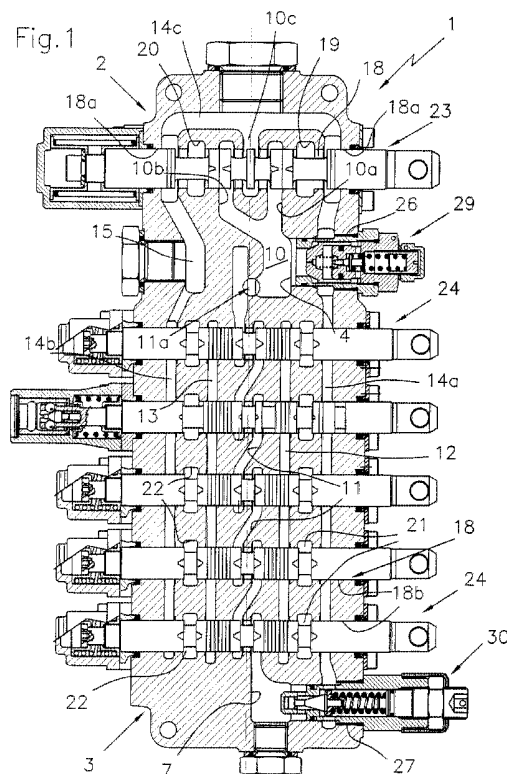
(30) Priority: **31.07.2000 IT BO000473**

(74) Representative: **Modiano, Guido, Dr.-Ing. et al**
Modiano & Associati SpA Via Meravigli, 16
20123 Milano (IT)

(71) Applicant: **Hydrocontrol S.p.A.**
40060 Osteria Grande (IT)

(54) **Hydraulic distribution unit for controlling the actuation of a bush cutter**

(57) A hydraulic distribution unit (2) for controlling the actuation of a bush cutter, comprising a high flow-rate distribution unit associated with a rotary mower and a low flow-rate distribution unit associated with a positioning arm of the rotary mower; the distribution units have respective intake ducts (4,7) which are supplied by a high flow-rate pump and by a low flow-rate pump and respective discharges which lead into a common reservoir for collecting the oil; the distribution units are suitable to feed, by means of a pair of delivery manifolds (5,6), a motor for actuating the rotary mower and, by means of a series of pairs of delivery manifolds (8,9), a piston-type hydraulic servomechanism for mutually opposite movements of the positioning arm, the high flow-rate and low flow-rate distribution units being provided as a single body which has a first portion (2) dedicated to the actuation of the rotary mower and a second portion (3) dedicated to the actuation of the positioning arm.



EP 1 178 222 A2

Description

[0001] The present invention relates to a hydraulic distribution unit for controlling the actuation of a bush cutter suitable to cut roadside weeds.

[0002] Bush cutters are constituted by a rotary mower, which is driven by a hydraulic motor, and by a positioning arm, which generally has three to five movements.

[0003] It is known that the actuation of the bush cutter is controlled by using a hydraulic system constituted by two monobloc distribution units which are supplied by respective pumps generally having a constant flow-rate. The first distribution unit is provided with a number of working sections which can vary from three to five, depending on the situation, each working section being dedicated to a movement of the positioning arm. The second distribution unit is provided with a single section which is completely dedicated to the actuation of the rotary mower.

[0004] The need to have a first distribution unit assigned to the positioning arm and a second distribution unit dedicated to the rotary mower is due to the fact that the positioning arm requires flow-rates, for example of 40-50 l/min, which are lower than the flow-rates, for example 100-130 l/min, required by the hydraulic motor associated with the rotary mower. This need is also dictated by the fact that the hydraulic motor of the rotary mower must not be affected, during operation, by the simultaneous action related to the movements of the positioning arm.

[0005] Finally, the commands for actuating the bush cutter are transmitted to the distribution units by way of control means which are mostly cable controls and in other cases are electrohydraulic controls or on-off electric controls.

[0006] It has been found that the hydraulic system used to control the actuation of the bush cutter is very complicated, because it is necessary to operate two separate distribution units supplied by respective pumps. This also entails a considerable space occupation in the region of the vehicle that carries the distribution units, the pumps and the control means.

[0007] The aim of the present invention is to obviate the above drawbacks by providing a hydraulic distribution unit which overcomes the above mentioned problems.

[0008] Within this aim, an object of the present invention is to provide a structure which is easy to manufacture in practice, safe in use, effective in operation and relatively low in cost.

[0009] This aim and this and other objects which will become better apparent hereinafter are achieved by the present hydraulic distribution unit for controlling the actuation of a bush cutter, comprising a high flow-rate distribution unit associated with a rotary mower and a low flow-rate distribution unit associated with a positioning arm of said rotary mower, said distribution units being provided with respective intake ducts which are supplied

by a high flow-rate pump and by a low flow-rate pump and respective discharges which lead into a common reservoir for collecting the oil, said distribution units being suitable to supply, by means of a pair of delivery manifolds, a motor for actuating said rotary mower and, by means of a series of pairs of delivery manifolds, a piston-type hydraulic servomechanism for mutually opposite movements of said positioning arm, characterized in that said high flow-rate and low flow-rate distribution units are provided as a single body which has a first portion dedicated to the actuation of said rotary mower and a second portion dedicated to the actuation of said positioning arm.

[0010] Further characteristics and advantages of the present invention will become better apparent from the detailed description of a preferred but not exclusive embodiment of a hydraulic distribution unit for controlling the actuation of a bush cutter, according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a sectional view, taken along a longitudinal line, of a distribution unit with additive flow-rate;

Figure 2 is a sectional view, taken along a longitudinal line, of a distribution unit without additive flow-rate;

Figure 3 is a top view of said distribution unit;

Figures 4, 4a respectively illustrate two transverse sectional views of said distribution unit.

[0011] With reference to the figures, the reference numeral 1 generally designates a distribution unit according to the invention. The distribution unit 1 is formed by a longitudinally elongated single body which comprises a first portion 2, dedicated to the actuation of a rotary mower, not shown, and a second portion 3, dedicated to the actuation of a positioning arm, also not shown. The first portion 2 has, as shown in Figure 3, in its upper part an intake duct 4, which is supplied by a high flow-rate pump, and two delivery manifolds 5 and 6, which are connected to a motor for actuating the bush cutter. Likewise, the second portion 3 has, in its upper part, another intake duct 7, which is supplied by a low flow-rate pump, and a series of pairs of delivery manifolds 8 and 9, each whereof is connected to a piston-type hydraulic servomechanism which is designed to move the positioning arm in mutually opposite directions.

[0012] The high flow-rate pump is adapted to supply the actuation motor, while the low flow-rate pump is adapted to actuate the positioning arm; the high flow-rate pump and the low flow-rate pump draw from a common fluid collection reservoir. Such devices, i.e., the pumps, the motor and the positioning arm, are not described further herein since they are entirely conventional and unrelated to the innovative concept of the present invention.

[0013] The distribution unit 1, as shown in Figures 1

and 2, is internally provided with a high flow-rate supply channel 10 (see Figure 1), which is formed in the central region of the first portion 2 and is connected at its inlet to the intake duct 4, and a low flow-rate supply channel 11, which is formed in the central region of the second portion 3 and is connected at its inlet to the intake duct 7. The supply channel 10 has, on the opposite side with respect to the inlet duct 4, two branches 10a and 10b which are substantially parallel and converge toward an end portion 10c. The supply channel 11 is shaped so as to form zigzag portions which are symmetrical with respect to the longitudinal axis A of the distribution unit 1.

[0014] Two distribution channels 12 and 13, which are parallel to the longitudinal axis A of the distribution unit 1, and a discharge channel 14, which extends along the internal peripheral region of the distribution unit 1, are formed so as to be co-planar to the supply channels 10 and 11. The discharge channel 14 is constituted by two longitudinal portions 14a and 14b, at which there is a common discharge 15, and by a transverse portion 14c, into which the end portion 10c of the supply channel 10 converges.

[0015] The two distribution channels 12 and 13 are connected to the supply channel 11 at the intake duct 7 by way of valve means which are constituted by a single-acting check valve, not shown in the accompanying drawings.

[0016] The supply channels 10 and 11, the distribution channels 12 and 13 and the discharge channel 14 are affected by slider bores 18. In particular, in this preferred embodiment there is a slider bore 18a for the first portion 2 and there are five slider bores 18b for the second portion 3. The slider bore 18a has a larger diameter than the slider bores 18b, since the slider bore 18a is affected by higher flow-rates of liquid than the slider bores 18b.

[0017] The slider bore 18a has, in its central region, two portions with increased diameter which define, in symmetrically opposite positions, a first pair of delivery traps 19, 20 which continue upwardly until they encounter the delivery manifolds 5 and 6.

[0018] Likewise, the slider bores 18b have, in their central region located between the discharge channel 14 and the pair of distribution channels 12 and 13, portions having enlarged diameters which form, in symmetrically opposite positions, a second pair of delivery traps 21 and 22 which continue upwardly until they encounter each one of the series of pairs of delivery manifolds 8 and 9.

[0019] The slider bores 18a and 18b are crossed by respective sliders 23 and 24 which can move by way of actuation means.

[0020] The slider 23 can move on command so as to supply the actuation motor of the rotary mower. The translational motion imparted to the slider 23 by the actuation means selectively connects the branch 10a to the delivery trap 19 and the delivery trap 20 to the discharge channel 14 or, upon an opposite command, connects the branch 10b to the delivery trap 20 and the de-

livery trap 10 to the discharge channel 14.

[0021] Each one of the sliders 24 can move on command in the corresponding slider bore 18b in order to actuate opposite movements of the positioning arm. The translational motion imparted to the slider 24 by the actuation means selectively connects the distribution channels 12 and 13 to the delivery traps 21 and 22 and one of the two portions 14a and 14b of the discharge channel 14.

[0022] Damping valves 25 are associated with each one of the slider bores 18a and 18b and are designed to cushion the overpressure waves generated inside the distribution unit 1 at the delivery traps 19, 20 or 21, 22.

[0023] As regards the supply channels 10 and 11, they can be connected one another by means of a check valve 11a, which adds the flow-rate of the fluid of the supply channel 11 to the flow-rate of the fluid that flows through the supply channel 10.

[0024] Bores 26 and 27 are formed at the intake ducts 4 and 7 and affect the portion 14a of the discharge channel 14 until they lead into the ducts 4 and 7. The holes 26 and 27 are closed by the insertion of respective pressure limiting valves 29 and 30, which are rated so as to open, and thus connect the supply channels 10 and 11 to the discharge channel 14, according to set threshold pressure values.

[0025] The control means consist of two electric proportional actuation devices 32 and 33 being inserted in openings 34, 35 which are connected, by means of holes 36 and 37, to the opposite ends of the slider bores 18a and 18b. Said control devices 32, 33 are constituted by an electrical part and by a piston 38 which is provided inside the valve 32, 33 and is actuated by the electrical part. The piston 38, in its movement, varies the pressure in the holes 36 and 37, imparting translational motions to the sliders 23 and 24.

[0026] The electric proportional control devices 32 and 33 can be replaced with other control means known from the known art.

[0027] In practical operation, actuation control by means of the distribution unit 1 occurs as follows.

[0028] The high flow-rate pump and the low flow-rate pump inject into the inlet ducts 4 and 7 oil at a flow-rate and pressure which are respectively Q_1 , P_1 and Q_2 , P_2 . For a configuration of the sliders 23 and 24 as in Figure 2, the oil flows out through the supply channels 10 and 11 into the discharge channel 14, from which it exits toward the common collection reservoir by means of the common discharge 15. For a configuration of the sliders 23, 24 as in Figure 1, the oil having a flow-rate Q_2 and a pressure P_2 flows out of the supply channel 11 into the supply channel 10, adding to the flow-rate Q_1 of the oil injected by means of the duct 4. At this point the oil having the flow-rate $Q=Q_1+Q_2$ flows out directly into the discharge channel 14.

[0029] Starting from the configuration of Figure 1, the positioning arm is controlled by actuating the slider 24 by actuation means, while the rotary mower is controlled

by actuating the slider 23 by the control means. By moving one of the sliders 23 in one direction, the supply channel 12 is blocked and is connected, at the intake duct 7, to the distribution channels 12 and 13. The distribution channel 13 is connected to the delivery trap 22, where the pressurized oil, having a flow-rate Q_2 and a pressure P_2 , is sent to the piston-type hydraulic servomechanism by means of the delivery manifold 9. Correspondingly, an equal amount Q_2 of oil from the piston-type hydraulic servomechanism is sent through the delivery manifold 8 to the delivery trap 22, whence it flows into the discharge channel 14. This actuation is matched by a movement of the positioning arm. The opposite actuation reverses the movement of the positioning arm according to an operating cycle which is the opposite of the one described earlier. In this context, the oil flow-rate available in the supply channel 10 is Q_1 . If the slider 23 is actuated simultaneously with the slider 24, the oil having the flow-rate Q_1 and the pressure P_1 is sent through the delivery manifolds 5 and 6 to the motor for actuating the rotary mower. If the slider 23 were actuated when none of the sliders 24 actuates the positioning arm, the actuation motor receives, by means of the delivery manifolds 5 and 6, the oil having the flow-rate Q_1+Q_2 . Finally, if overpressures occur during normal operation in the supply channels 10 and 11, the pressure limiting valves 29 and 30 intervene, diverting the oil into the discharge channel 14.

[0030] It has thus been shown that the invention achieves the intended aim and objects.

[0031] In particular, the fact is stressed that the distribution unit is a single body which fully provides control of the actuation of the bush cutter.

[0032] Moreover, the distribution unit allows to increase the oil flow-rate on the bush cutter actuation motor by way of the check valve.

[0033] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0034] All the details may further be replaced with other technically equivalent ones.

[0035] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

[0036] The disclosures in Italian Patent Application No. BO2000A000473 from which this application claims priority are incorporated herein by reference.

[0037] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A hydraulic distribution unit for controlling the actuation of a bush cutter, comprising a high flow-rate distribution unit associated with a rotary mower and a low flow-rate distribution unit associated with a positioning arm of said rotary mower, said distribution units being provided with respective intake ducts which are supplied by a high flow-rate pump and by a low flow-rate pump and respective discharges which lead into a common reservoir for collecting the oil, said distribution units being suitable to supply, by means of a pair of delivery manifolds, a motor for actuating said rotary mower and, by means of a series of pairs of delivery manifolds, a piston-type hydraulic servomechanism for mutually opposite movements of said positioning arm, **characterized in that** said high flow-rate and low flow-rate distribution units are provided as a single body which has a first portion dedicated to the actuation of said rotary mower and a second portion dedicated to the actuation of said positioning arm.
2. The distribution unit according to claim 1, **characterized in that** said single body is internally provided with a high flow-rate supply channel and with a low flow-rate supply channel communicating at the inlets thereof with said respective intake ducts, two distribution channels which are connected to said low flow-rate supply channel by means of a check valve, and a peripheral discharge channel, said channels being affected by slider bores in which respective movable sliders operate, said sliders being suitable to selectively connect said high flow-rate supply channel to said discharge channel and said low flow-rate supply channel to said distribution channels in said discharge channel.
3. The distribution unit according to claims 1 and 2, **characterized in that** said discharge channel leads into a common discharge.
4. The distribution unit according to claims 1, 2 and 3, **characterized in that** said high flow-rate supply channel and said low flow-rate supply channel are connected by means of a check valve for flow-rate augmentation which is suitable to add the flow-rate of the fluid that circulates in the second portion to the flow-rate of the fluid that circulates in said first portion.
5. The distribution unit according to the preceding claims, **characterized in that** said slider bore related to said first portion is provided, in its central region, with a first pair of delivery traps which are provided as a continuation of said corresponding pair of delivery manifolds.

6. The distribution unit according to the preceding claims, **characterized in that** each one of said slider bores related to said second portion is provided in its central region, between said discharge channel and said distribution channels, with a second pair of delivery traps provided as a continuation of each one of said series of delivery manifold pairs.
7. The distribution unit according to the preceding claims, **characterized in that** valve means are provided at said intake ducts and are suitable to connect said high flow-rate supply channel and said low flow-rate supply channel to said discharge channel at a preset threshold pressure value.

5

10

15

20

25

30

35

40

45

50

55

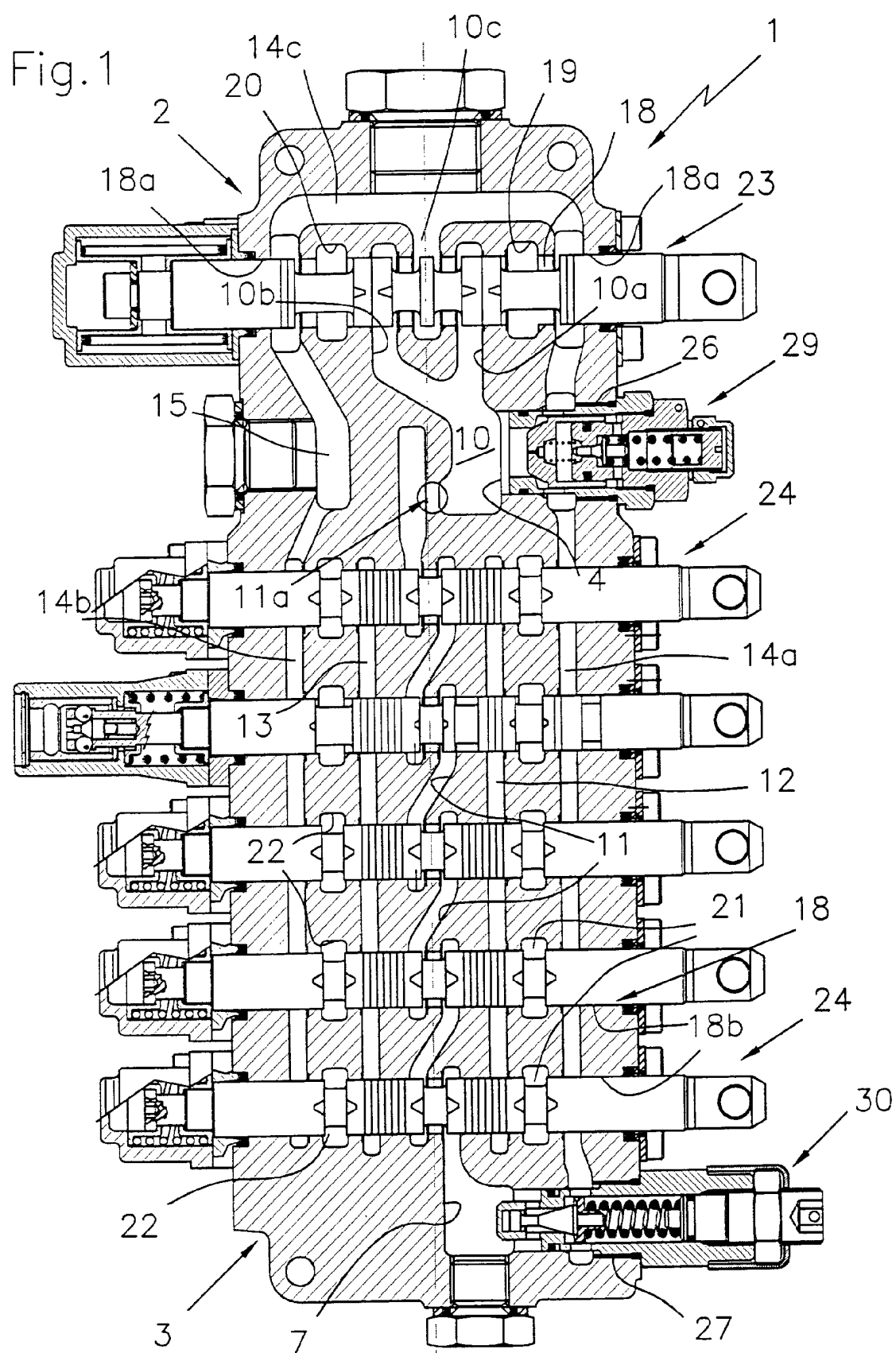


Fig.2

