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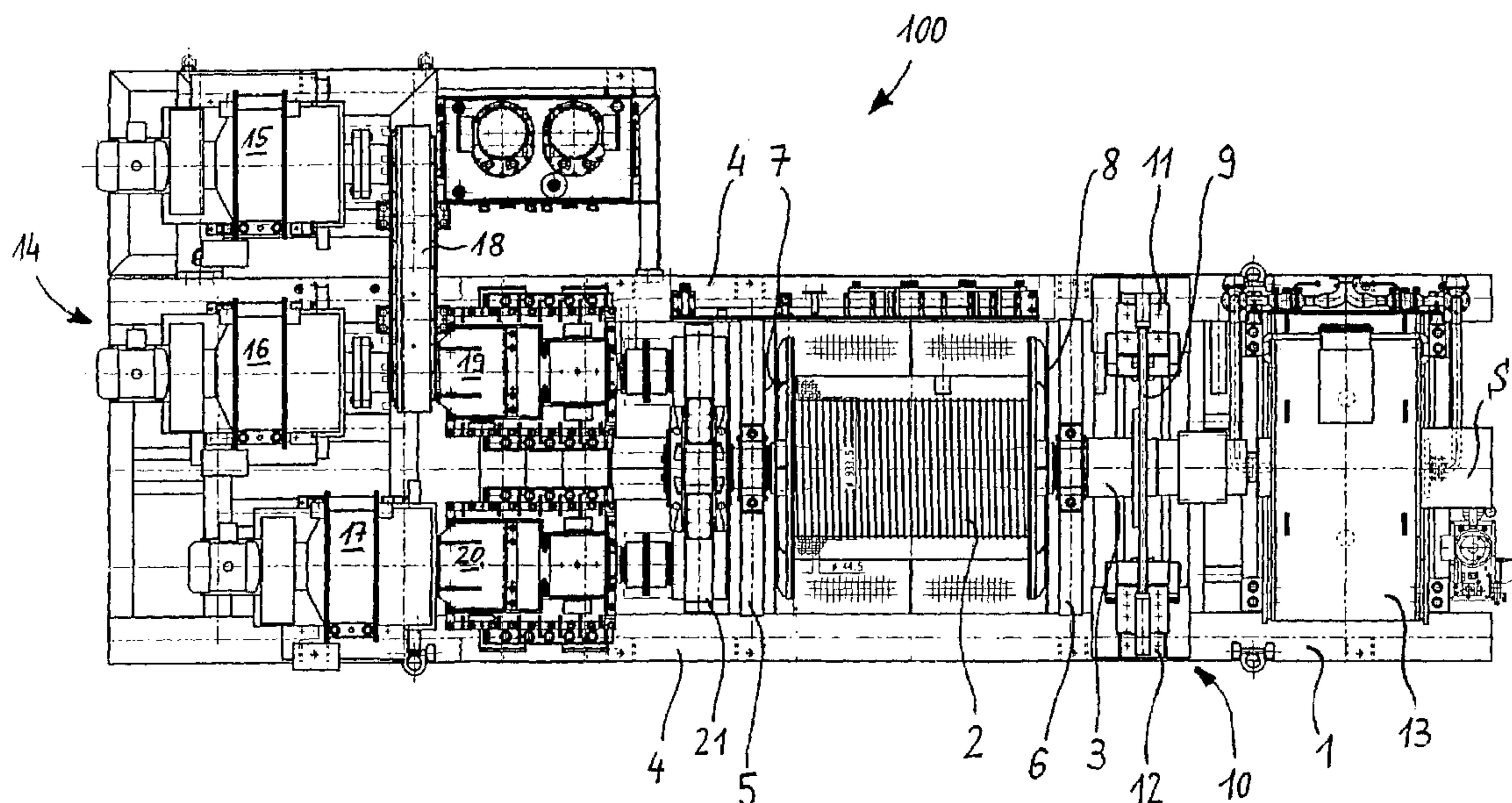
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(54) Titre : MECANISME DE LEVAGE

(54) Title: DRAW WORKS



(57) Abrégé/Abstract:

The invention relates to a draw works for lowering and hoisting a load, especially a drilling device or a drilling closing device. Said draw works is especially suitable for using on floating drilling rigs and comprises at least one braking mechanism for braking and holding the load. According to the invention, an emergency braking device is provided for producing an additional braking force.



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ABSTRACT

In the drawworks for lowering and withdrawing a load,
in particular a drilling or a drilling plugging device,
in particular for use on floating drilling platforms,
15 which drawworks has at least one brake arrangement for
braking and holding the load, an emergency brake device
is provided for producing an additional braking force
(fig. 1).

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DRAWWORKS

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The invention relates to a drawworks of the type corresponding to the preamble of claim 1.

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Such drawworks serve to lower and withdraw a load, in particular a drilling device or a borehole plugging device, for example from a floating platform onto the sea bottom or into or onto a borehole. They have a rotatably mounted winding drum, to which a flexible draw means is fastened, which is usually designed as steel cable and can be wound up or unwound by rotary drive of the winding drum.

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At least one rotary drive device is provided for the rotary drive of the drum. This rotary drive device regularly comprises an electric motor. However, it is likewise possible to use a hydraulic or pneumatic drive instead of a direct-current motor.

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To brake the winding drum during the lowering of the load and to hold the load above the bottom, such drawworks have a brake device which comprises a mechanically acting brake arrangement. To relieve this mechanically acting brake arrangement, further brake arrangements which do not act mechanically, for example eddy-current brake arrangements, may also be provided.

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In practice, the drawworks are adapted in their construction to the maximum hoisting capacity to be expected, which is determined by the intended use of

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the drawworks. Said hoisting capacity, by definition, is specified for the first cable layer on the winding drum. For further winding layers, i.e. during further winding-up of the cable onto the winding drum, the maximum hoisting capacity decreases due to the larger lever associated therewith, under which the load acts on the winding drum.

For safety, the cable is dimensioned in such a way that its breaking load corresponds to at least twice the hoisting load of the drawworks. The superstructures via which the cable is deflected - for example a mast - are designed for 1.8 times the hoisting load. In order to avoid a situation, caused by actuation of the brake device, in which forces can be exerted on the superstructures or the cable which are greater than the breaking load of these components, the brake device is conceived in such a way that the maximum load to be held corresponds to 1.5 to 1.6 times the hoisting load.

In the past, incidents have repeatedly occurred in which an unwinding operation could not be stopped or could not be stopped in good time by means of the brake device. A possible cause for a series of such incidents could have been that loads were held above the bottom close to the maximum hoisting load with multiple cable layer on the winding drum, which has finally led to overloading of the brake device.

The object of the invention is therefore to improve the operational safety of such drawworks.

This object is achieved by the invention reproduced in claim 1.

Owing to the fact that, according to the invention, an emergency brake device is provided for producing an additional braking force, the brake devices used

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hitherto, which - as described above - offer protection against overloading of other components and ensure trouble-free operation in the vast majority of applications, can continue to be used. The additional
5 emergency brake device now enables an additional braking force to be applied if required, i.e. if the braking power is momentarily inadequate. Since the emergency brake devices are devices which are provided in addition to the brake device, and the latter is not
10 simply dimensioned to be larger, the emergency brake devices are only activated when they are actually required. Braking of the winding drum is therefore even possible in the event of a total failure of the brake device.

15
In a first preferred embodiment of the drawworks according to the invention, the brake arrangement has at least one brake shoe acting on a rotary part and a device for applying a braking force to the at least one
20 brake shoe, the emergency brake arrangement being designed in such a way that an additional device for optionally exerting an additional braking force on the rotary part is provided. If the braking power which can be achieved with the brake arrangement in normal
25 operation is no longer sufficient, additional braking power can be actively produced by actuating the additional device.

The device for applying a braking force to the at least
30 one brake shoe preferably comprises a spring arrangement applying the braking force to the at least one brake shoe. To control the braking force exerted on the brake shoe, the device comprises an arrangement which acts in the opposite direction to the spring
35 arrangement and is intended for controlling the braking force exerted on the brake shoe. This measure ensures that, if the hydraulic device fails, the brake shoes

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are pressed against the brake disk with the maximum force, so that the maximum braking power is produced.

5 The additional device is then preferably designed in such a way that it comprises an arrangement for displacing the seat absorbing the reaction forces of the spring arrangement. When the additional device is actuated, the preloading of the spring arrangement is therefore increased, which leads to an increase in the
10 braking force acting on the at least one brake shoe and thus to an increase in the braking power.

The additional device is preferably designed as a device which can be actuated hydraulically.

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In a further preferred embodiment of the drawworks according to the invention, the emergency brake arrangement comprises an additional brake device which can be engaged alternatively to the brake arrangement.

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If the brake arrangement and emergency brake arrangement are designed in such a way that in each case at least one hundred percent of the maximum braking power required can be achieved with them, the
25 emergency brake arrangement can completely replace the brake arrangement, so that emergency operation of the drawworks is possible even in the event of complete failure of the brake arrangement.

30 The construction of the emergency brake arrangement can at least essentially correspond to that of the main brake arrangement.

If the drawworks comprises at least one gearbox coupled
35 on the input side to a drive motor and interacting on the output side with a summation gear, it is possible to arrange the emergency brake arrangement on the input side and/or on the output side of the gearbox.

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The emergency brake arrangement can be engaged manually.

- 5 Especially preferred, however, is an embodiment in which a control device is provided which compares the respective braking-power setpoint with a parameter characteristic of the braking-power actual value achieved by the main brake arrangement and, in the
10 event of a differential value of braking setpoint - braking actual value > 0 , activates the emergency brake device so that the differential value corresponds approximately to 0, the maximum total braking power preferably being $\leq 130\%$ of the braking-power setpoint.
15 In this especially preferred embodiment, if the braking power achieved with the main brake arrangement decreases below the setpoint, the emergency brake arrangement is activated via the control device for producing the additional braking power required.
20 Limiting the total braking power to a maximum of 130% of the setpoint avoids a situation in which forces exerted on the components of the drawworks or on other components by initiating the braking power reach values above the breaking loads of these components, thereby
25 avoiding the risk of damage due to the initiation of excessive braking power.

In a further embodiment of the drawworks according to the invention, the emergency braking arrangement is
30 formed by a feeding device for the controlled or regulated lowering, holding or withdrawal of the load, to be precise by virtue of the fact that the lowering device has a capacity suitable for braking and holding the maximum hoisting capacity of the drawworks.

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The feeding device preferably comprises an electrically, hydraulically or pneumatically driven motor, which also serves to apply the emergency braking

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power. Furthermore, if the feeding device comprises a gearbox, to which the motor is coupled, the motor can be coupled to the gearbox via an additional gear shaft. However, it is likewise possible to couple the motor to the input shaft of the gearbox for a main drive motor for the drawworks.

Exemplary embodiments of the invention are shown in the drawing, in which:

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Fig. 1 shows a first embodiment of a drawworks according to the invention in a plan view;

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Fig. 2 shows a hydraulic plan which shows one possibility for the hydraulic design and activation of the embodiment according to fig. 1;

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Fig. 3 shows a further embodiment of a drawworks according to the invention in an illustration corresponding to fig. 1;

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Fig. 4 shows a hydraulic plan which shows one possibility for the design and activation of the exemplary embodiment according to fig. 3;

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Fig. 5 shows a cutaway side view of the left-hand region according to figs 1 and 3 of a further embodiment of a drawworks according to the invention, and

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Fig. 6 shows a further embodiment of a drawworks according to the invention in a view corresponding to fig. 5.

The drawworks designated overall by 100 in fig. 1 comprises a frame 1, on which the components of the drawworks are mounted. For withdrawing and lowering and

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also for holding a load, in particular a drilling implement or the like, the drawworks 100 comprises a drum 2 which is fastened to a drum shaft 3 in a rotationally fixed manner and the axis S of which runs parallel to the longitudinal sides 4 of the frame 1. It is mounted in bearing blocks 5, 6 which are arranged beyond the two end faces 7, 8 of the drum 2.

A brake disk 9 is arranged in a rotationally fixed manner on that region of the drum shaft 3 which is located on the right of the drum 2 in fig. 1, this brake disk 9 being part of a brake arrangement which is designated overall by 10 and furthermore comprises two brake caliper arrangements 11, 12 offset by 180° in the direction of rotation of the axis S. A further brake caliper arrangement is concealed by the drum shaft 3 and is thus arranged in such a way that it cannot be seen in fig. 1. By means of the brake arrangement 10, the drum 5 can be braked in its rotary speed or even completely stopped during the unwinding operation of a flexible draw means (not shown in the drawing).

To assist the brake arrangement 10 during the braking of an unwinding operation, an eddy-current brake 13 connected to the drum shaft 3 is provided on the other side of the brake arrangement 10 as viewed from the drum 2.

The drive unit 14 of the drawworks 100 for driving the drum 2 is arranged on the left-hand side of the drum 2 according to fig. 1. In the exemplary embodiment shown, it comprises three electric drive motors 15, 16, 17, of which the two shown at the top are coupled to one another via a transmission unit 18.

On the output side, the drive motors 15, 16 on the one hand and 17 on the other hand are operatively connected to gearboxes 19, 20 which are coupled on the output

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side to a summation gear 21 which transmits the drive moment provided by the drive motors 15, 16, 17 to the drum shaft 3.

5 In the drawworks 100, the brake caliper arrangements 11, 12 are configured in the manner which can be seen schematically from fig. 2. They each comprises spring arrangements 22, 23 which press brake shoes (not shown in the drawing) against the brake disk 9. To reduce the
10 braking force thus exerted on the brake shoes until the brake is completely released, hydraulically acting devices 24, 25 are provided which are designed in such a way that an admission of pressure leads to the contraction of the respectively associated spring
15 arrangement 22, 23.

Furthermore, each spring arrangement comprises a further device 26, 27 which can be actuated hydraulically and with which the spring preloading can
20 be increased, which, during actuation, leads to the increase in the braking force with which the respective brake shoe is pressed against the brake disk and thus leads to an increase in the braking power. To this end, in the exemplary embodiment shown in Fig. 2, the seat
25 28, 29 absorbing the reaction force of the respective spring arrangement 22, 23 is displaced toward the brake disk 9.

The emergency brake device formed by the measures
30 described above is actuated by an emergency switch 30 which can be actuated manually and via which electromagnetically actuated hydraulic valves 31, 32 are activated, which upon actuation direct hydraulic fluid from a pressure reservoir 33 via lines 34 to the
35 devices 26, 27.

The configuration described with reference to fig. 2 of the brake caliper arrangement may be realized in one

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brake caliper arrangement or in a plurality of brake caliper arrangements of the brake arrangement.

5 The further exemplary embodiment, shown in fig. 3, of a drawworks according to the invention, which is designated overall by 200, corresponds in its construction and functioning in essential parts to the drawworks 100 according to fig. 1. Accordingly, those components of the drawworks 200 which correspond to
10 those of the drawworks 100 are provided with reference numerals increased by 100. In order to avoid repetitions, reference may be made in this respect to the above description. Only the differences between the drawworks 200 and the drawworks 100 are to be explained
15 below.

In the drawworks 200, the shafts of the drive motors 116, 117 are connected to disk brake arrangements 35, 36, with which the respectively associated shaft can be
20 braked. The disk brake arrangements 35, 36 together form an emergency brake device for producing an additional braking force.

The disk brake arrangements 35, 36 are actuated in the
25 manner which can be seen from fig. 4 via an emergency switch 130 which can be actuated manually and via which an electromagnetically actuated hydraulic valve 131 is activated, which upon actuation draws off hydraulic fluid from the brake calipers 37, 38 via lines 134 to a
30 tank. The brake caliper arrangements 37, 38 of the brake disk arrangements close elastically in a manner corresponding to the brake calipers 111, 112.

In the further exemplary embodiment shown in a cutaway
35 view in fig. 5, the drawworks is equipped with a feeding device 40 which serves to slowly lower a load by means of the drawworks, for example a drilling device at feed rate. To this end, at least one of the

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gearboxes 19, 20, 119, 120 (by way of example reference is only to be made below to the gearbox 20) is provided with an additional input shaft 41 which can be coupled to the main gear shaft (not shown in the drawing). An additional drive motor 42 acts on the input shaft 41 via a miter gear 43. The entire feeding device 40 is dimensioned in such a way that the maximum permissible hoisting load for the drawworks can be applied by it. It may therefore be used as an emergency brake device for the case where the braking power of the brake arrangement of the drawworks diminishes and there is a risk of uncontrolled lowering of a load. To this end, the drive motor 42 is designed as an alternating-current motor which is operated via a frequency converter. To further increase the safety, two electric motors may also be provided instead of the one drive motor 42.

The exemplary embodiment of a drawworks shown in fig. 6 in a cutaway view corresponds in its function to that according to fig. 5. Here, however, the feeding device (designated overall here by 140) is not formed by a unit connected to the gearbox 20, but rather the drive motor 142 is connected via a coupling arrangement 144 to the shaft of the drive motor 17 on the side opposite the gearbox 20. The drive motor 142 may again be replaced by a plurality of motors.

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LIST OF DESIGNATIONS

	1, 101	Frame
	2, 102	Drum
5	3, 103	Drum shaft
	4, 104	Longitudinal side
	5, 105	Bearing block
	6, 106	Bearing block
	7, 107	End face
10	8, 108	End face
	9, 109	Brake disk
	10, 110	Brake arrangement
	11, 111	Brake caliper arrangement
	12, 112	Brake caliper arrangement
15	13, 113	Eddy-current brake
	14, 114	Drive unit
	15, 115	Drive motors
	16, 116	Drive motors
	17, 117	Drive motors
20	18, 118	Transmission unit
	19, 119	Gearbox
	20, 120	Gearbox
	21, 121	Summation gear
	22	Spring arrangement
25	23	Spring arrangement
	24	Device
	25	Device
	26	Device
	27	Device
30	28	Seat
	29	Seat
	30	Emergency switch
	31	Valve
	32	Valve
35	33	Pressure reservoir
	34	Lines
	35	Disk brake arrangement
	36	Disk brake arrangement

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	37	Brake caliper arrangement
	38	Brake caliper arrangement
	40	Feeding device
	41	Input shaft
5	42	Drive motor
	43	Miter gear
	100	Drawworks
	S	Axis
10	200	Drawworks
	140	Feeding device
	142	Drive motor
	144	Coupling

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PATENT CLAIMS

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1. A drawworks for lowering and withdrawing a load, in particular a drilling or a drilling plugging device, in particular for use on floating drilling platforms, having at least one brake arrangement for braking and
15 holding the load, characterized in that an emergency brake device is provided for producing an additional braking force.

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2. The drawworks as claimed in claim 1, characterized in that the brake arrangement has at least one brake shoe acting on a rotary part and a device for applying a braking force to the at least one brake shoe, the emergency brake arrangement being designed in such a way that an additional device for optionally exerting
25 an additional braking force on the rotary part is provided.

30

3. The drawworks as claimed in claim 2, characterized in that the device for applying a braking force to the at least one brake shoe comprises a spring arrangement applying the braking force to the at least one brake shoe.

35

4. The drawworks as claimed in claim 3, characterized in that the device comprises an arrangement which acts in the opposite direction to the spring arrangement and is intended for controlling the braking force exerted on the brake shoe.

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5. The drawworks as claimed in claim 4, characterized in that the additional device comprises an arrangement for displacing the seat absorbing the reaction forces of the spring arrangement.

6. The drawworks as claimed in claim 5, characterized in that the additional device is a hydraulically actuated device.

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7. The drawworks as claimed in claim 1, characterized in that the emergency brake arrangement comprises an additional brake device which can be engaged alternatively to the brake arrangement.

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8. The drawworks as claimed in claim 7, characterized in that the brake arrangement and emergency brake arrangement are designed in such a way that in each case at least one hundred percent of the maximum braking power required can be achieved.

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9. The drawworks as claimed in claims 7 and 8, characterized in that the construction of the emergency brake arrangement at least essentially corresponds to that of the main brake arrangement.

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10. The drawworks as claimed in one of claims 7 to 9, having at least one gearbox coupled on the input side to a drive motor and interacting on the output side with a summation gear, characterized in that the emergency brake arrangement is arranged on the input side and/or on the output side of the gearbox and/or of the summation gear.

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11. The drawworks as claimed in one of claims 7 to 10, characterized in that the emergency brake arrangement can be engaged manually.

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12. The drawworks as claimed in one of claims 7 to 10, characterized in that a control device is provided which compares the respective braking-power setpoint with a parameter characteristic of the braking-power
5 actual value achieved by the main brake arrangement and, in the event of a differential value of braking setpoint - braking actual value > 0 , activates the emergency brake device so that the differential value corresponds approximately to 0, the maximum total
10 braking power preferably being $\leq 130\%$ of the braking power setpoint.

13. The drawworks as claimed in claim 1, characterized in that the emergency braking arrangement is formed by
15 a feeding device for the controlled or regulated lowering, holding or withdrawal of the load, this feeding device being suitably designed for braking and holding the maximum hoisting capacity of the drawworks.

20 14. The drawworks as claimed in claim 13, characterized in that the feeding device comprises an electrically, hydraulically or pneumatically driven motor.

25 15. The drawworks as claimed in claim 14, characterized in that the feeding device comprises a gearbox, to which the motor is coupled.

30 16. The drawworks as claimed in claim 15, characterized in that the motor can be coupled to the gearbox via an additional gear shaft.

17. The drawworks as claimed in claim 15, characterized in that the motor can be coupled to the
35 input shaft of the gearbox for a main drive motor for the drawworks.

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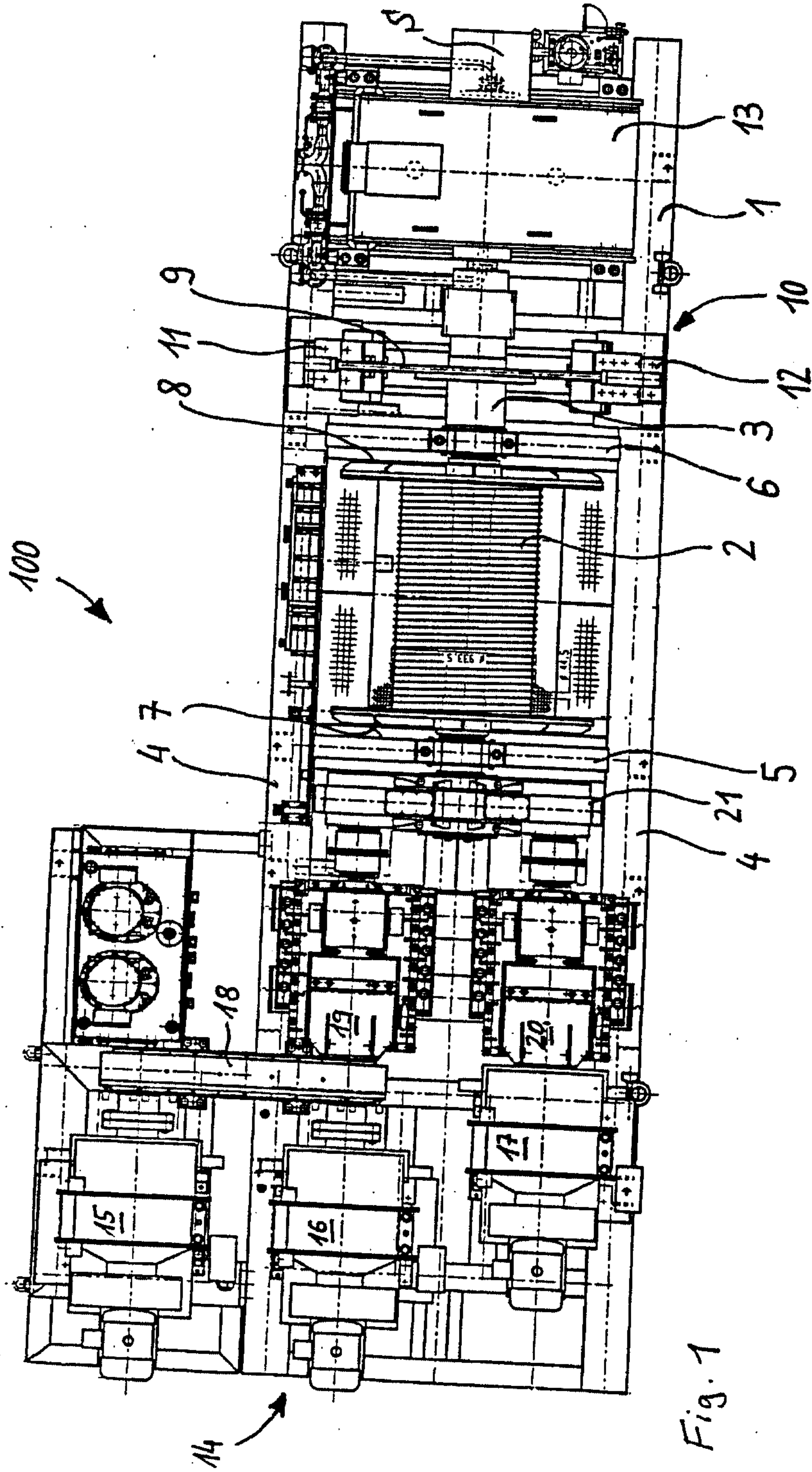
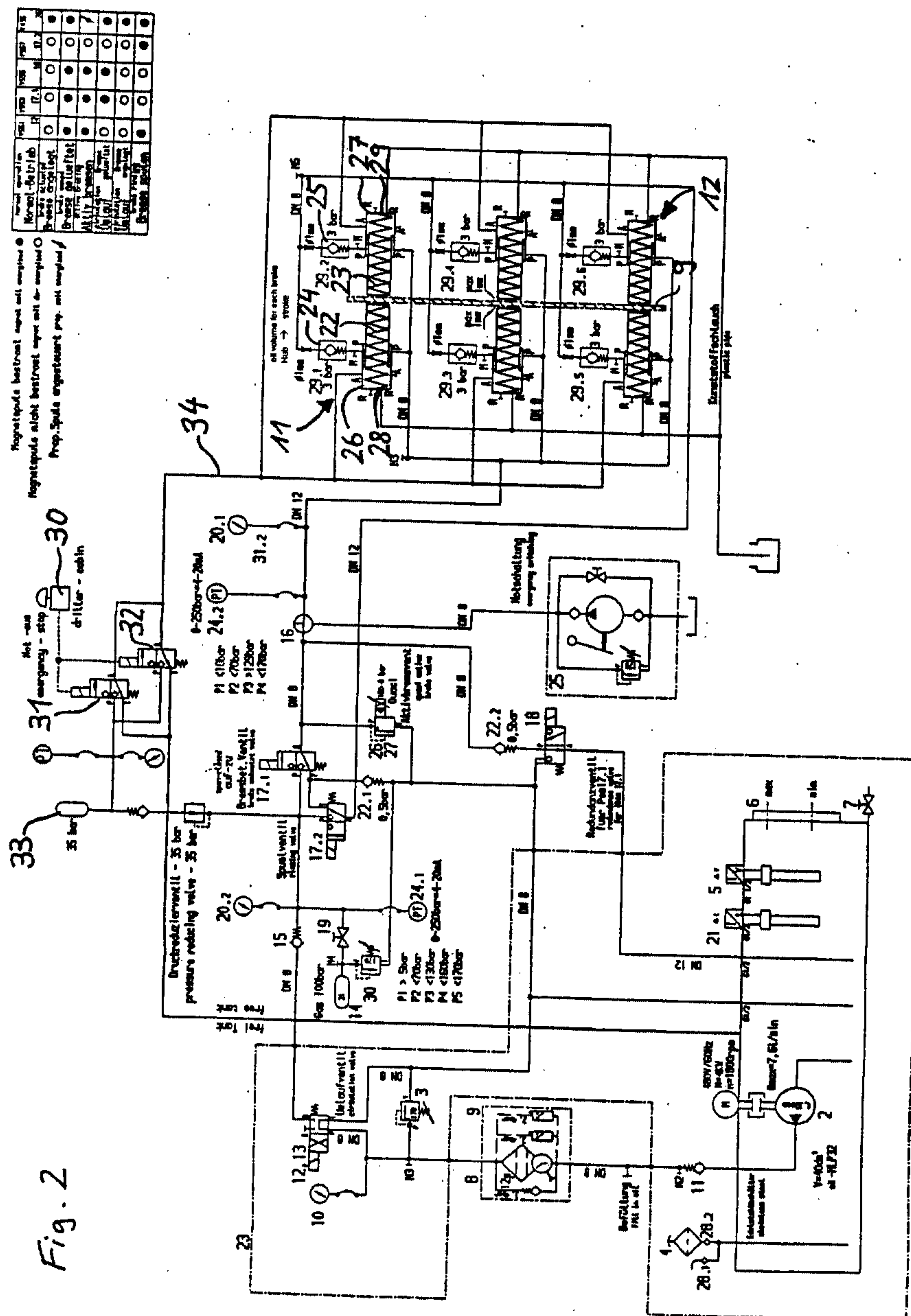
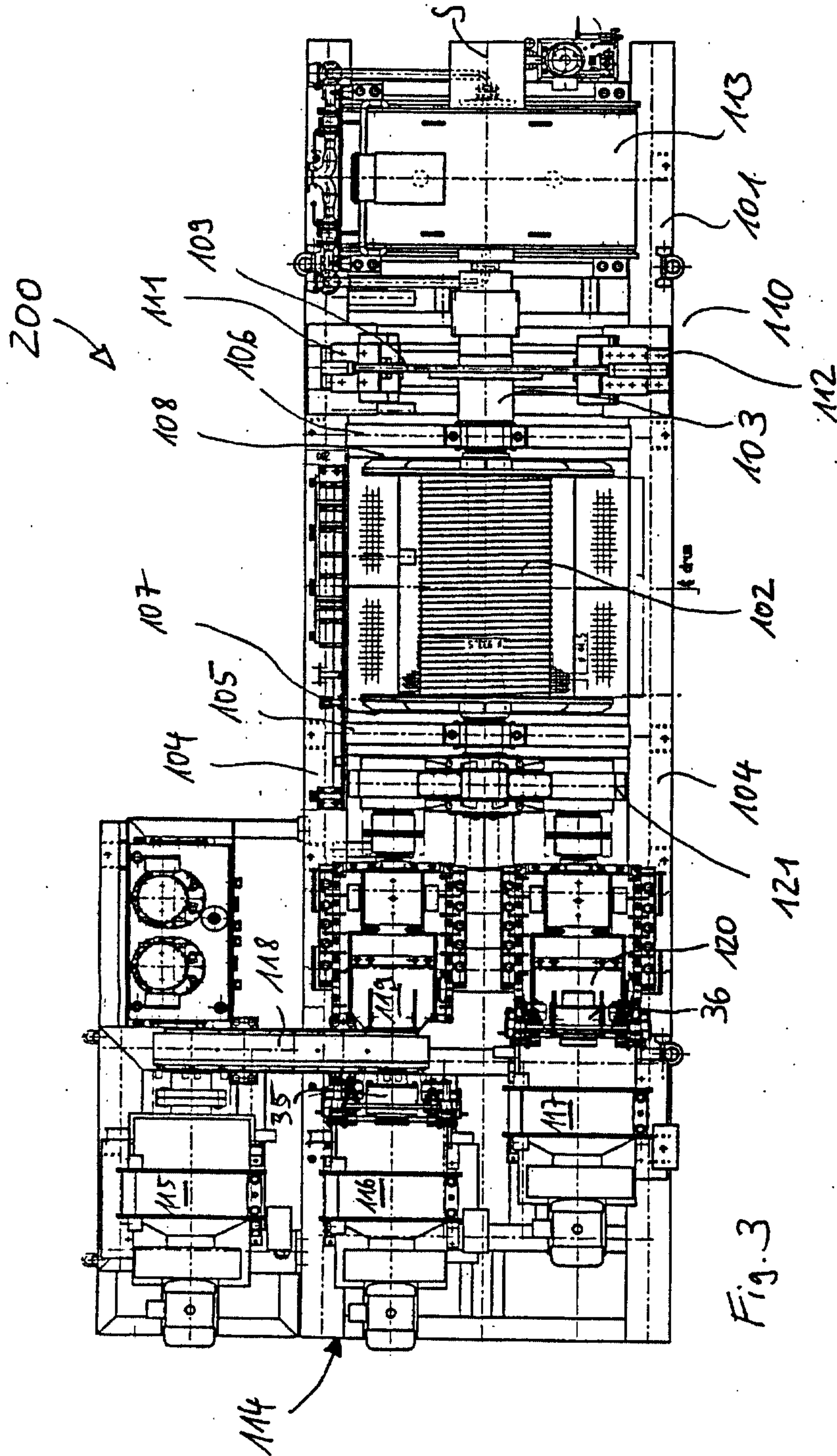


Fig. 1

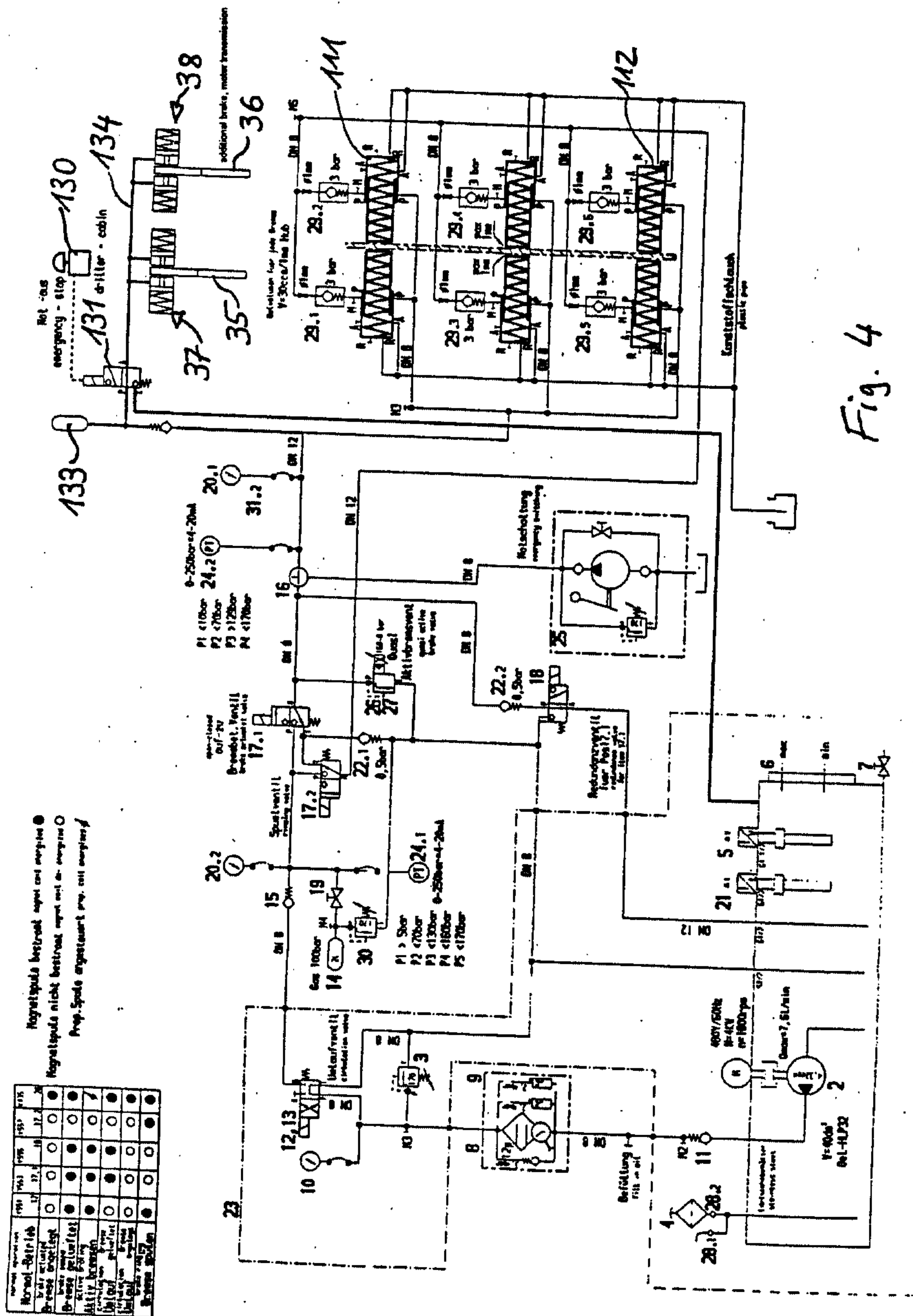
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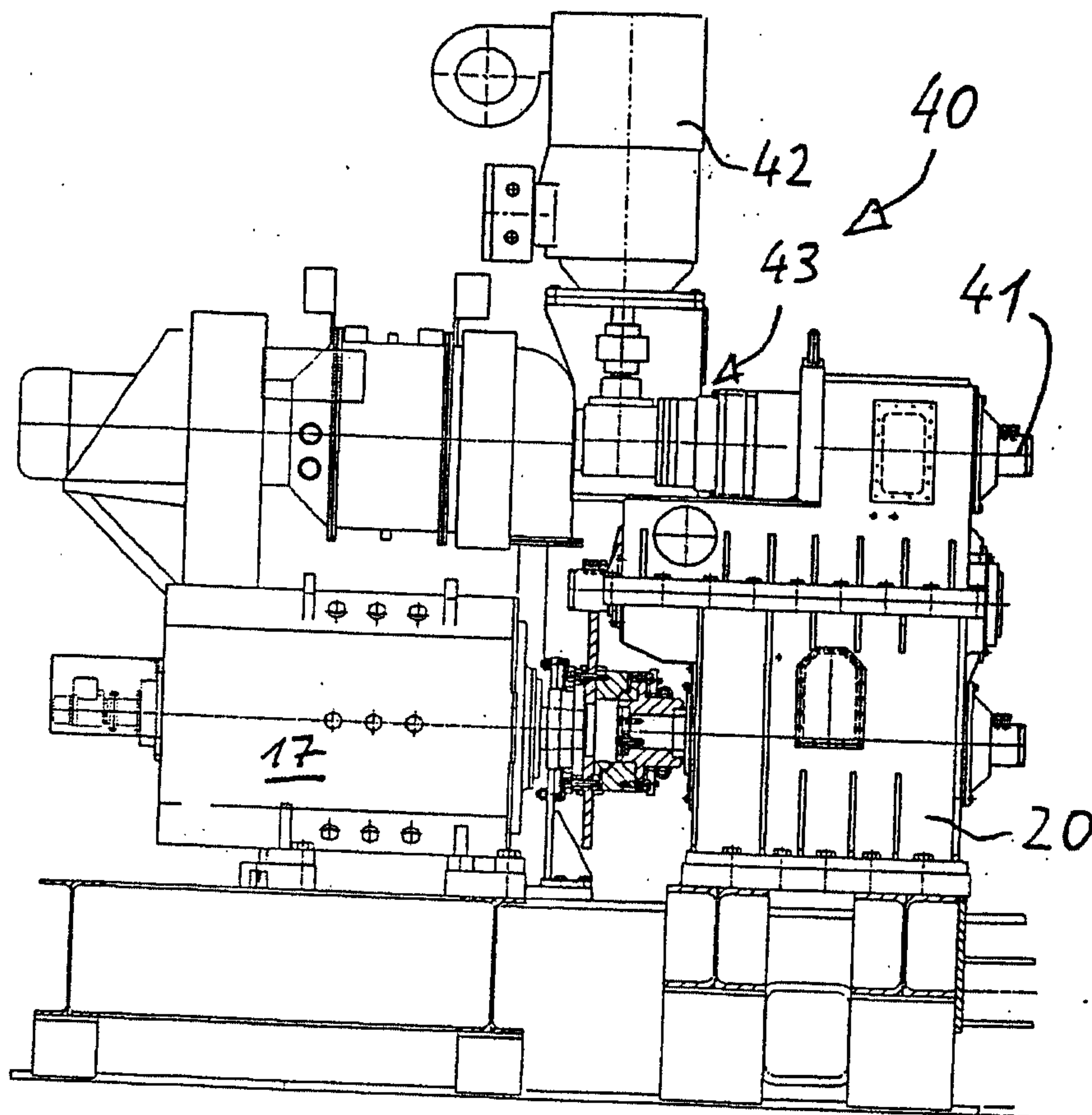


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Fig. 5



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