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(54) **Weft feeder for weaving looms with a device for measuring the weft reserve**

(57) The feeder comprises a stationary cylinder (12) supporting a plurality of yarn loops (RT) wound helically along its outer skirt. A finger (28) with a magnet (38) incorporated therein is mounted in an elastically yielding way along the skirt of the cylinder under the pressure of the yarn wound on the cylinder, to be biased from a first

position projecting outside the skirt, to a second, inner position, and vice versa. A sensor (40) is supported in front of the magnet (38) in a stationary position relative to the cylinder to generate an output signal (U) proportional to the distance between the magnet and the sensor.

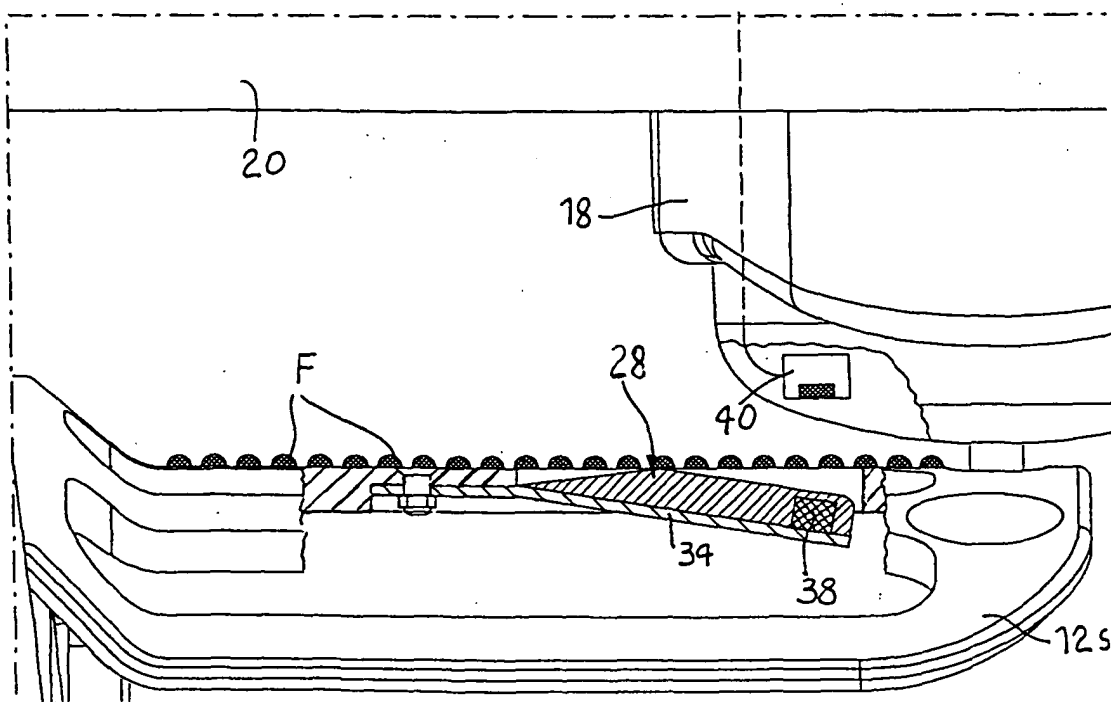


Fig. 3

Description

[0001] The present invention relates to a weft feeder for weaving looms, particularly fluid-jet looms, with a device for measuring the weft reserve on the loom.

[0002] A general weft feeder for weaving looms comprises a stationary cylinder on which a motorized swivel arm winds a plurality of yarn loops forming a weft reserve. Upon request from the loom, the yarn is unwound from the cylinder and is fed to the loom.

[0003] The above feeders are generally provided with a weft-premeasuring device, which has the duty of stopping the unwinding yarn at each insertion when a desired number of loops has been inserted. Such device typically comprises an electrically operated pin which is operated to lock/unlock the unwinding loops on the basis of a signal generated by a loop-counting sensor for the unwinding loops.

[0004] A second sensor is provided for counting the loops wound on the cylinder, so that the reserve of loops on the cylinder can be indirectly determined, in order to maintain it constant, by comparing the signals generated by said sensors.

[0005] However, in case of flaws in the insertion of the weft, e.g., when the weft gets entangled in the warp or, in fluid-jet looms, when the feeding nozzles are inaccurately adjusted, the loop-counting sensor may fail to detect a few unwinding loops, thereby deceiving the reserve-measuring system and causing a corresponding, uncontrolled reduction of the weft reserve.

[0006] The above circumstances affect the correct operation of the weaving apparatus, because the resistance of the loops to unwind is higher when the reserve is reduced. This may cause "short" weft insertions, i.e., delayed insertions, or also may cause the air pressure to rise excessively.

[0007] Nevertheless, restoring the correct operative conditions requires the stop of the machine and the manual intervention of an operator, with evident inconveniences.

[0008] Therefore, a main object of the present invention is to overcome the above drawbacks of the known systems for measuring the weft reserve by providing a weft feeder for weaving machines provided with a device which is capable of directly measuring the presence of a suitable reserve on the cylinder, i.e., which is not influenced by any miscounts of the number of loops which are wound/unwound upon/from the cylinder.

[0009] The above object and other advantages, which will better appear below, are achieved by the device for measuring the weft reserve having the features recited in claim 1, while the other claims state other advantageous, unessential features.

[0010] The invention will be now described in more detail with reference to a preferred embodiment shown by way of non-limiting example in the attached drawings, wherein:

Fig. 1 is a side view of a general weft feeder;

Fig. 2 shows a detail to an enlarged scale of a weft feeder of the kind of Fig. 1, which is provided with a device for measuring the weft reserve according to the invention;

Fig. 3 is a view similar to Fig. 2, in which the reserve-measuring device is shown in a different operative condition;

Fig. 4 is a diagram showing the relation between two operative variables of the reserve-measuring device of Figs. 2, 3.

[0011] With reference to the above Figures, a weft feeder 10 comprises a stationary cylinder 12 on which a swivel arm 14 driven by a motor 16 winds a plurality of yarn loops forming a weft reserve RT. Upon request from the loom (not shown), yarn F is unwound from the cylinder to feed the loom.

[0012] In a known way, cylinder 12 consists of four cylinder parts such as 12s supported in such a way that their radial position can be changed. This allows the diameter of the cylinder, and therefore of the loops, to be adjusted in order to make the weft length, so called "loom height", correspond to an exact integral multiple of the length of the loop.

[0013] Feeder 10 is provided with a weft-premeasuring device 18 supported on the free end of a stationary arm 20 projecting longitudinally from the motor housing. Weft-premeasuring device 18 comprises a pin 22 that is axially operated by a solenoid valve (not shown) to stop yarn F unwinding from the delivery end of the cylinder when a desired number of loops has been unwound. Such number is measured in a known way by a loop-counting sensor for the unwinding loops 24 (Fig. 1).

[0014] In a known way, the position of weft-premeasuring device 18 relative to stationary arm 20 is adjustable in order to maintain constant the distance of the device from cylinder 12 when the diameter of the cylinder is changed.

[0015] With reference to Figs. 2, 3, feeder 10 is provided with a device for measuring the weft reserve 26 according to this invention. The device comprises a rigid finger 28 arranged in a longitudinal groove 30 made in a middle section of cylinder part 12s in front of the weft-premeasuring device. The finger is elastically connected with one of its ends to the cylinder for swinging under the pressure of the yarn wound on the cylinder, from a first position projecting outside the skirt of the cylinder (Fig. 2), to a second, inner position (Fig. 3), and vice versa. The outer surface of finger 28 is suitably profiled so that the slope of the finger will change in proportion to the number of loops engaging the finger. To this purpose, said outer surface has a proximal sloping section 28a extending from the connection end of the finger.

[0016] Preferably, finger 28 consists of a rigid, elongated

gated member 32 of a non-magnetic metal material, which is supported on an elongated, elastic blade 34 having one end screwed to cylinder part 12s.

[0017] A permanent magnet 38 is incorporated within member 32 near the distal end of finger 28, and a Hall sensor 40 of a conventional kind is mounted on weft-premeasuring device 18 in front of the magnet. As well known, such sensors are provided with an analog voltage output whose amplitude is proportional to the normal component of the intensity of the magnetic field generated by the magnet, which component is itself inversely proportional to the distance between the magnet and the sensor. Fig. 4 shows the relation between the output voltage U of sensor 40 and the distance D between the magnet and the sensor. It will be noted that the voltage U is variable from a maximum value U_{max}, corresponding to the nearest position D_{min} of the magnet, i.e., with raised finger 28, to a minimum value U_{min} corresponding to the farthest position D_{max} of the magnet, i.e., when finger 28 is lowered.

[0018] Hall sensor 40 is connected to convey the voltage signal U to a control unit consisting of a micro-controller M via an Analog to Digital converter A/D. Micro-controller M is programmed to compare the voltage value U with a threshold value U_s stored in a permanent memory MEM such as, e.g., a Eeprom. The threshold value U_s is conventionally chosen in the range U_{max} to U_{min}, and corresponds to an intermediate position of finger 28 regarded as a threshold in relation to the absence/presence of the reserve. Micro-controller M is connected to the motor to restore the reserve on the basis of the above comparison.

[0019] The operation of the present device prevents emptying/overstoring of the weft reserve on the cylinder as described below.

[0020] Upon request from the loom, feeder 10 feeds groups of yarn loops partitioned in a known way by the weft-premeasuring device, which has the duty of stopping the unwinding yarn at each weft insertion when a desired number of loops has been inserted.

[0021] Finger 28 swings in relation to the number of loops wound upon the corresponding axial portion of the cylinder. Hall sensor 40 generates a voltage signal U that is inversely proportional to the distance of the magnet incorporated in finger 28, and sends such signal to the micro-controller. In case of over-emptying of the cylinder, the generated voltage value exceeds the threshold value U_s and micro-controller M controls the motor in order to wind new loops on the cylinder.

[0022] When the diameter of the cylinder is changed in order to make the length of the loops correspond to the loom height, the position of premeasurer 18 is adjusted as usual in order to maintain constant the distance of the premeasurer from the skirt of the cylinder. Automatically, since the Hall sensor is incorporated within device 18, the nominal value of the distance of sensor 40 from finger 28 is also restored.

[0023] The threshold value U_s may be set in a factory

setting step or may be automatically acquired, e.g., during the procedure of restoring the reserve. Such procedure is usual in this field and consists of completely unwinding the reserve from the cylinder, and then rewinding it. In this case, the micro-controller is programmable to acquire the maximum value U_{max} after unwinding the reserve, when the finger is free to return to its horizontal, resting position, as well as the minimum value U_{min} during rewinding the reserve, when the finger is covered as shown in Fig. 3. The micro-controller is automatically capable of recognizing the latter condition in that the signal generated by the sensor, once reached this position, becomes constant. The threshold value U_s is determined on the basis of a desired algorithm whose variables are said values U_{max} and U_{min}, e.g., the arithmetical mean thereof. Programming the micro-controller is usual for the person skilled in the art and therefore will be not further disclosed.

[0024] A preferred embodiment of the invention has been described herein but of course many changes may be made by the person skilled in the art, depending on the circumstances, within the scope of the inventive concept. For example, finger 28 may consist of a shaped, monolithic member of a non-magnetic, elastic material. Also, the fact that the voltage value generated when the finger is raised is higher than the voltage value generated when the finger is lowered is a mere project option, since the relation between the output voltage of the sensor and the intensity of the magnetic field will depend on the kind of sensor used.

Claims

1. A weft feeder for weaving machines, comprising a stationary cylinder (12) adapted to support a plurality of yarn loops (RT) wound helically along its outer skirt, **characterized in that** a finger (28) with a magnet (38) incorporated therein is mounted in an elastically yielding way along the skirt of the cylinder under the pressure of the yarn wound on the cylinder, to be biased from a first position projecting outside the skirt, to a second, inner position, and vice versa, and **in that** a sensor (40) is supported in front of the magnet (38) in a stationary position relative to the cylinder to generate an output signal (U) proportional to the distance between the magnet and the sensor.
2. The feeder of claim 1, **characterized in that** said finger (28) is elastically connected with one of its ends to the skirt of the cylinder for swinging from said first position to said second position and vice versa.
3. The feeder of claim 2, **characterized in that** said finger (28) has an outer operative surface that is engageable by the yarn and is profiled so that the

slope of the finger is proportional to the number of loops engaging said operative surface.

4. The feeder of claim 3, **characterized in that** said operative surface has proximal sloping section (28a) adjacent to the connection end of the finger. 5

5. The feeder of any of claims 1 to 4, **characterized in that** said finger (28) consists of an elongated rigid member (32) made of a non-magnetic material and supported on an elastic blade (34) screwed to the cylinder (12). 10

6. The feeder of any of claims 1 to 5, **characterized in that** it comprises a control unit (M) connected to receive said output signal (U) and to compare it with a threshold value (Us) corresponding to an intermediate position of the finger (28), which intermediate position is located between said first and second positions and is regarded as a threshold in relation to the absence/presence of the reserve. 15 20

7. The feeder of claim 6, **characterized in that** said control unit (M) is connected to cause loops to be wound on the cylinder (14) when said output signal (U) exceeds said threshold value (Us) to inform about a reduction of loops wound on the cylinder. 25

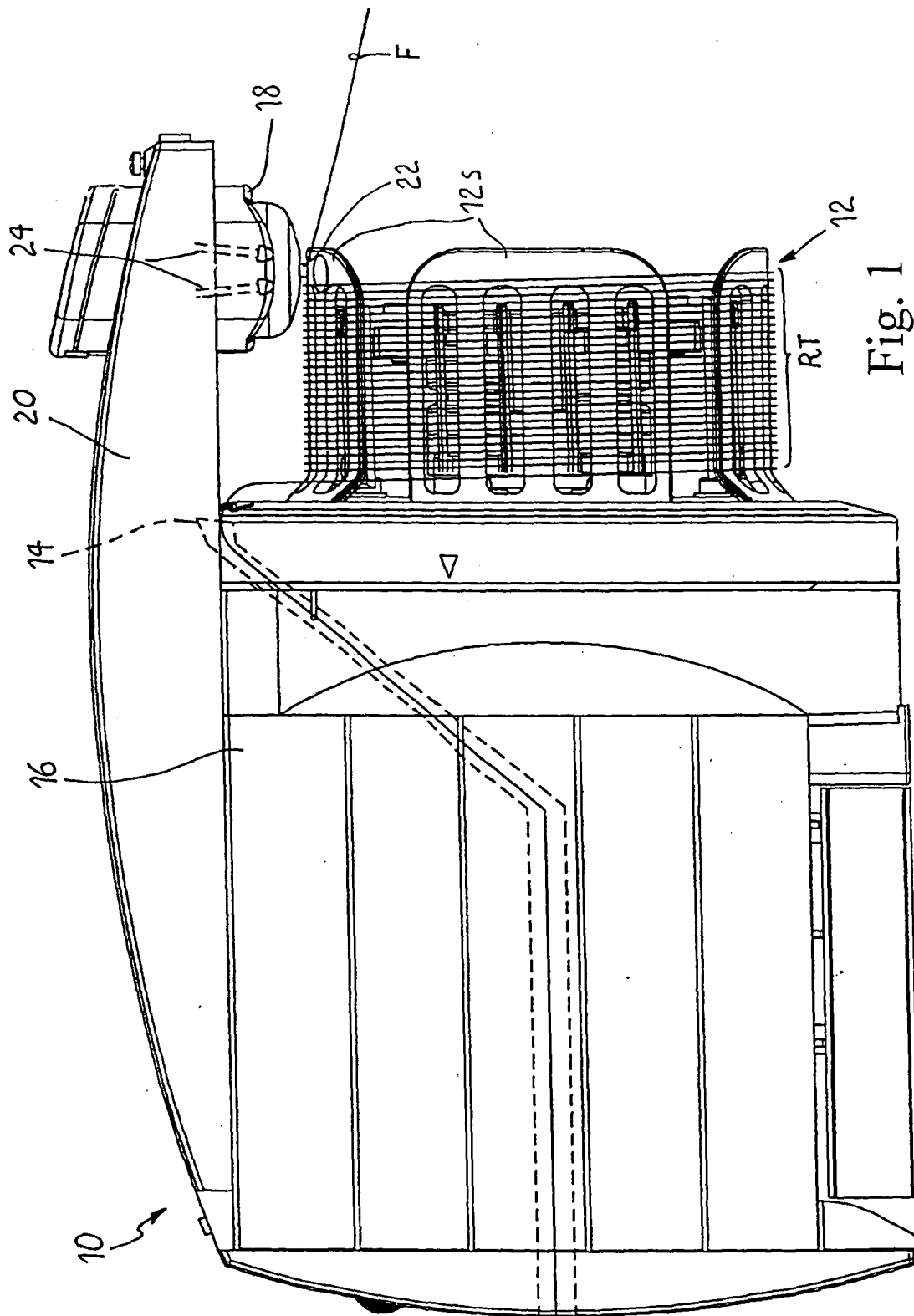
8. The feeder of claim 7, **characterized in that** said control unit is programmed to automatically acquire a no-load voltage value (U_{max}), with the finger in said first position, and a full-load voltage value (U_{min}), with the finger in said second position, and to determine said threshold value (Us) on the basis of an algorithm having said no-load voltage value and full-load voltage value as variables. 30 35

9. The feeder of claim 8, **characterized in that** said algorithm consists of the arithmetical mean of said no-load voltage value (U_{max}) and full-load voltage value (U_{min}). 40

10. The feeder of any of claims 1 to 9, also comprising a weft-premeasuring device (18) supported at an adjustable distance from the axis of the cylinder, **characterized in that** said sensor (40) is mounted on said weft-premeasuring device (18). 45

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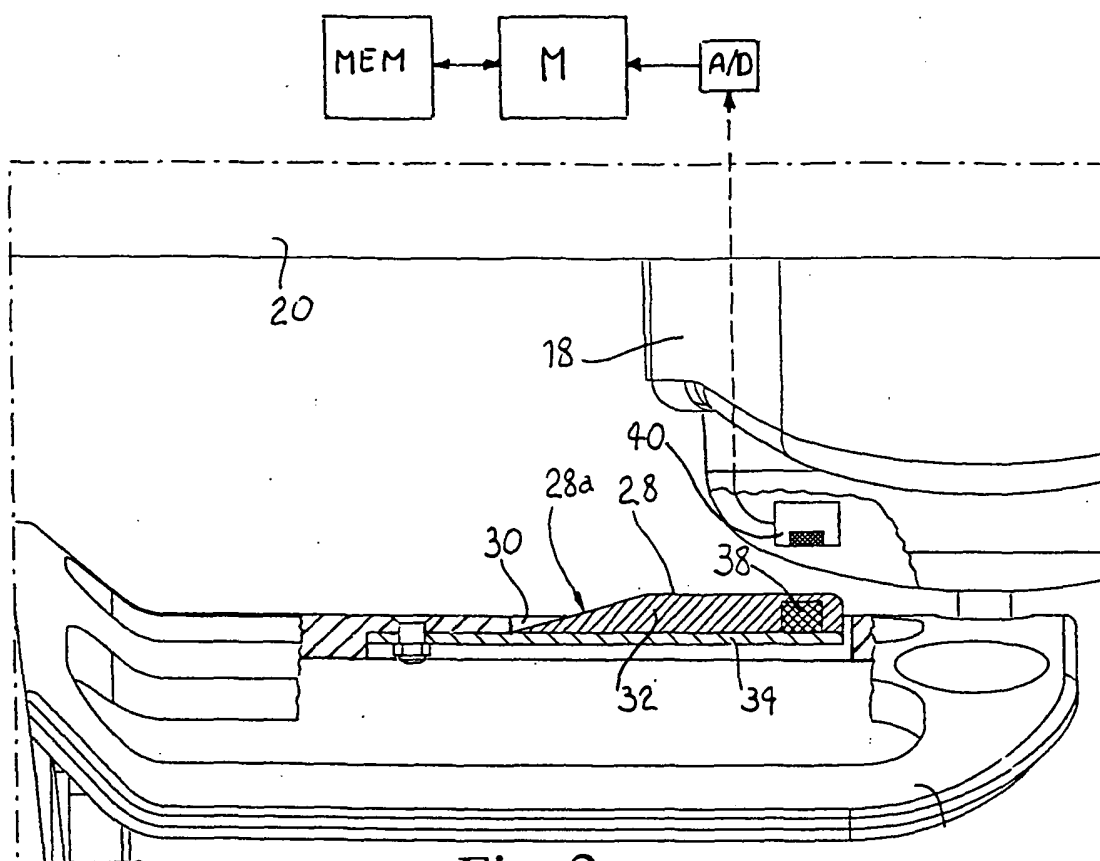


Fig. 2

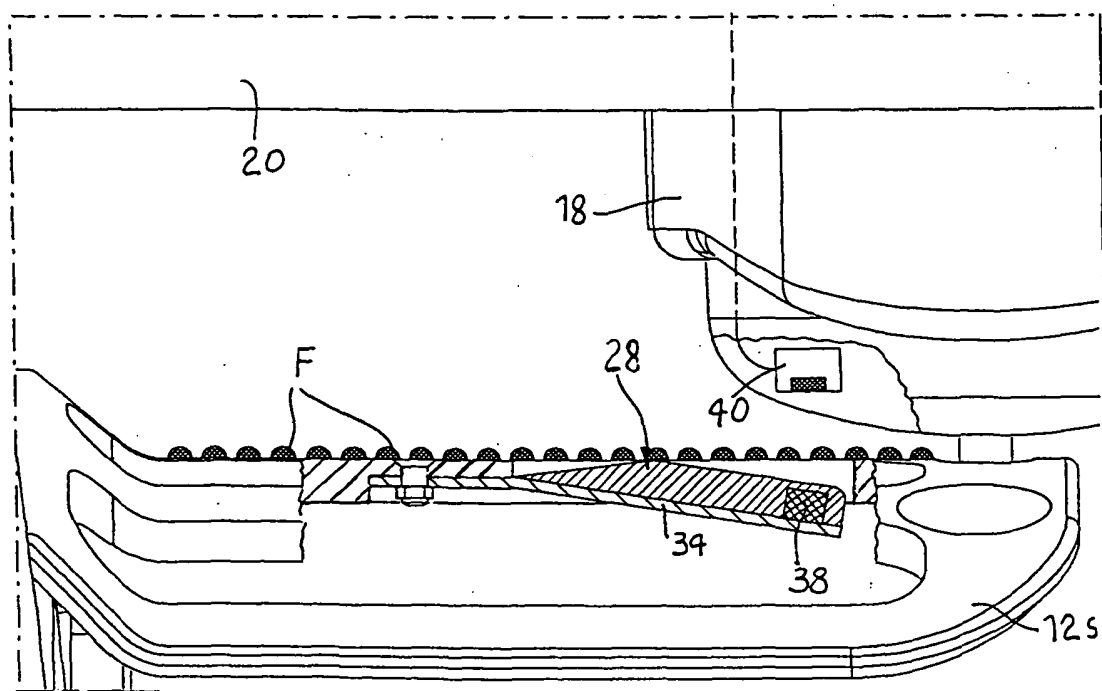


Fig. 3

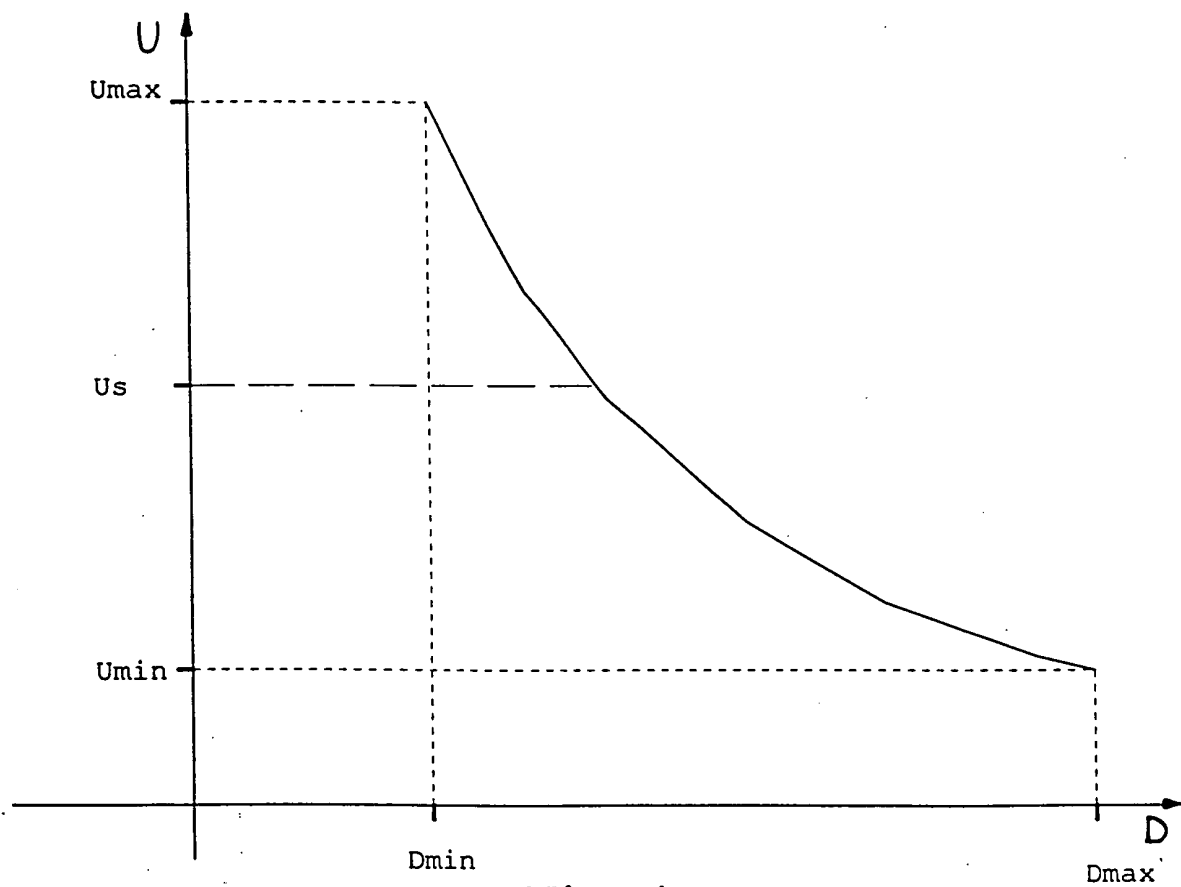


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 05 00 2742

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Place of search Munich		Date of completion of the search 23 June 2005	Examiner Hannam, M
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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