(12) UK Patent Application (19) GB (11) 2 146 774 A

(43) Application published 24 Apr 1985

(21) Application No 8324740

(22) Date of filing 15 Sep 1983

(51) INT CL⁴
G01L 1/26

(52) Domestic classification
G1N 1A2P 1A3B 1B3 1D2B 1F 1M3 4D 7H2 AHJ
U1S 1645 2168 G1N

(56) Documents cited
GB 1576006 GB 0664160

(58) Field of search
G1N
H4B

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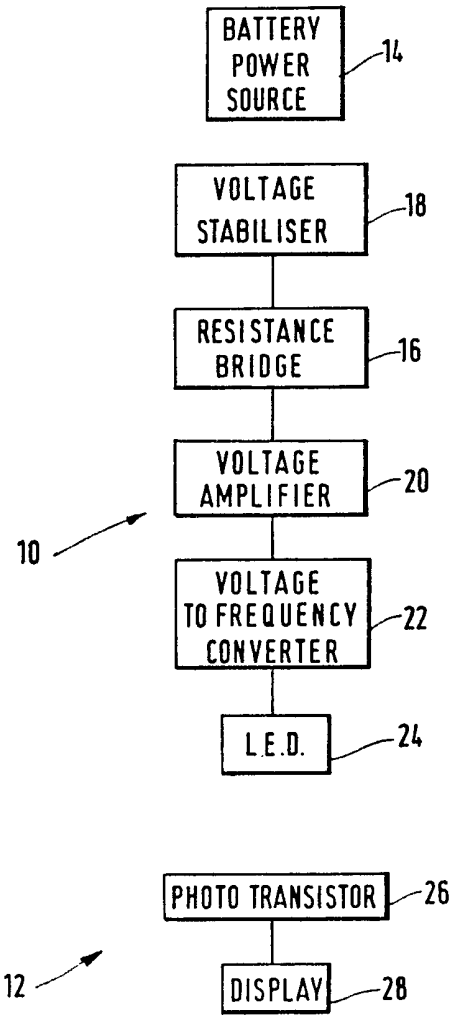
(54) Grip measuring device

(57) A grip measuring device comprises a measuring unit 10 locatable between the jaws of a chuck to be rotated with it, and including means to measure the gripping force being exerted on it, and a transmitter 24 arranged to transmit a signal proportional to the measured gripping force to a receiver 26, the receiver being spaced from the transmitter and connected to an indicator 28 of the gripping force. The measuring unit may include a resistance bridge 16 including strain gauges. Its voltage output is applied to a voltage to frequency converter 22 via an amplifier 20. Thus L.E.D receives half square waves, and sends out light pulses at a frequency proportional to the grip of the jaws to a stationary phototransistor 26. The pulses received are counted, and from the rate of the pulses the display 28 gives a figure proportional to the gripping force.



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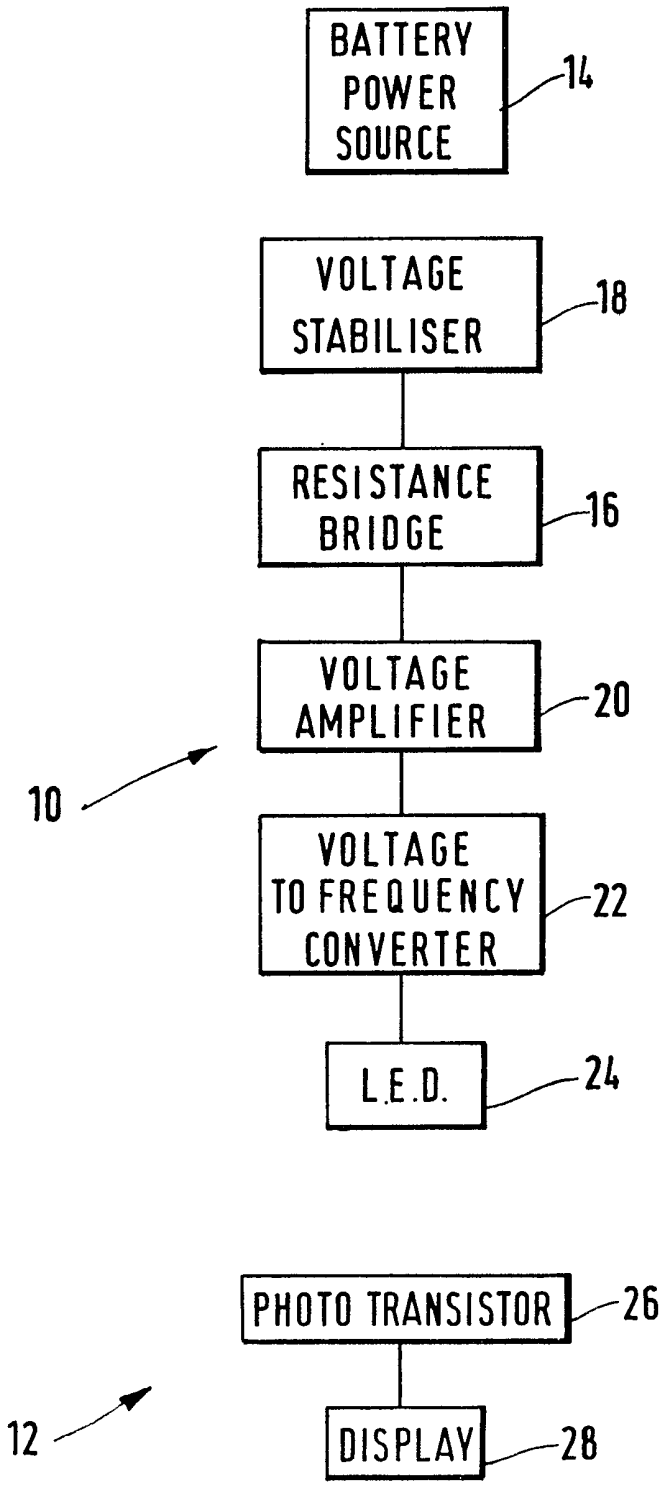
The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.


BATTERY POWER SOURCE
14
VOLTAGE STABILISER
18
RESISTANCE BRIDGE
16
VOLTAGE AMPLIFIER
20
10
VOLTAGE TO FREQUENCY CONVERTER
22
L.E.D.
24
PHOTO TRANSISTOR
26
12
DISPLAY
28

SPECIFICATION

Grip measuring devices

The present invention relates to grip measuring devices and in particular to devices arranged to measure the gripping force exerted by the jaws of a chuck when the chuck is rotating.

When a workpiece is held by the jaws of a chuck, if the workpiece is not held with a sufficient force when the chuck rotates, the workpiece may slip or be released from the chuck. Slipping or release of the workpiece can not only be extremely dangerous to personnel in the immediate vicinity but can also damage the workpiece.

The gripping force exerted by the jaws under a given input power may decrease as a result of normal wear in the mounting of the jaws, bad maintenance and poor lubrication. Furthermore, the gripping force may decrease when the chuck starts to rotate, as the centrifugal force acting on each of the jaws urges them away from gripping the workpiece. Obviously, as the rotational speed increases, the centrifugal force acting on the jaws increases and the gripping force exerted on the workpiece decreases. Accordingly there is a need to measure the gripping force which will be exerted on a workpiece while the chuck is rotating.

A prior proposal for measuring the gripping force exerted by the jaws of a rotating chuck has comprised a measuring unit held between the jaws, which is thus caused to rotate with the chuck. A stationary lead is electrically connected to the rotating measuring unit by a slip ring assembly provided on the measuring unit. The measuring unit produces an electrical signal proportional to the force being exerted by the jaws, and the signal is fed via the slip ring assembly and the stationary lead to a display unit which gives an indication of the gripping force. Whilst this arrangement is able to give a reading of the gripping force exerted by the rotating jaws of the chuck, the slip ring assemblies are expensive to produce and are prone to wear, particularly if the central axis of the slip ring assemblies is not precisely coincident with the rotational axis of the chuck. Furthermore, as the measuring unit with the slip ring assemblies has to be so accurately mounted on the chuck, it is difficult and time consuming to set up the measuring device.

According to one aspect of the present invention, a grip measuring device comprises a measuring unit adapted to be located between the jaws of a chuck, the measuring unit including means arranged to measure the gripping force being exerted on the measuring unit and a transmitter arranged to transmit a signal proportional to the measured gripping force to a receiver, the receiver being spaced from the transmitter and connected to an indicator arranged to give an indication of the gripping force being exerted on the measuring unit. With such a measuring device, there is no contact between one component which rotates relatively to a stationary component, and accordingly the measuring device does not suffer any wear in that respect. Furthermore, the device may be quickly and easily mounted in the jaws of a chuck as there is no need to precisely align the rotating component with the stationary component in order to reduce the frictional wear which will take place between the components.

The means arranged to produce the gripping force may be adapted to produce a voltage proportional to the gripping force, and the measuring device may include a converter adapted to convert the voltage to a frequency proportional to the voltage. The frequency produced by the converter provides a convenient way of transmitting the signal to the receiver for example, either in the form of electromagnetic waves or via a light emitting diode mounted on the measuring unit. Where a light emitting diode is used to transmit the signal, the receiver may comprise a phototransistor arranged to be located adjacent to, but spaced from the light emitting diode. The converter may be adapted to produce a frequency in the form of a half square wave which allows the light emitting diode to produce light in pulses, each pulse being for the required duration and being of generally constant luminous intensity.

There may be a frequency measuring device connected between the receiver and the indicator, which frequency measuring device may comprise a gate which counts pulses from the receiver.

The indicator may comprise a digital display arranged to give a figure proportional to the gripping force.

It will be appreciated that the measuring device, although primarily intended for measuring the gripping force of the jaws of the chuck whilst the chuck is rotating, may also measure the same gripping force while the chuck is stationary.

The invention may be carried into practice in various ways, but one embodiment will now be described by way of example and with reference to the accompanying diagram of a grip measuring device.

The grip measuring device comprises a measuring unit 10 which, in use, is mounted in the jaws of a chuck so as to be able to rotate with the chuck, and a receiving unit 12 which is spaced from the unit 10 and remains stationary when the chuck is rotating.

The measuring unit 10 includes a battery power source 14 which applies a voltage across a resistance bridge 16 via a voltage stabiliser 18. The resistance on one side of the bridge 16 remains generally constant, its function being to nullify or reduce any mis-

readings which might tend to be produced on alteration of the temperature or humidity in which the measuring unit operates. The resistance on the other side of the bridge 16 varies in dependence upon the load exerted by the jaws of the chuck on the measuring unit. One way of enabling the resistance to so vary is to include strain gauges into the bridge.

The voltage produced by the bridge 16, which is proportional to the load being exerted by the jaws, is fed through a voltage amplifier 20 and then through a voltage to frequency converter 22 which produces a half square wave whose frequency is proportional to the grip of the jaws. The half square wave is supplied to a light emitting diode 24 which produces pulses of light at the frequency dictated by the output of the converter 22.

The receiving unit 12 includes a phototransistor 26 which is positioned so that it can receive light from the light emitting diode 24. When the photo-transistor 26 receives pulses of light from the diode 24, a gate provided in the receiving unit counts the pulses, and from the rate of pulses counted the display 28 produces a figure proportional to the gripping force of the jaws.

CLAIMS

1. A grip measuring device comprising a measuring unit adapted to be located between the jaws of a chuck, the measuring unit including means arranged to measure the gripping force being exerted on the measuring unit and a transmitter arranged to transmit a signal proportional to the measured gripping force to a receiver, the receiver being spaced from the transmitter and connected to an indicator arranged to give an indication of the gripping force being exerted on the measuring unit.

2. A grip measuring device as claimed in claim 1, in which the means arranged to measure the gripping force is adapted to produce a voltage proportional to the gripping force, and the measuring device includes a converter adapted to convert the voltage to a frequency proportional to the voltage.

3. A grip measuring device as claimed in claim 2, in which the signal is transmitted in the form of electromagnetic waves.

4. A grip measuring device as claimed in claim 2, in which the signal is transmitted in the form of light.

5. A grip measuring device as claimed in claim 4, in which the measuring device includes a light emitting diode.

6. A grip measuring device as claimed in claim 5, in which the receiver comprises a photo-transmitter arranged to be located adjacent to, but spaced from, the light emitting diode.

7. A grip measuring device as claimed in claim 5 or claim 6, in which the converter is adapted to produce a frequency in the form of a half square wave which allows the light emitting diode to produce light in pulses, each pulse being of the required duration and being of generally constant luminous intensity.

8. A grip measuring device as claimed in any one of claims 2 to 7, in which a frequency measuring device is connected between the receiver and the indicator.

9. A grip measuring device as claimed in claim 8, in which the frequency measuring device comprises a gate which counts pulses from the receiver.

10. A grip measuring device as claimed in any one of the preceding claims, comprising a digital display arranged to give a figure proportional to the gripping force.

11. A grip measuring device constructed and arranged substantially as herein described, with reference to the accompanying drawing.

12. A method of measuring the gripping force of the jaws of a chuck, comprising locating between the jaws of the chuck a measuring unit including means to measure the gripping force exerted on the measuring unit and a transmitter arranged to transmit a signal proportional to the measured gripping force, and positioning a receiver to receive the transmitted signal, the receiver having an indicator arranged to give an indication of the gripping force.

13. A method of measuring substantially as herein described with reference to the accompanying drawing.

Printed in the United Kingdom for
Her Majesty's Stationery Office, Dd 8818935, 1985, 4235.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.