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PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO TAXIMETERS

(71) I, KEITH SCOTT, a British Subject and New Zealand citizen, of 39 Kitemui Avenue, Mt. Albert, Auckland, New Zealand, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to taximeters.

In the past taximeters have been provided incorporating mechanical linkages and gear trains to provide a visual representation of a fare for a taxi hireage proportional to some predetermined combination of the distance travelled and the time taken. Such taximeters are subject to the normal limitations of wear and servicing requirements of mechanical appliances, and also involve considerable difficulty and expense to change the apparatus when changes are made in taxi hireage tariffs, which changes are at present frequently required.

It is therefore an object of the present invention to provide a taximeter which will obviate or minimise the foregoing disadvantages in a simple yet effective manner or which will at least provide the public with a useful choice.

Accordingly the invention provides a taximeter for calculating a fare total from a predetermined combination of charges based on distance and time factors, said taximeter comprising an electronic circuit and associated components adapted to take said distance factor in the form of a second electrical pulse train produced by a transducer and representing the speed of the taxi and use said second pulse train to modify or control a first pulse train emitting from a constant frequency oscillator and forming said time factor so that said first pulse train is caused to conform to a frequency proportional to the frequency of said second pulse train when the frequency of said second pulse train exceeds a predetermined limit, said taximeter

including a control circuit adapted on operation to activate the taximeter, a fare counter for counting directly or indirectly the sum of pulses issuing from said oscillator and display means adapted to display the fare resulting from the sum of pulses counted by said counting means in a convenient form.

To those skilled in the art to which this invention relates, main changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosure and the description herein are purely illustrative and are not intended to be in any sense limiting.

The invention consists in the foregoing, and also envisages constructions of which the following gives examples only.

One preferred form of the invention will now be described with reference to the accompanying drawings in which:—

Fig. 1 is a general block wiring diagram of a taximeter according to the invention, and

Fig. 2 is a graph showing the inter-relationship between the output pulses of the first and second electrical pulse train.

In the arrangement shown in the drawings a transducer 1 is provided consisting of a sensitive pickup coil 2, a very high gain amplifier 3 and a schmitt trigger 4. When the pickup coil is in a varying magnetic field, a minute current flows. This current is amplified and integrated over the complete cycle of variation thus reducing the sensitivity to noise and short sharp changes. The amplifier signal is then applied to the schmitt trigger, where it is converted to clean sharp pulses. These pulses are then applied to the meter via an interfacing transistor 5. When the transducer is located close to a vehicles speedometer it picks up the rotating magnetic field which is generated within the speedo. This produces a

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distance pulse train having one pulse per revolution of the speedo cable at sensor output 6.

5 Alternatively the transducer could consist of a permanent magnet, a reed switch and a slotted vane connected to the drive train of the taxi so that the slotted vane rotates within the magnetic field to open and close the reed switch to create a
10 similar distance pulse train.

The pulse train, having a frequency proportional to the speed of the taxi, is fed into a monostable 7 which triggers on both edges of the input signal thus giving two
15 pulses per revolution and the resulting output fed into a calibration rate divider 8. As the number of pulses per kilometre is dependent on the car type and model this must be normalised to the meter standard and this is done by the calibration divider.
20 A fixed pulse rate, for example 1200 pulses per is chosen and as the input is arranged to always be greater than 1200 pulses per kilometre the calibration divider will be set per installation to inhibit one pulse in every
25 one of a predetermined number of pulses to give the standard rate of 1200 pulses per kilometre. To this end the calibration circuit is arranged so that one pulse in every
30 X pulses (where X is presetable) is prevented from being applied to the clock generator. This calibration circuit utilises a divide by sixty four counter which counts distance pulses from the monostable 7 these
35 pulses are also applied to a J.K. flip-flop 9. When the predetermined number of pulses has been accumulated the counter 8 disables the J.K. flip-flop for one pulse and resets itself to its initial state. Thus, one
40 pulse will be omitted in every X pulse, where X can be any number from 2 to 64 settable by way of calibration switches 10. The output from the calibration divider 8 at the rate of e.g. 1200 pulses per kilometre is
45 then fed as a distance trigger pulse into a master oscillator circuit 11 as will be described further later. From the calibration divider the distance pulses are, applied to the J.K. flip-flop 9 and nand gate
50 12. The output of gate 12 is used as a trigger input to an oscillator in the form of an astable multivibrator 13, the operation of which will now be discussed. The astable multivibrator 13 has a free running
55 frequency proportional to the waiting time, typically 6 pulses per second, each of these pulses ensuring that the J.K. flip-flop 9 is in the reset state. In this state nand gate 12 will prevent the distance pulses from
60 triggering the astable 13. If however the distance pulses are faster than 6 pulses per second, then more than one pulse will appear between two astable pulses. The first will set the J.K. flip-flop 9, preparing
65 the gate 12 to pass the next pulse which will

trigger the astable, terminating its relaxation period causing a pulse from the astable to conform with the distance pulse. Provided the distance pulse rate does not fall below the astables free running rate, the
70 astables output will continue to conform to the distance pulses. Mode determination and annunciation is provided by monostable 40. The continuing presence of the trigger holds the monostable
75 in the set state representing the distance mode, the absence of trigger pulses allows the monostable to reset, displaying the waiting time mode.

In this manner the output from the oscillator provides a first pulse train, the frequency of which is modified or controlled under predetermined conditions by a second pulse train arriving from the calibration divider at the rate of e.g. 1200
80 pulses per kilometre. The arrangement of the oscillator is such that when the frequency of the second pulse train exceeds a predetermined limit corresponding to a predetermined speed of the taxi the second
85 pulse train will cut off or truncate the pulses of the first pulse train to conform with the frequency of the calibration divider output. If more than one pulse from the second pulse train is present between the oscillator
90 output pulses of the first pulse train then obviously the distance rate must be greater than the waiting time rate. This fact enables the distance pulse train to trigger the master oscillator during its relaxation
95 period as above described. For example, with reference to Fig. 2 showing a second pulse train at 14 and a first pulse train at 15 the master oscillator receives only one pulse from the second pulse train during
100 pulse build-up 16 and 17 of the first pulse train. During pulse build-up 18 however two pulses 19 and 20 are received from the second pulse train so that pulse 20 causes the first pulse train to be triggered at point
105 21 to give the resulting output pulse 22.

The output of the master oscillator circuit 11 representing the fare in a certain proportion whether in time or distance mode is then fed into a programmable rate
110 divider 23.

In order to provide one pulse to represent a unit increase in the indicated fare, programmable rate divider 23 is used having a division rate dependent upon tariff
120 selection, and mode i.e. time or distance. In the preferred form of the taximeter provision has been made for predetermined tariff rate to be selectable from a control circuit 24. The fare input pulses first pass
125 through a divider 25 whose rate is set to give an optimum resolution for the particular distance per drop, then to a divide by X counter 26 where X is a function of tariff and mode and is preset by
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wire links. In order to reduce the number of links required to two per rate, a decimal to BCD converter (not shown) is used between a rate evaluator 27 and the divider 26. The divider output then is a pulse train, each pulse representing a unit increase in the indicated fare.

The rate evaluator consists of a number of gates arranged to program the divider to the selected tariff and mode as set by the control circuit 24. The unit increase (known as "drop") is different for different areas and may be e.g. 1, 2, 5 or 10 cents. Consequently it is necessary to increase the fare indication by this number of cents for each pulse output from the programmable rate divider.

This is achieved by a flag/drops programming circuit 28 which, when enabled by a pulse from the programmable rate divider produces a number of pulses to a fare counter 29 which is a four stage decade counter which receives 20 KHz pulses each representing one cent. These are accumulated by the counter and the total indicated on the seven segment displays 33. This fare is reset to zero after each fare. A decoder driver 34 is used to drive the seven segment displays in a known manner. The flag/drops programming circuit determines how many pulses (each pulse representing one cent increase in the fare change) will be allowed to be transmitted to the counter 29.

The initial distance covered by the flag-fall is usually a multiple of the drop distance so that the first so many pulses from the programmable rate divider 23 must be prevented from reaching the drop's flip-flop 31. This is achieved by enabling the initial distance extension counter 32 when in the distance mode to count the output pulses from the programmable rate divider and when the predetermined number have passed, the output of the counter 32 goes high and locks there gating all subsequent output pulses from the programmable rate divider to the drop flip-flop 31. In this manner the fare counter 29 does not register its first drop until after the first say two drop distances. Programmable rate divider pulses which occur during the time mode are unaffected by the initial distance extension counter due to the setting of the counter in the distance mode.

Control of the taximeter is effected by means of two push buttons 35 and 36 the first 35 of which cycles the control counter 37 through its four possible states, i.e. Reset (for hire), Tariff 1, Tariff 2 (where applicable), and stopped. The second button 36 has the sole function of re-enabling tariff 1.

The outputs from the control counter 37 go to the various sections of the meter

where they define the modes of operations as described previously.

When "stopped" is selected the "clock" pulse train is stopped by increasing the relaxation period of the astable 13 to infinity so that only distance pulses from the calibration divider 8 are metered. This achieved by way of connection 39 between the control counter 37 and the astable 13.

A third push button 41 may also be provided to allow the operator to clock up "extras". This is displayed on a separate two decade digital indicator 42. Each consecutive push of the extras button increases the count by 5 cents to a maximum of 95 cents. The indicator is driven by a 1 1/4 decade B.C.D. counter 43 via a decoder driver 44 and the counter is wired so that each pulse fed into it advances the counter by 5.

An alternative to the Extras described above would be an automatic increase in the flag fall when the fare is to include a phone change. This could be achieved by preventing the first, say twenty five 20 KHz pulses to the fare counter from reaching the flag/drops counter.

Any suitable power supply may be used but preferably the supply is provided as shown at 50. This is a tube width controlled switching mode power supply providing both 200 v d.c. and 5 v d.c. The power supply includes a 40 KHz oscillator 51, a J.K. flip-flop 52 and two gates 53 and 54 driving the switching drive circuit 55 to the transformer 56. The 5v output is at 57 and the 200v output at 58. Feedback is taken from the 5v line to the pulse width control circuitry by way of comparator 59 to ensure regulation of the power. There is also an auxiliary 5v output at 60 to the control circuit 24.

If desired a master memory display unit (not shown) can be provided. This unit contains a convenient digital display output which can be switched to receive the output of one of several CMOB counters. Alternatively mechanical drum counters could be used. These counters receive information from the meter, for example total miles, paid miles, total earnings etc., at convenient points in the circuit. It is preferable that this unit contains a nickel cadmium battery to supply the necessary uninterrupted power. A power line is included to charge the nickel cadmium battery from the power supply of the taxi when the meter is running.

WHAT I CLAIM IS:—

1. A taximeter for calculating a fare total from a predetermined combination of charges based on distance and time factors, said taximeter comprising an electronic circuit and associated components adapted



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1. A taximeter for calculating a fare total from a predetermined combination of charges based on distance and time factors, said taximeter comprising an electronic circuit and associated components adapted

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to take said distance factor in the form of a second electrical pulse train produced by a transducer and representing the speed of the taxi and use said second pulse train to modify or control a first pulse train emitting from a constant frequency oscillator and forming said time factor so that said first pulse train is caused to conform to a frequency proportional to the frequency of said second pulse train when the frequency of said second pulse train exceeds a predetermined limit, said taximeter including a control circuit adapted on operation to activate the taximeter, a fare counter for counting directly or indirectly the sum of pulses issuing from said oscillator and display means adapted to display the fare resulting from the sum of pulses counted by said counting means in a convenient form.

2. A taximeter as claimed in Claim 1 wherein said modifying means include a flip-flop and a nand gate in circuit with said oscillator, said second electrical pulse train being applied in use to said flip-flop, the output of which is connected to said nand gate and hence to said oscillator the output of which is fed back to said flip-flop so that in use each pulse issuing from said oscillator fixes said flip-flop in the reset state causing said nand gate to prevent said second pulse train triggering said oscillator until said second pulse train exceeds the predetermined frequency whereupon more than one pulse from said second pulse train appears between two pulses of said first pulse train, the first of said pulses from said second pulse train setting said flip-flop to prepare said nand gate to pass the second of said pulses from said second pulse train, which pulse then triggers said oscillator terminating the relaxation period thereof and causing a pulse in said first pulse train to issue from said oscillator conforming with said second pulse from said second pulse train.

3. A taximeter as claimed in either claim 1 or claim 2 including a rate divider adapted to

delete a predetermined proportion of the output pulses from said oscillator so that each remaining pulse represents a unit increase in the indicated fare.

4. A taximeter as claimed in claim 3 wherein said rate divider is programmable to adapt to varying tariffs.

5. A taximeter as claimed in any one of the preceding claims wherein said counting means include provision to provide a number of pulses corresponding to a preset hireage or flag-fall feed.

6. A taximeter as claimed in any one of the preceding claims wherein the number of pulses issuing from said counting means relative to the number of pulses from said first pulse train is settable in said counting means.

7. A taximeter as claimed in any one of the preceding claims wherein said display means comprises a seven segment display driven from said counting means by a decoder driver.

8. A taximeter as claimed in any one of the preceding claims wherein said transducer includes a coil capable of carrying an electric current, placed adjacent to a part of the taxi incorporating magnetic material and rotating proportional to the speed of the taxi, an integrator adapted to smooth the output from said coil and a Schmitt trigger adapted to convert the output from said integrator to distinct pulses.

9. A taximeter as claimed in Claim 8 wherein said coil is placed to pick up changes in the magnetic field of the speedometer of said taxi.

10. A taximeter when constructed arranged and operable substantially as described herein with reference to the accompanying drawings.

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