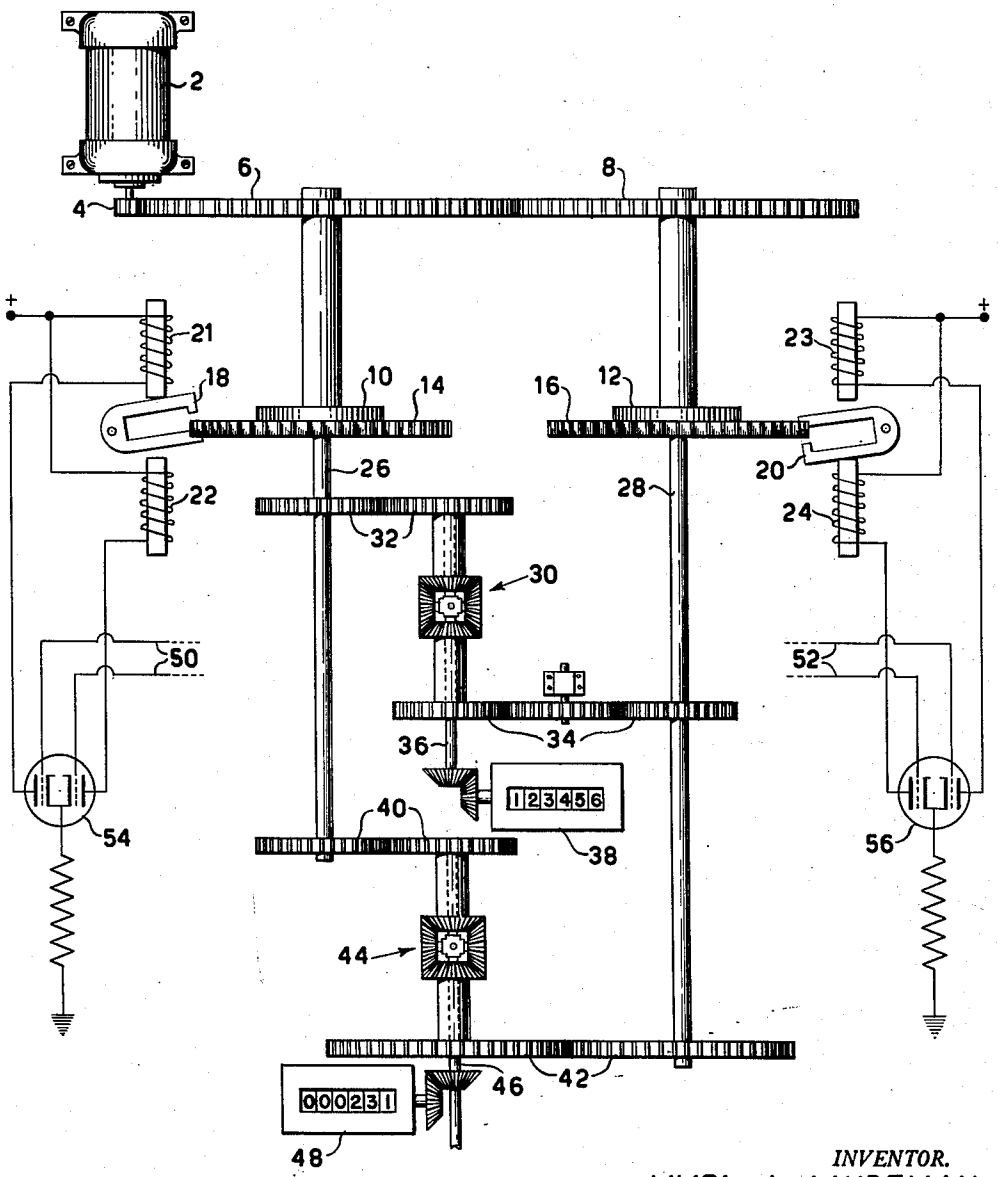
Feb. 2, 1954 M. A. LINDEMAN 2,668,012

DIFFERENTIAL COUNTER

Filed May 5, 1949



INVENTOR.
MYRL A. LINDEMAN
BY
Russell & Hardy
ATTORNEYS.

Patented Feb. 2, 1954

2,668,012

UNITED STATES PATENT OFFICE

2,668,012

DIFFERENTIAL COUNTER

Myrl A. Lindeman, Drexel Hill, Pa., assignor to Sun Oil Company, Philadelphia, Pa., a corporation of New Jersey

Application May 5, 1949, Serial No. 91,472

3 Claims. (Cl. 235—92)

1

This invention relates to a differential counter mechanism suitable for counting both the sum and the difference of the number of signal pulses delivered to the mechanism.

It is an object of this invention to provide a counter suitable for counting impulses occurring at a rate more rapid than can be counted by ordinary counting means. It is another object of the invention to provide a counter which will count both the sum and difference of impulses coming from a plurality of sources and which is not adversely affected by any time overlap existing among pulses from different sources.

These and other objects of the invention will become apparent from the following description read in conjunction with the accompanying drawing showing a mechanical diagram of the differential counting system.

Referring to the figure there is shown a yielding drive in the form of a motor 2 which through gearing 4, 6 and 8 drives a pair of friction discs 10 and 12 which, in turn, tend to drive escape wheels 14 and 16 at speeds in excess of the maximum speeds which may be permitted to them by the action of escape latches 18 and 20. The escape latches are operated by solenoids. These latches have their upper and lower detent portions offset in the usual fashion so that, upon each stroke in one direction of the latch, the escape wheel will advance through half the tooth spacing and will advance a full tooth spacing upon each complete cycle of latch movement. Little power is required to operate the escapement latches which may be of light weight and operated at high speeds. Solenoids 21 and 22 control the escape latch 18 and solenoids 23 and 24 control the escape latch 20. These solenoids are energized by circuits which will be hereinafter described.

The shafts 26 and 28 connected to the escape wheels 14 and 16 drive a differential mechanism conventionalized at 30, the former through gearing 32 and the latter through gearing 34. The gearing is such as to drive the input bevel gears of the differential mechanism in the same direction. The output shaft 36 of this differential mechanism drives a counter 38 which counts the sum of the pulses delivered by both circuits.

The shafts 26 and 28 also drive through gearing 40 and 42 a second differential gear mechanism 44, the output shaft 46 of which drives a counter 48 which records the difference of the pulses delivered by both circuits. It will be noted that there are three gears at 34 compared with two gears at 32 for producing the counting

2

of the sum, while two gears at 40 and two gears at 42 provide for the counting of the difference, by driving the input bevel gears of the differential gear mechanism in opposite directions of rotation.

Pulses at a rate in excess of 50 cycles per second may be fed through each of the lines 50 and 52 to the amplifiers 54 and 56, respectively, which serve to selectively energize the solenoid coils 21 and 22, and 23 and 24, respectively. Mechanical pulses in many forms may also be counted when employed to control the operation of the escapements; however, because of the relative ease of transmission and control, electrical pulses will generally be employed to transmit the pulse signals in high speed counting applications.

A typical application for this type of counter may be found in conjunction with the elevation meter disclosed in the application of Ford Johnson and Fred Mayes, Serial No. 776,250, dated September 26, 1947.

It will be obvious that the present counting system will operate in response to an extremely high frequency of input pulses and with an accuracy far in excess of the more conventional counting systems. The differential mechanism permits simultaneous counting of both sum and difference, and any overlap existing in signals delivered to the system from different sources will not affect the accuracy of the count.

It will be obvious that by employing a repetition of the differential units herein disclosed it is possible to receive and count the sum of the signal pulses received from a number of sources and also to count the differences between the number of signal pulses received from pairs of sources or pairs of groups of sources.

What is claimed is:

1. A counting mechanism comprising a pair of escapements, each of said escapements including an escape wheel and an escape latch controlling step by step movement of its associated wheel, means continuously frictionally urging said escape wheels in a forward direction at speeds in excess of the maximum speed permitted by their associated escape latches, a pair of independent electromagnetic means each responsive to successive high speed electrical pulses and controlling the operation of one of said escape latches, counting means, and differential means connecting said escape wheels to said counting means, said connecting means actuating said counting means in response to operation of said escape wheels to provide a count of the difference of the number of operations of the escape latches.

2. A differential counting mechanism comprising a pair of escapements, each of said escapements including an escape wheel and an escape latch having opposed members controlling step by step movement of its associated wheel, continuously running driving means frictionally urging said escape wheels in a forward direction at speeds in excess of the maximum speed permitted by their associated escape latches, independent means each responsive to high speed signals controlling the operation of one of said escape latches independently of operation of the other of said escape latches, a pair of counters, means connecting said escape wheels to one of said pair of counters, said connecting means actuating said counter in response to operation of said escape wheels to provide a count of the sum of the number of operations of said escape latches associated with said escape wheels, and differential means connecting said escape wheels to the other of said pair of counters, said differential connecting means actuating said second mentioned counter in response to the operations of said escape wheels to provide a count of the difference of the number of operations of said escape latches associated with said escape wheels.

3. A differential counting mechanism comprising a pair of escapements, each of said escapements including an escape wheel and an escape latch controlling step by step movement of its associated wheel, continuously running driving means frictionally urging said escape wheels in a

forward direction at speeds in excess of the maximum speed permitted by their associated escape latches, a pair of independent electromagnetic means each responsive to successive high speed electrical pulses and controlling the operation of one of said escape latches, a pair of counters, means connecting said escape wheels to one of said pair of counters, said connecting means actuating said counter in response to operations of said escape wheels to provide a count of the sum of the number of operations of said escape latches associated with said escape wheels, and differential means connecting said escape wheels to the other of said pair of counters, said differential connecting means actuating said second mentioned counter means in response to the operations of said escape wheels to provide a count of the difference of the number of operations of said escape latches associated with said escape wheels.

MYRL A. LINDEMAN.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,070,835	Nowak	Aug. 19, 1913
1,377,844	McCutchen et al.	May 10, 1921
1,973,106	Rosenberger	Sept. 11, 1934
2,018,858	Landolt	Oct. 29, 1935
2,196,996	Lang	Apr. 16, 1940
2,527,661	Stack	Oct. 31, 1950
2,544,610	Nelson	Mar. 6, 1951