

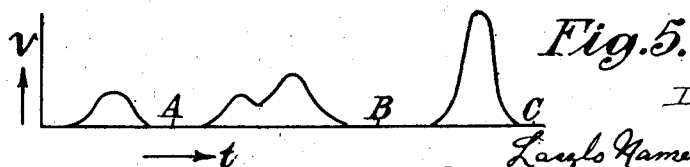
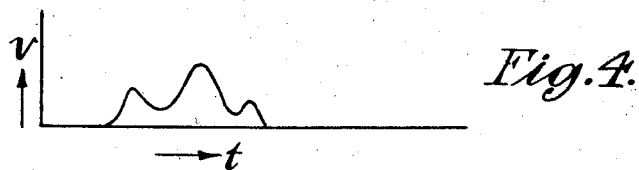
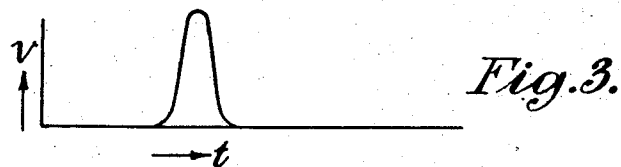
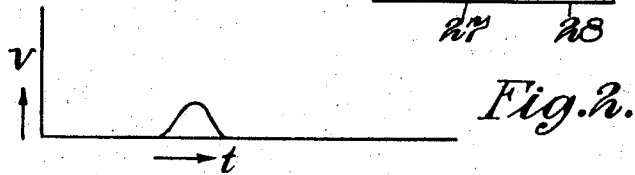
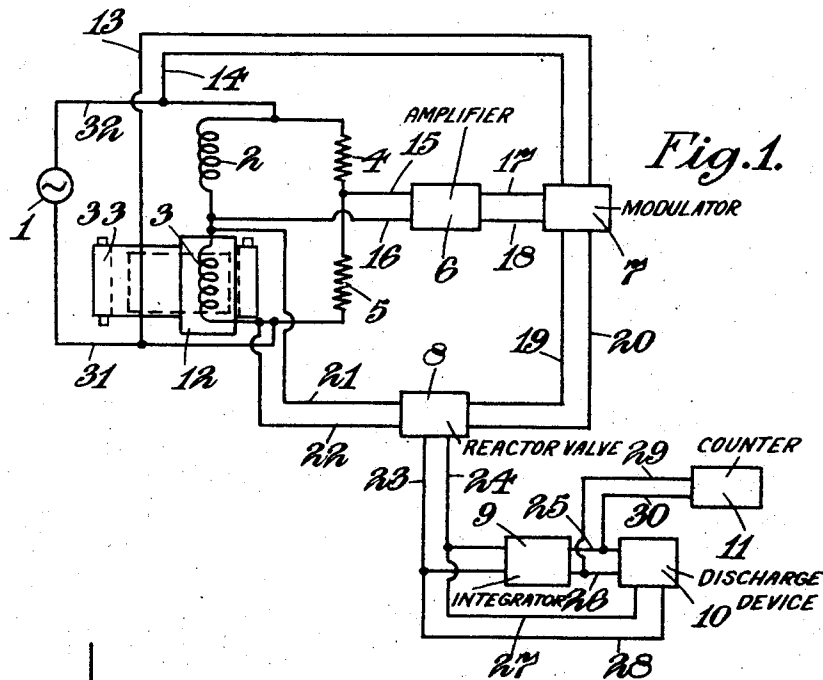
June 21, 1949.

L. NAMENYI-KATZ
COUNTING MECHANISM.

2,474,156

Filed April 3, 1945

2 Sheets-Sheet 1



Inventor
By *Laurel Hamenigi-Katz*
Watson, Cole, Grindle & Watson,
Attorneys.

June 21, 1949.

L. NAMENYI-KATZ
COUNTING MECHANISM

2,474,156

Filed April 3, 1945

2 Sheets-Sheet 2

Fig. 6.

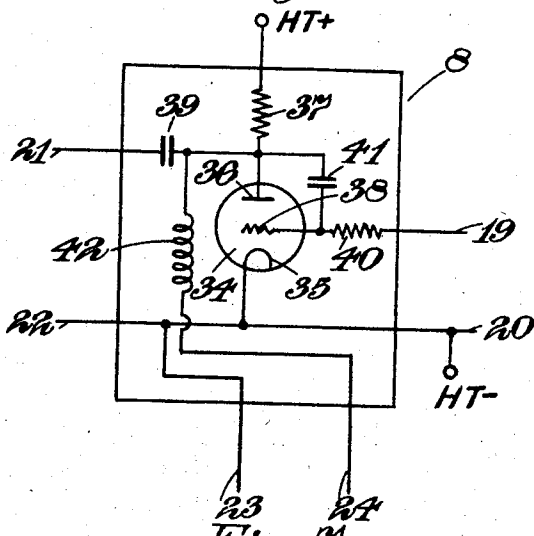


Fig. 7.

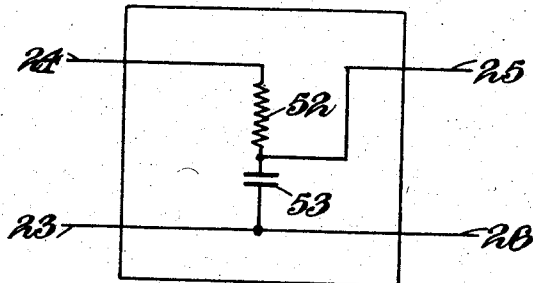
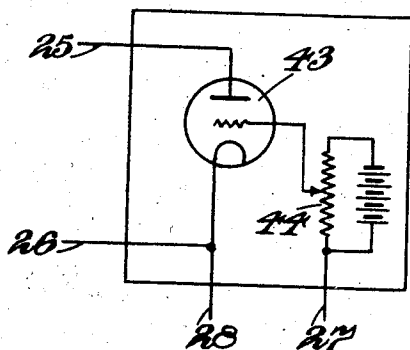


Fig. 8.



INVENTOR
Lezlo Namenyi-Katz

BY *Natam, Co., Grindle & Natam*

ATTORNEYS

UNITED STATES PATENT OFFICE

2,474,156

COUNTING MECHANISM

Laszlo Namenyi-Katz, London, England, assignor
of one-half to Furzehill Laboratories Limited,
Boreham Wood, England

Application April 3, 1945, Serial No. 586,333
In Great Britain December 23, 1943

11 Claims. (Cl. 235—92)

1

This invention relates to apparatus actuated by the passage of articles through it, such as banknotes, for example, for the purpose of counting the articles, or for operating other mechanism in response to the passage of the articles.

According to this invention, an apparatus actuated by the passage of an article through it comprises means for generating a field of energy in the ether which is capable of being disturbed by the presence of the article therein, means for traversing the article through said field and means responsive to the disturbance of the field, which means are arranged to control counting and/or indicating apparatus.

In the case of an apparatus for actuation by banknotes having metal strips therein, such apparatus comprises means responsive to the presence of such strips, means for feeding said notes past the responsive means, and means operable by the responses set up for actuating indicating or counting apparatus.

Means may be provided for generating an electric or magnetic field through which said banknotes are traversed whereby an impulse is set up in said generating means, and means are provided for indicating or counting the number of impulses and/or their amplitude. Means may be provided for integrating the amplitude and duration of said disturbances.

The means for generating the aforesaid field of energy may comprise an inductance arranged in an oscillatory circuit, means for traversing articles past said inductance, whereby its value is altered and an impulse is set up in the circuit associated therewith, and means for indicating and counting said impulses.

The aforesaid inductance may be arranged in one limb of an electric bridge and a power supply is connected across one diagonal of the bridge, while means are provided for applying the resulting potential across the second diagonal to a circuit controlling indicating or counting means.

In one form of construction, a variable inductance is arranged with the first said inductance in said bridge and is so controlled by a follow-up device responsive to the resulting potential across the second diagonal as to tend electrically to balance said bridge, which follow-up device is arranged also to control the aforementioned indicating or counting means. A source of alternating supply may be connected across one diagonal of the bridge, while a valve amplifier is connected across the other diagonal, and the aforesaid variable inductance may comprise a reactor valve circuit which reactor valve

2

is so energised from control means associated with said amplifier as also to constitute said follow-up device whereby the inductance value of the reactor valve is brought to a value which tends to balance the bridge, and means are provided for feeding the indicating and/or counting means with a voltage proportional to that fed to the input of the reactor valve.

The control means may comprise a balanced modulator fed both with a carrier from said source of alternating supply and with the output from said amplifier, so that a D. C. output is obtained from the balanced modulator, which reverses in sign as the bridge output goes through the balance point.

The aforesaid reactor valve may be connected in parallel with the inductance, which produces the aforesaid field of energy, through which the article is traversed.

With the above arrangement, variation in the gain of the amplifier does not adversely affect the operation of the apparatus.

The following is a description of one form of the apparatus for use with a banknote counting device according to the invention, reference being made to the accompanying drawing, in which:

Figure 1 is a circuit diagram of the apparatus,

Figures 2 to 5 show the form of impulses provided by the apparatus according to how the notes are fed through it,

Figure 6 is a block diagram of a reactor valve unit and the wiring connections associated therewith,

Figure 7 is a similar diagram of an integrator device, and

Figure 8 is a diagram of a discharge device, indicated diagrammatically in Figure 1 of the drawings.

Referring to Figure 1, the apparatus comprises an alternating current bridge, having resistors 4 and 5 and inductors 2 and 3. The bridge is fed across one diagonal with a source of alternating E. M. F., 1, by leads 31, 32, at an appropriate frequency. The input of an amplifier 6 is connected across the other diagonal by leads 15, 16, in such a manner that this amplifier amplifies the out-of-balance voltage of the bridge. The output of the amplifier is connected to a balanced modulator 7, by leads 17, 18, which is also supplied by leads 13, 14, with a signal input derived from the A. C. source 1. The output from the balanced modulator which feeds the leads 19, 20, is D. C., and its magnitude is substantially proportional to the out-of-balance voltage of the bridge and its sign depends on the direction of the out-of-balance,

according to whether the cross product of arms 3, 4, is greater than the cross product of arms 2, 5, or vice versa. The output of the balanced modulator 7 is fed to a reactor valve unit 8 of known kind by leads 19, 20.

The unit 8 includes the reactor valve 34 as a thermionic valve having a cathode 35 connected to a negative H. T. supply, an anode 36 connected through a suitable de-coupling resistance 37 to a positive H. T. supply and a control grid 38. The cathode and anode of this valve are connected across the inductance 3 through a suitable condenser 39 and the grid and cathode of the valve are connected to the conductors 19 and 20 so that the D. C. potential or bias of the grid 38 is derived from the modulator 7. A resistance 40 is interposed between the grid 38 and the conductor 19 and the grid is coupled to the plate by means of capacity 41 so that the grid receives an A. C. feed back potential through the plate circuit in phase quadrature with the alternating potential across the inductance 3. The effect of this arrangement is that the valve 34 functions as an inductance connected across the inductance 3 and having an inductance value which is variable in dependence upon the D. C. voltage applied to the grid 38 from the modulator 7. The valve 34 may be of any type having a characteristic such that the variations of grid potential supplied from the conductor 19 vary the mutual conductance of the valve and thus vary the reactance effect obtained by the feed-back through the capacity 41. The input from the modulator 7 is amplified by the valve 34 and applied across the conductors 23, 24 through a high-frequency choke 42 or equivalent device which transmits the low frequency amplified potential variations from the plate of the valve 34 to the conductor 24 whilst substantially isolating the conductor 24 from the high frequency potential variations applied to the plate of the valve 34 through the conductor 21.

Leads 21, 22 are so connected to the reactor valve as to make use of its characteristics of an inductance whose value depends upon the voltage input derived from the balanced modulator 7. The inductance value is not reversible about the point of zero input voltage, but will continue to change in inductance in the same direction as the voltage input passes through zero. The reactor valve 8 is connected across the bridge arm 3 by leads 21, 22.

The direction of connections of all the apparatus so far described is such that any unbalanced voltage produced by the bridge will be amplified and applied to the reactor valve so as to cause an inductance change to arm 3 of the bridge, which will tend to cause the bridge to re-balance. The reason for this effect is as follows: Suppose the bridge to have been balanced, whereafter the arm 3 is changed by a small amount L , this will produce an unbalance voltage E so that $E=kL$ where k is a constant of proportionality. Assume the value of the signal voltage is V and this produces an inductance change of $-H$ in such a fashion that $-H=p.V$ where p is the constant of proportionality of the reactor valve. As indicated above, the bridge tends to re-balance. The original change in arm 3 of L will now have been reduced to $L-H$. The unbalanced voltage caused by this will be $k(L-H)$ and the signal input to the balanced modulator $uK(L-H)$ where u is the effective gain of the amplifier and modulator system. Now this must produce the compensating inductance change of $-H$ which obviously can be written as $puk(L-H)$. The con-

dition of the system is given by $-H=puk(L-H)$. Now provided the factor puk is much greater than unity, $L=H$, L can be made as near equal to H as required by making the factor puk large enough. It will be noted that each of these factors is, in a sense, a sensitivity factor and each operates in a fashion when large to apply the greatest re-balancing effect to the bridge.

From the foregoing description it is clear that if puk is made large enough any change of inductance that is caused to occur to arm 3 will be almost completely nullified by a similar change of inductance to the reactor valve 8.

Now since $L=H$ and $V=H/p$, $V=L/p$. In other words, the voltage derived at the input to the reactor valve 8 is nearly proportional to the original inductance change in arm 3. The design of reactance valve 8 is such that the factor p is of high stability so that the voltage V is always closely proportional to the inductance change in arm 3. It should be noted that, whereas the factor p is required to be stable the actual value of the other factors ku have no great influence on the performance of the device, providing the product of the factors kup is large. Any change in the value of K or u only make 2nd order differences to the relation between V and L .

In practice, this means that neither the magnitude of the voltage applied to the bridge nor the gain of the amplifier are in any way critical. It should be noted that the foregoing analysis is descriptive rather than rigorous and is given to show in what manner the device operates and not as a mathematical treatment.

Means 33 are provided for passing the banknotes shown in dotted lines in Fig. 1 to be counted in such a fashion that the metal strips pass through the field of inductance 3. As shown in Figure 1, the banknote is being passed endwise through the machine, and thus the embedded metallic strips, which extend across the short dimension of the banknote, move through the counting device in a position transverse to the direction of the feeding movement. A measure of the disturbance is available in the form of a voltage at the input to the reactor valve, as already explained. Provided the notes pass only one at a time and are spaced such that one metal strip clears the field of the coil before another enters it the voltage V may be used to operate a counter without difficulty. Furthermore, if the notes, due to imperfections in the mechanical arrangements, are liable to pass in packets of a small number at a time and with the strips at the same end of the note and substantially superimposed it would be possible again to use the voltage available at the input to the reactor valve, which will be substantially proportional to the number of notes in each packet, to operate a discriminating counter which is responsive to the size of the impulse.

On the other hand, if notes pass through the field with the strips not in alignment which is the condition envisaged in the apparatus being described, other means must be adopted to produce a voltage which bears such a relation to the number of notes passing that it can be used to operate a counter indicating this number.

The means hereinafter described which are used to overcome this difficulty are provided to pass the notes across the field of the coil at a fixed speed and to construct a time integral of the disturbance produced. Figure 2 shows the form of the voltage produced by a single note passing through the field of the coil. Figures 3 and 4

show the form of the voltage produced by the passage of 3 notes lying superimposed and three notes not quite superimposed. Figure 5 shows the effect produced by successive packets of 1, 2 and 3 notes, in which the second packet is out of alignment.

Now considering again the circuit of Figure 1 a voltage proportional to the input to the reactor valve is fed into an integrating device 9 by leads 23, 24. This integrating device has as its essentials a resistance feeding into a condenser. The integrator shown in Figure 7 of the drawings comprises a resistance 52 connected in series with a condenser 53 across the input 23, 24. The resistance 52 and condenser 53 constitute an integrating circuit which has a long time constant as compared with the time period of the impulses received by the integrator. When, therefore, these impulses are applied as a variable voltage across the conductors 24, 23 the potential across the condenser 53 varies as the time integral of the disturbances produced. The condenser 53 is connected by the leads 25 and 26 to the discharging device 10 by which the condenser is discharged when the signal input falls to zero. The voltage across the condenser constitutes the output of the integrator and the voltage at this point (leads 25, 26) will thus be proportional to the area of the curves, shown in Figures 2 to 5. It is plain that the integral of voltage produced in Figures 3 and 4, for instance, will be substantially similar. In other words, a means has been found for producing the same effect from a number of notes in close alignment and a number of notes close together but not in alignment. As so far described, the integrator would continue to summate the number of notes, whether in packets or not, indefinitely, and in fact it is possible to make the device operate in this fashion for a small number of notes. In the instrument being described, however, the integrator condenser is arranged to be discharged after each multiple or single impulse. This is effected by the discharging device 10 connected to the integrator by leads 25, 26 and operated from a proportion or function of the integrator input signal and connected by leads 27, 28 so that the integrator is discharged whenever the signal input falls to zero. For instance, in Figure 5, the integrator would be discharged at points marked A, B and C.

The discharged device 10 is illustrated in Figure 8 and comprises a gas discharge valve 43 having its plate electrode connected to the conductor 25 and its cathode connected to the conductor 26. The conductor 28 is connected to the cathode of the valve 43 and the conductor 27 (which is continuous with the conductor 24 and is thus connected to the grid thereof, through a suitable biasing device represented at 44 in Figure 8 which is adjusted so that the potential applied to the grid of the valve 43 when the valve 34 receives no signal from the modulator 7 is just sufficient to fire the valve 43. During the reception of signals, the plate of the valve 34 becomes more negative with the result that the grid of the valve 43 is biased negatively so that the valve 43 is non-conductive. When the signal falls to zero, the potential of the grid 43 rises to a sufficient positive value to fire the valve and discharge the condenser 53.

In the device being described allowance has been made only to count continuous impulses caused by up to a maximum number of 3 notes, it being considered that the mechanical arrangements feeding the notes will never allow more

than 3 notes to go through more or less together.

The counter 11 which is connected to the integrator by leads 29, 30 and which is described in detail in United States Patent application Serial No. 586,332, filed Apr. 3, 1945, is operated by means of relays so that it will discriminate between unit, double and treble size impulses and operate accordingly.

I claim:

1. An apparatus actuated by the insertion or passage of articles, comprising means for generating a field of energy in the ether which is capable of being disturbed by the presence of an article therein, means for traversing the articles separately or together through said field whereby impulses are set up in said generating means, and means for indicating the number of articles passing through said field comprising indicating means responsive to the number of impulses and their amplitude.

2. An apparatus of the class described adapted to be actuated by the presence of bank notes having metal strips therein, said apparatus comprising means for generating a field of energy, said generating means being responsive to the presence of said strips, means for feeding said bank notes with the strips transverse to the direction of feeding movement past said responsive means, and means for counting said bank notes operably responsive to the number of the responses set up in the field by the passage of said bank notes and to their amplitude.

3. Apparatus for counting articles comprising means for traversing said articles at constant speed through a counting station, electrical impulse producing means for producing an electrical impulse when an article passes said station and integrating means for integrating the amplitude and duration of said impulses so as to produce an integrated signal having an amplitude proportional to the number of articles which have passed through said head.

4. Apparatus for counting articles comprising means for traversing said articles through a counting station, electrical impulse producing means located at said station for producing an electrical impulse when an article passes said station and an integrating device comprising a long time-constant circuit comprising a resistance and a condenser for producing across said condenser a voltage proportional to the number of articles passed through said counting station.

5. Apparatus for counting articles comprising an electrical inductance element, means for traversing said articles through the field of said inductance element, means for electrically energizing said inductance element, means responsive to variations in the inductance value of said inductance element for producing electrical signals proportional to said variations in inductance value, a long time constant circuit comprising a resistance and capacity, for integrating said signals whereby there is produced across said capacity a signal voltage proportional to the number of articles passed through the field of said inductance element and means for applying said signals to said circuit.

6. An apparatus of the class described adapted to be actuated by the insertion or passage of an article, comprising, in combination, means for generating a field of energy in the ether which is capable of being disturbed by the presence of an article therein, said means being an inductance arranged in an oscillatory circuit, means

for traversing articles past said inductance whereby its value is altered and an impulse is set up in said circuit, and means for indicating said impulses, said inductance being arranged to form one limb of an electric bridge, a power supply arranged across one diagonal of said bridge, means for applying the potential resulting across the second diagonal to a circuit controlling said indicating means, which circuit includes a variable inductance in said bridge associated with the first said inductance and a follow-up device controlling said variable inductance so as electrically to balance said bridge and also controlling said indicating means.

7. An apparatus according to claim 6, wherein said power source consists of an alternating supply and said means for applying the potential resulting across the second diagonal consists of a valve amplifier, and wherein said variable inductance comprises a reactor valve so energized from control means associated with said amplifier as to constitute said follow-up device whereby the reactor valve inductance is brought to a value which balances the bridge and wherein means are provided feeding the indicating means with a voltage proportional to that fed to the input of the reactor valve.

8. An apparatus according to claim 6, wherein said power source consists of an alternating supply and said means for applying the potential resulting across the second diagonal consists of a valve amplifier, and wherein said variable inductance comprises a reactor valve so energized from control means associated with said amplifier as to constitute said follow-up device whereby the reactor valve inductance is brought to a value which balances the bridge and wherein means are provided feeding the indicating means with a voltage proportional to that fed to the input of the reactor valve, said control means comprising a balanced modulator fed with a carrier from said source of alternating supply and with an output from said amplifier, so that a D. C. output is obtained which reverses in sign as the bridge output goes through the balance point.

9. An apparatus according to claim 6, wherein said power source consists of an alternating supply and said means for applying the potential resulting across the second diagonal consists of a valve amplifier, and wherein said variable inductance comprises a reactor valve so energized from control means associated with said amplifier as to constitute said follow-up device whereby the reactor valve inductance is brought to a value which balances the bridge and wherein means are provided feeding the indicating means with a voltage proportional to that fed to the input of the reactor valve, said control means comprising a balanced modulator fed with a carrier from said source of alternating supply and with an output from said amplifier, so that a D. C. output is obtained which reverses in sign as the bridge

output goes through the balance point, said reactor valve being connected in parallel with the inductance which produces the aforesaid field of energy.

10. An apparatus according to claim 6, wherein said power source consists of an alternating supply and said means for applying the potential across the second diagonal consists of a valve amplifier and wherein said variable inductance comprises a reactor valve so energized from control means associated with said amplifier as to constitute said follow-up device whereby the reactor valve inductance is brought to a value which tends to balance the bridge and wherein means are provided feeding the indicating means with a voltage proportional to that fed to the input of the reactor valve and, wherein said voltage proportional to that fed to the input of the reactor valve is fed to means for producing an output voltage dependent on the time integral of the input voltage, which output voltage is applied to the indicating means.

11. An apparatus according to claim 6, wherein said power source consists of an alternating supply and said means for applying the potential across the second diagonal consists of a valve amplifier and wherein said variable inductance comprises a reactor valve so energized from control means associated with said amplifier as to constitute said follow-up device whereby the reactor valve inductance is brought to a value which tends to balance the bridge and wherein means are provided feeding the indicating means with a voltage proportional to that fed to the input of the reactor valve and, wherein said voltage proportional to that fed to the input of the reactor valve is fed to means for producing an output voltage dependent on the time integral of the input voltage, which output voltage is applied to the indicating means, and wherein said electrical integrating means is of the resistance and condenser type and wherein a discharging device is associated with said condenser and is so controlled by the input to the reactor valve that a discharge takes place when the signal input falls to zero.

LASZLO NAMENYI-KATZ.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,708,524	Tatz	Apr. 9, 1929
1,797,651	Gergacsevics et al.	Mar. 24, 1931
1,957,222	Mershon	May 1, 1934
2,005,892	Gulliksen	June 25, 1935
2,228,068	White	Jan. 7, 1941
2,251,973	Beale et al.	Aug. 12, 1941
2,337,132	Shaw	Dec. 21, 1943
2,402,222	Willis	June 18, 1946