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2,437,168

TIMING APPARATUS

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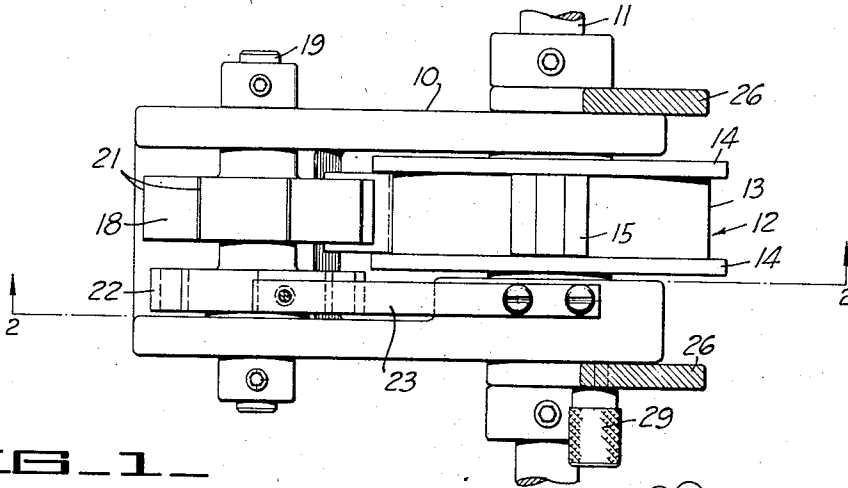


FIG. 1

FIG. 2

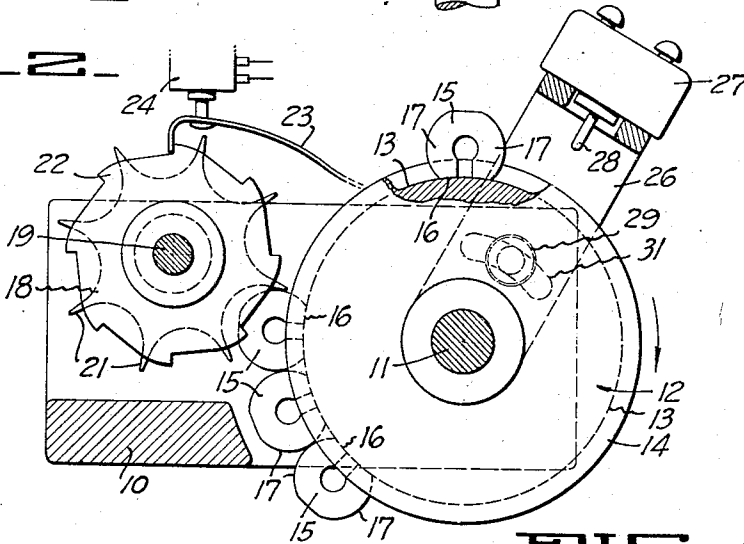


FIG. 4

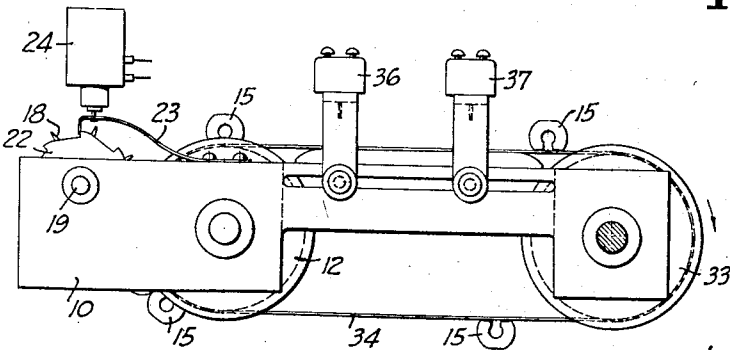
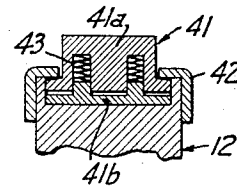


FIG. 3



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TIMING APPARATUS

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6 Claims. (Cl. 161—1)

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This invention relates generally to timing apparatus of the type adapted to provide a series of recurrent responses in accordance with the reception of recurrent impulses.

In many types of equipment it is frequently desirable to provide electrical or mechanical responses having a time interval between the same corresponding to the time interval between sequential applied impulses, but with a definite time lag between each applied impulse and its corresponding response. Relatively complicated equipment has been proposed for this purpose, as for example a tape perforator, together with contacting means synchronized with the perforator and operating in accordance with the perforations in the tape. In general however such timing apparatus has been too complicated for many types of equipment, particularly where the service required is relatively severe and does not permit the supervision by highly skilled technicians. In addition many prior types of timing apparatus have lacked accuracy and speed and have not been susceptible of quick adjustment to suit different operating conditions.

It is an object of the present invention to provide a relatively simple type of timing apparatus which will provide recurrent or sequential responses at a desired time interval following the reception of applied impulses.

A further object of the invention is to provide apparatus of the above character which will be capable of relatively high speed operation, and which will afford relatively accurate timing.

Additional objects of the invention will appear from the following description in which the preferred embodiment has been set forth in detail in conjunction with the accompanying drawing.

Referring to the drawing:

Figure 1 is a plan view showing timing apparatus incorporating the present invention.

Figure 2 is a side elevational view partly in section, showing the timing apparatus of Figure 1.

Figure 3 is a side elevational view illustrating another embodiment of the invention.

Figure 4 is a detail illustrating another embodiment of the invention.

The apparatus illustrated in the drawing consists of a suitable mounting support or frame 10, which is provided with suitable journals for the rotatable shaft 11. This shaft is connected to other equipment to drive the same at either a continuous or predetermined rate as will be presently explained. Mounted upon shaft 11 there is a wheel 12, the outer periphery 13 of which forms what can be termed a circular trackway. The

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sides of the wheel are shown provided with suitable flanges 14 to define the sides of the trackway.

A plurality of relatively small transfer elements 15 are frictionally and slidably retained upon the trackway 13. In the embodiment of Figures 1 and 2 these elements are in the form of small permanent electromagnets, formed of suitable metal having relatively high magnetic permeability. The shaping of these elements can be horseshoe fashioned, with the end faces 16 of the two branches 17 being shaped concave to contact flush upon the periphery 13. The wheel itself, or at least that part forming the periphery 13, is made of suitable magnetic material such as iron or steel. The magnetic attraction between the elements 15 and the periphery 13 forms a convenient and simple slidable frictional engagement, whereby the elements can be held stationary while the wheel revolves. When an element is released, it moves in synchronism with the wheel until again arrested.

Releasable means is utilized for retaining the elements 15 and for releasing them singly upon the receipt of impulses. Thus in this instance a retention or star wheel 18 is provided, which is carried by the rotatable shaft 19. Wheel 18 is provided with projecting circumferentially spaced fingers 21 adapted to engage the forward faces of the elements 15 as illustrated in Figure 2. Mounted to rotate together with wheel 18 there is a ratchet wheel 22 adapted to be engaged by the pawl 23. This pawl in turn is connected to operating means such as the solenoid 24. When an electrical impulse is received by the solenoid 24, pawl 23 is lifted to release the ratchet wheel 22, and as a result the ratchet wheel together with wheel 18 rotate a given angular amount to permit the release of one element 15, but to then engage and retain the next succeeding element. A released element travels in synchronism with the wheel until it is returned to the row of elements being retained by the wheel 18.

Means is provided in conjunction with the wheel 12 to effect a response when a released element passes through a given position. Thus an arm 26 is provided which serves to support a suitable electrical switch unit 27. The operating member 28 of this switch extends into the path of movement of the elements 15. Thus when an element engages member 28 a circuit is closed or opened to effect the desired response. It is desirable that the positioning of the switch 27 be adjustable, whereby the time interval between the receipt of an impulse and the effecting of a corresponding response, may be adjusted to suit

requirements. Thus in this instance arm 26 is shown movable about the shaft 11, and is retained in an adjusted position by nut 29 which extends through a segmental slot 31, and which is threaded into the support 10.

Operation of the apparatus described above can be reviewed as follows: The wheel 12 is continuously rotated and the retained elements 15 are held magnetically in frictional engagement with the periphery 13. The source of impulses, presumed in this instance to be electrical, is applied to the solenoid 24. Upon receipt of an impulse pawl 23 is temporarily lifted to permit limited movement of the wheel 18, whereby the first element 15 of the row of elements is released. A released element 15 is accelerated practically instantaneously to thereafter move in synchronism with the wheel 12. In Figure 2 one such released element is shown travelling over the top of the wheel. Within a predetermined time interval following its release the element contacts member 28 of the switch 27 thus either opening or closing an electrical circuit. In this manner a desired response is obtained which can be used in various ways depending upon the equipment with which the apparatus is employed.

In certain instances the shaft 11 and wheel 12 can be operated at a constant rate in order to provide at all times a fixed time interval between the receipt of an impulse, and the effecting of a corresponding response. However, in other instances the operation of wheel 12 may be at a variable rate in synchronism however with an operating member of the equipment with which the apparatus is being used. As one specific example of equipment with which my apparatus can be used, reference can be made to the automatic agricultural machine disclosed in my co-pending application Serial Number 482,679, filed April 12, 1943, now Patent No. 2,400,562. When used with such a machine wheel 12 is connected to rotate in synchronism with the rotation of the ground wheels of the vehicle, and the impulses are produced by light indications from a photo-electric cell. The recurrent responses obtained serve to operate a plant cutting mechanism, and the timing made possible by my apparatus is such that the cutting mechanism is thereby operated exactly in accordance with the location of the plant responsible for the initiating impulse.

The embodiment of Figure 3 is similar to Figures 1 and 2, but in this instance an idler wheel 33 is provided in addition to the wheel 12. An endless steel band 34 engages both wheel 12 and idler 33, and can be made of suitable magnetic material such as spring steel. The elements 15 engage the surface of the band 34, and therefore an extended trackway is provided. A plurality of response switches 36, 37 are provided in this instance, and these switches are mounted adjustably to enable their movement to different positions along the trackway. Apparatus of this type enables an extended time lapse between receipt of an impulse, and the effecting of a corresponding response.

Although the use of magnetic elements is deemed desirable and simplifies the construction of the apparatus, it is possible to obtain the frictional retention by means other than magnetic attraction. Thus as shown in Figure 4 the elements 41 are retained in place by the overlying annular flanges 42, and the two parts 41a, 41b of this element are urged apart by the use of one or more springs 43. Thus a suitable slidable frictional engagement is obtained with the

periphery of the wheel, thereby enabling retention in the same manner as the magnetic elements of Figures 1 and 2, and release in response to the receipt of an impulse to effect movement in synchronism with the trackway.

It will be evident that various additional alterations and adaptations can be made to suit various design requirements and various types of equipment. In most installations it is desirable to provide suitable lubricating means to minimize wear between the transfer elements and the periphery of the wheel, as for example by encasing the entire timing apparatus in a suitable housing with the wheel 12 being partly immersed in oil.

My timing apparatus is relatively simple in construction and operation, and in addition it affords a relatively high degree of accuracy. Operation can be at a relatively high rate, without danger of mechanical failure and without involving inaccuracies.

I claim:

1. In timing apparatus adapted to provide a series of recurrent responses in accordance with the reception of recurrent impulses, means providing a continuously moving trackway, a plurality of transfer elements slidably and frictionally engaging the trackway, trigger means associated with the trackway for retaining a plurality of said transfer elements stationary in a row one behind the other, said trigger means being adapted to be operated by received impulses to release the first element of a retained element, and means located at a station along the trackway adapted to be actuated by a transfer element moving along the trackway after release of the same.

2. In timing apparatus adapted to provide a series of recurrent responses in accordance with the reception of recurrent impulses, means providing a continuously moving endless trackway, a plurality of transfer elements slidably and frictionally engaging the trackway, trigger means for retaining a plurality of said transfer elements stationary relative to the trackway and in single file one behind the other, said trigger means operating responsive to the reception of an impulse to release the first element of the row whereby said element is free to move along the trackway, and means located at a station along said trackway and adapted to be actuated by a transfer element during movement of the latter.

3. In timing apparatus adapted to provide a series of recurrent responses in accordance with the reception of recurrent impulses, means providing a continuously moving trackway, said trackway including electrically magnetic material adjacent the surface of the same, a plurality of electro magnetic transfer elements slidably and frictionally magnetically retained upon the trackway, trigger means for retaining a plurality of said transfer elements in single file one behind the other and relatively stationary with respect to the trackway, said trigger means being adapted to release the first element in the row upon receiving an impulse, and means located at a station along said trackway adapted to be actuated by a moving transfer element.

4. In timing apparatus adapted to provide a series of recurrent responses in accordance with the reception of recurrent impulses, a continuously rotating wheel having its outer periphery formed to provide a circular trackway, a plurality of transfer elements slidably and frictionally engaging said trackway, trigger means for retain-

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ing a plurality of said transfer elements relatively stationary and in single file one behind the other, said trigger means being adapted to release the first one of said row of elements responsive to the reception of an impulse, whereby the released element is thereby caused to move together with the trackway, means located along the trackway adapted to be actuated by a moving transfer element to effect a desired response, and mounting means for said last named means enabling adjustment of the same to different locations along the trackway.

5. In timing apparatus adapted to provide a series of recurrent responses in accordance with the reception of recurrent impulses, means providing a continuously moving endless trackway, a plurality of transfer elements slidably and frictionally engaging the trackway, each element being provided with spring means serving to effect a frictional engagement with the trackway, trigger means for retaining a plurality of transfer elements stationary relative to the trackway and in single file one behind the other, said trigger

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means operating responsive to the reception of an impulse to release the first element of the row whereby said element is free to move along the trackway, and means located at a station along said trackway and adapted to be actuated by a transfer element during movement of the latter.

6. In timing apparatus adapted to provide a series of recurrent responses in accordance with the reception of recurrent impulses, a continuously rotating wheel having its outer periphery formed to provide a circular trackway, a plurality of transfer elements slidably and frictionally engaging said trackway, trigger means for retaining a plurality of said transfer elements relatively stationary and in single file one behind the other, said trigger means being adapted to release the first one of said row of elements responsive to the reception of an impulse, whereby the released element is thereby caused to move together with the trackway, and means located along the trackway adapted to be actuated by a moving transfer element to effect a desired response.

LEO A. MARIHART.

Certificate of Correction

Patent No. 2,437,168.

March 2, 1948.

LEO A. MARIHART

It is hereby certified that the address of the inventor in the above numbered patent was erroneously described and specified as "Monterey, California", whereas said address should have been described and specified as *County of Monterey, California*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of May, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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