

Jan 6, 1931.

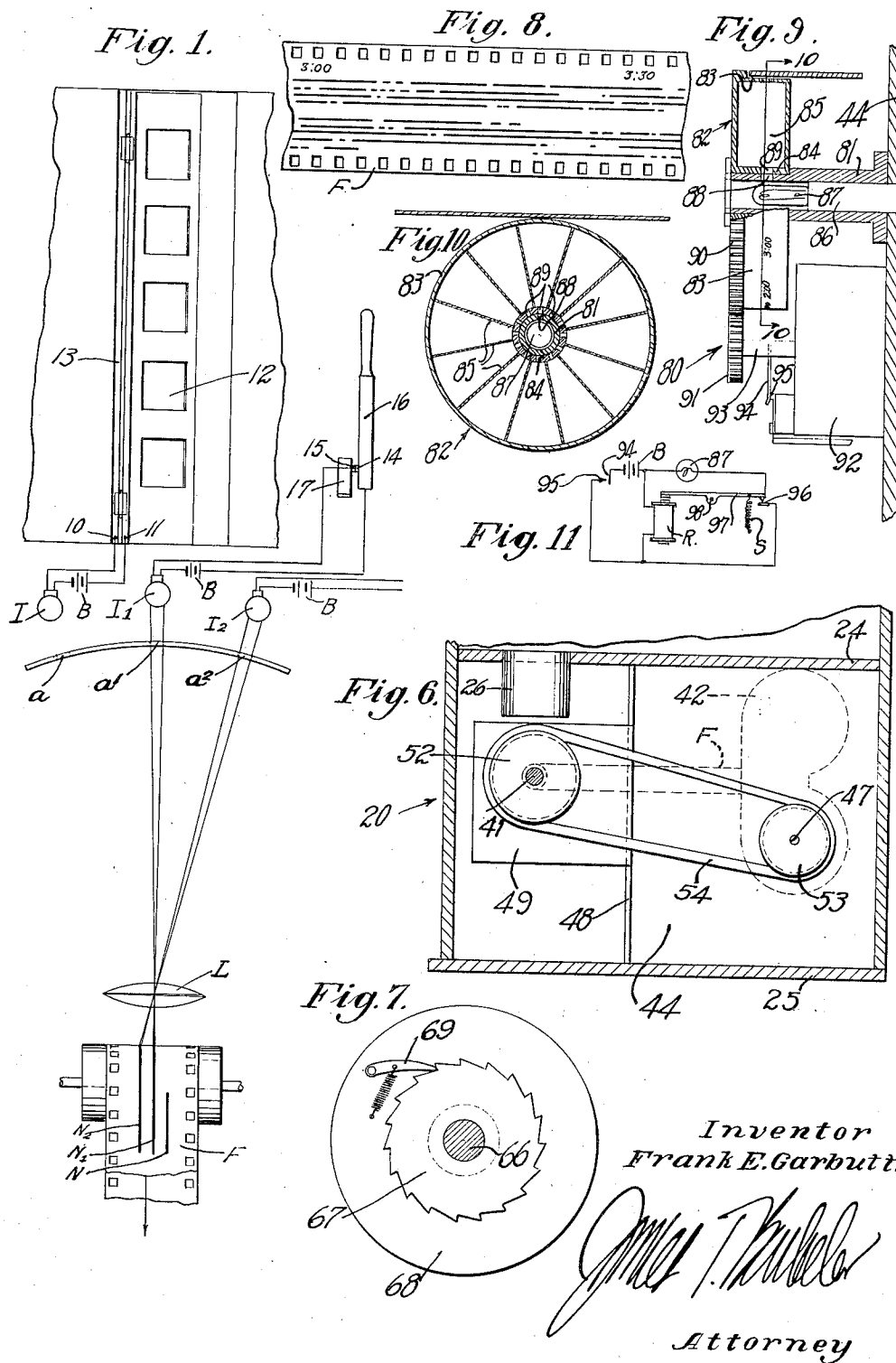
F. E. GARBUTT

1,787,940

TIME RECORDING SYSTEM

Filed Jan. 18, 1928

2 Sheets-Sheet 1



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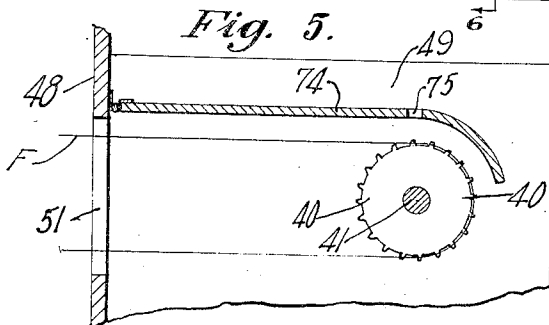
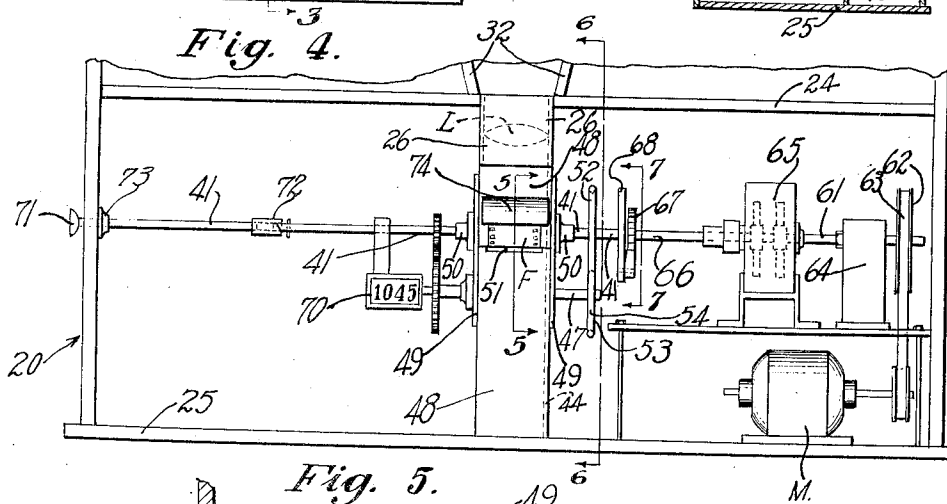
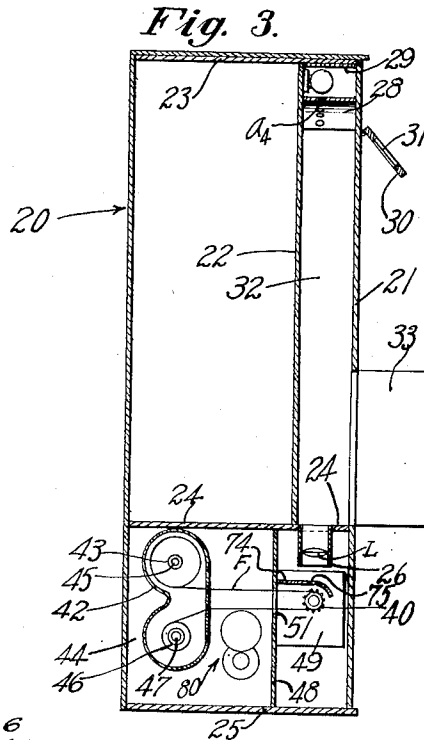
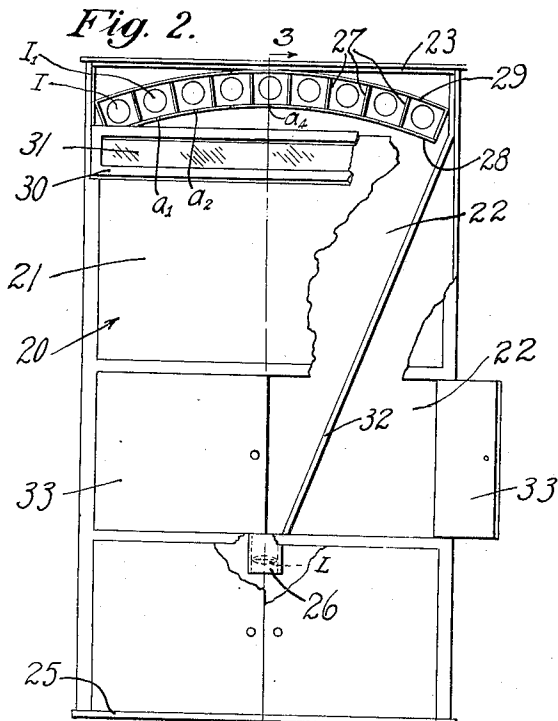
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TIME RECORDING SYSTEM

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2 Sheets-Sheet 2



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TIME-RECORDING SYSTEM

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This invention has to do with a system for the recording of time, or more particularly for the making of a permanent record of the time intervals during which certain events takes place, or certain conditions are existent. And while its field of application is much broader, it will probably best be illustrated as embodied in a form adapted to be installed in a factory or laboratory for the purpose of obtaining a permanent record of the time intervals during which certain processes are in operation, certain men at work, etc.

The invention provides, in its simplest form, an illuminant arranged to be lighted during the time intervals in which an event which it is recording is taking place, and a film traveling at a constant rate and exposed to light rays from the illuminant. The light rays thus print a continuous image upon the moving film during the time in which the event is taking place, and when the film is developed, a broken line light image represents the time intervals during which the event was in operation.

The invention will be better understood from the following detailed description of a typical embodiment of the system and of apparatus for carrying it into effect. This arrangement is only to be considered as illustrative of the invention, however, and all variations and improvements which come within the scope and spirit of the appended claims are contemplated as lying within the invention.

In the drawings:

Fig. 1 shows diagrammatically a simplified form of the optical and electrical system;

Fig. 2 is a front elevation, partly in section of the time recorder;

Fig. 3 is a section on line 3—3 of Fig. 2;

Fig. 4 is a view, somewhat enlarged, showing the film moving mechanism;

Fig. 5 is a section taken on line 5—5 of Fig. 4;

Fig. 6 is a section taken on line 6—6 of Fig. 4;

Fig. 7 is a section taken on line 7—7 of Fig. 4;

Fig. 8 shows a portion of a film containing a typical time record;

Fig. 9 shows, partly in section, the time clock unit;

Fig. 10 is a section taken on line 10—10 of Fig. 9;

Fig. 11 shows diagrammatically a means of breaking the electrical circuit containing the printing light of the time clock unit.

With particular reference to Fig. 1, in which is shown a simplified form of the optical and electrical system, illuminants I , I_1 and I_2 are shown, each being contained in an electrical circuit with a battery B and with a pair of contacts or other means of closing the circuit. For illustration, I show in circuit with illuminant I contacts 10 and 11 placed on a door 12 and its frame 13 respectively, so that the contacts will be closed and the illuminant I lighted during the time that the door is closed. Thus, if a certain operation can only be performed while the door is closed, the illuminant will be lighted during all of that time. In this case, the door is shown open and the illuminant is dark. Similarly, illuminant I_1 may be connected to contacts 14 and 15 upon a starting lever 16 and a stationary part 17 upon a machine, for instance, an illuminant I_1 will be thus lighted during the time intervals in which the machine is in operation. Illuminant I_1 is here shown lighted, indicating that the machine is in operation. Illuminant I_2 may likewise be connected to any other arrangement of contacts or circuit closing means, and is here shown as being lighted, indicating that its circuit is closed.

A lens L is disposed to receive light rays from the illuminants I , I_1 , etc., and an aperture plate containing apertures a , a_1 , etc. allows only a thin pencil of light from each illuminant to reach the lens. These several pencils of light are focused by the lens to points upon a traveling film F and thus form continuous line images N , N_1 , etc. upon the film during the periods that the illuminants are lighted. The broken image N indicates that illuminant I was lighted a short time back, but is now dark. Fig. 8 shows a typical developed negative record in which a larger

number of events and conditions were being recorded.

In Figs. 2 to 7 is shown a typical physical embodiment suitable for carrying the system into effect. With particular reference to Figs. 2 and 3, numeral 20 indicates a cabinet in which are supported the elements of the system. In cabinet 20, horizontally spaced from and parallel to its front face 21 is a vertical partition 22 extending from the top 23 of cabinet 20 to a horizontal partition 24 which is vertically spaced from the cabinet bottom 25, as shown. Depending from the horizontal partition 24 and located between the front face 21 and the vertical partition 22 is a lens supporting means 26 containing lens L. Supported in spaced relation upon the upper portion of the vertical partition 22, and disposed equi-distantly from lens L are the illuminants I, I₁, etc. Between the illuminants are light shielding partitions 27, and in contact therewith at their lower edges is an arcuately disposed aperture plate 28 having small apertures *a*, *a*₁, etc., which correspond to the illuminants I, I₁, etc. and are located in direct line between these illuminants and the lens L. In contact with the light shielding partitions 27 and conforming to the curvature of the aperture plate 28 and the illuminants is a top shield 29. A door 30 is hinged at its lower edge to the front 21 of the cabinet and swings downwardly to expose the illuminants. Within the door 30 is preferably a red glass panel 31 through which can be seen the illuminants, but which will shield out all actinic light rays. It will be thus seen that the illuminants are entirely enclosed as to actinic rays except for their apertures *a*, *a*₁, etc.

For the purpose of shielding the space between the apertures and lens L as effectively as possible, slanting partitions 32 are preferably placed between the front face 21 and vertical partition 22, and extending from the edges of the lens holder 26 at the bottom to beyond the ends of the aperture plate 28 at the top. Front doors 33 swing open to expose the interior of the light ray enclosing compartment.

Pencils of light transmitted through the apertures *a*, *a*₁, etc. from the illuminants are brought to spaced point foci in a plane below the lens L; and in this plane is arranged a traveling film F adapted to take line images of the several points of light from the lighted illuminants. The film F is supported in this plane upon sprocket 40 on shaft 41.

A magazine 42 is supported upon a wall 44 which extends between horizontal partition 24 and bottom 25, and at right angles to the front 21 of the cabinet 20. The film is wound upon a spool 43 carried upon spindle 45 of magazines 42. The film passes from spool 43 over the sprocket 40 to the take up spool 46 carried in the magazine 42 below spool

43 and upon a flexibly driven shaft 47 which extends through wall 44.

Parallel to the front 21 of the cabinet and abutting against the forward edge of wall 44 is a supporting plate 48 which has wings 49 carrying bearings 50 in which is supported the shaft 41. Supporting plate 48 has an aperture 51 through which passes film F on its path from the magazine to the sprocket 40.

On shaft 41 and adjacent bearing 50 is a pulley 52 which drives a pulley 53 upon shaft 47 by means of a spring or other flexible belt 54 to drive the film take-up spool 45.

The shaft 41 is suitably driven so that the film will move, preferably, at a rate of, for instance, six inches per hour. The power unit for the film drive is a motor M which drives shaft 61 by means of pulley 62 and belt 63. A bearing plate 64 supports shaft 61. A reduction gear indicated at 65 drives shaft 66 from shaft 61 at a greatly reduced rate of rotation, this making possible the desired slow and constant rate of movement of the film. Shaft 66 drives shaft 41 by means of the device shown most clearly in Fig. 7. The ratchet wheel 67 drives disk 68 by means of pawl 69. It will be evident that the shaft 41 and film moving sprocket 40 can thus be rotated in only one direction and the film can only be moved forwardly. For if the motor M were to be reversed, the ratchet wheel 67 could not drive the pawl 68 and no motion of the film would result; and if it were attempted to move the sprocket backwards, the pawl 68 would engage the ratchet teeth, but because of the resistance of the reduction gear, it could not move the ratchet wheel 67.

On shaft 41 and on the other side of the sprocket 40 may conveniently be placed a film measuring machine 70. Shaft 41 extends through the side of the cabinet 20 to a ring 71, and is broken by a clutch 72. Shaft 41 is normally held so that clutch 72 is out of engagement by spring means at 73. It is thus possible, by pushing in on ring 71 until clutch 72 is in engagement, to rotate manually shaft 41 to move the film forward. This means is provided so that unexposed film may be moved into position for operation after the doors are closed and light excluded from the cabinet; and also so that the exposed portion of the film which contains a record may be wound up in the magazine before the doors are opened so that exterior light cannot obliterate the time record contained upon the film.

Preferably, a light hood 74 is provided over the film F and is hinged to the plate 48 as shown. Aperture 75 is provided in the top of the hood through which the light rays pass to reach the film. This hood is provided to shield the film from any stray light from above, but may be omitted if desired.

Below the film as it passes from the sprocket wheel 40 to the magazine may conveniently be located a time clock unit 80. In Figs. 9

and 10 is shown a possible embodiment of such a unit. Extending from wall 44 is the hollow stud 81 and mounted thereupon is an enclosed cylindric light-directing wheel 82, about the peripheral surface 83 of which are stencilled figures representing successive time units of a clock, these being simply taken, for illustrative purposes, at intervals of one hour. Extending radially from the hub 84 of wheel 82 to the inner surface of its peripheral shell 83 are light shielding partitions 85, these being so disposed as to intersect the surface 83 between its stencilled time figures. In the hollow within the stud 81 is a socket 86 carrying an electric light bulb 87. A light aperture 88 is provided in stud 81 directly over the light bulb 87, and light apertures 89 are provided in the hub 84 of wheel 82 in line between the stencilled figures upon the peripheral surface 83 and the light bulb 87, apertures 89 being disposed to register successively with the aperture 88 in the stud as wheel 82 is rotated. Gear teeth 90 are provided about the peripheral surface 83 and the wheel is driven by gear 91 which is in turn driven by clock 92. Gear 91 may be connected to the minute hand shaft 93 of the clock, and the gear ratio will then be made one to twelve, one revolution of gear 91, which takes a period of one hour, rotating wheel 82 one-twelfth of a revolution, or from one stencilled figure to the next. Upon shaft 93 may be mounted an electric contact arm 94 which rotates with its shaft and makes with contact 95 once each hour, closing an electric circuit to light the bulb 87. The contact arm is positioned so that it will make contact and illuminate light bulb 87 just as aperture 89 comes into full register with aperture 88, light rays thus being transmitted through the stencilled figures and printing the hour upon the film. Preferably, means are provided for breaking the circuit immediately after it is made so that the light bulb will not remain lighted and blur the figures upon the traveling film. This may be done in a variety of ways, one of which is illustrated in Fig. 11. The clock operated contact arm 94 and contact 95, previously referred to in connection with Fig. 9, are here shown in a series circuit with a battery B and a slow acting relay R. In parallel with the relay R is a circuit which contains light 87 and a pair of contacts 96. These contacts are broken when the relay armature 97, which is pivoted at 98, is pulled down by the relay, as is apparent from the diagram. The contacts 96 are normally held closed by spring S when relay R is de-energized. The operation is then as follows: When contacts 94 and 95 are closed, a circuit is closed through the light 87 and the closed contacts 96, thus causing the light to be illuminated. A circuit is also closed through the relay R, pulling armature 97 thereto and breaking contacts 96 and the circuit contain-

ing the light. Relay R being one which is relatively slow acting, the light 87 will light up first, and then the relay will act to break the circuit, just time enough being allowed to print the figures upon the film before the light is cut off.

Since the time clock prints the time units upon the film at a distance along the film from the point at which the records of observed operations are printed, the time clock must be retarded by a certain amount so that the time units will be printed at the proper points to correspond with the operation time records.

Other methods of designating the time upon the film may be utilized. For instance, one of the illuminants I may be included in a circuit containing contacts which are closed at definite intervals by a time clock. One of the contacts might be carried by the hour hand of the clock, and close the circuit for a short time each hour as it makes with a corresponding contact. Every twelve hours the circuit may be closed for a somewhat longer time. The film will then contain a short line every hour, and a longer line every twelve hours, and the exact time corresponding to any point of the film may be easily determined.

To prevent fogging of the film, the cabinet is tightly constructed and all joints are made light proof, and the entire interior is painted black to eliminate reflection of any stray light from the illuminants.

To arrange the system for operation, the illuminants are severally connected to electrical circuits containing means to maintain these circuits closed during the time intervals in which the events which they are to record are taking place. A raw film is then arranged over the sprocket wheel, and all light excluded from the cabinet by tightly closing the doors. By means of the ring at the side of the cabinet, the film is then moved forward a sufficient amount so that unexposed film is in position upon the sprocket. The motor is then started, and the film slowly travels by the lens, taking continuous or broken line images depending upon the intervals of illumination of the several illuminants.

Various modifications of the system will be at once apparent, such, for instance, as substituting converging separating shields between the illuminants for the apertures and lens, and with this arrangement substantially the same time records would be obtainable. Or, with proper proportioning of shields and apertures, the lens might be omitted. Such elements are therefore not essential to the system, and the use of equivalent means to direct light upon the film is contemplated within the scope of the invention. Also, it is equally possible to carry out the invention by maintaining the illuminants normally lighted, and causing them to be

darkened during the periods in which the conditions or events under observation are present or taking place.

I have set out in some detail an embodiment of the invention in a typical application, but it is to be understood that this specific application is not limited to the various details therein shown, nor is the invention limited to this specific application, which has merely been selected as suitably illustrative of the invention in one of its phases. Means for practicing the system in its broadest form having been disclosed, the invention is to be limited only as defined in the following claim.

I claim:

In a device of the character described, the combination of an enclosed compartment, a lens mounted therein, an arcuate aperture plate mounted in said compartment and having a plurality of spaced light apertures in the field of view of said lens and equally spaced therefrom, illuminants mounted beyond said light apertures at the side of the aperture plate away from said lens, light shielding means between said illuminants, and means for moving a raw film strip on the opposite side of said lens in such a manner that aperture images are cast thereupon in spaced relation by said lens.

In witness that I claim the foregoing I have hereunto subscribed my name this 5th day of January, 1928.

FRANK E. GARBUTT.

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