J. W. BRYCE.

SYNCHRONOUS CLOCK SYSTEM.

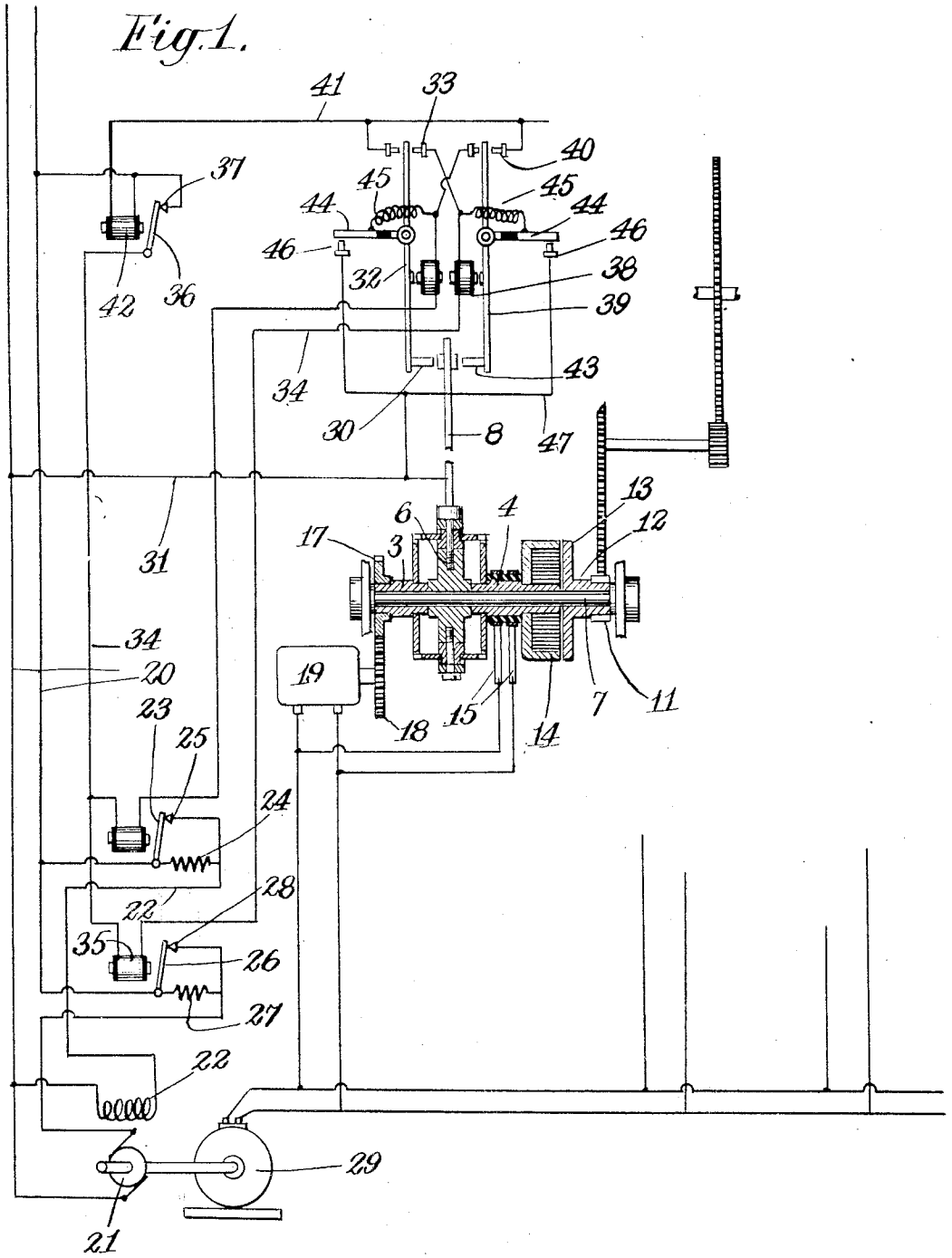
APPLICATION FILED JUNE 22, 1918.

1,310,781.

Patented July 22, 1919.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

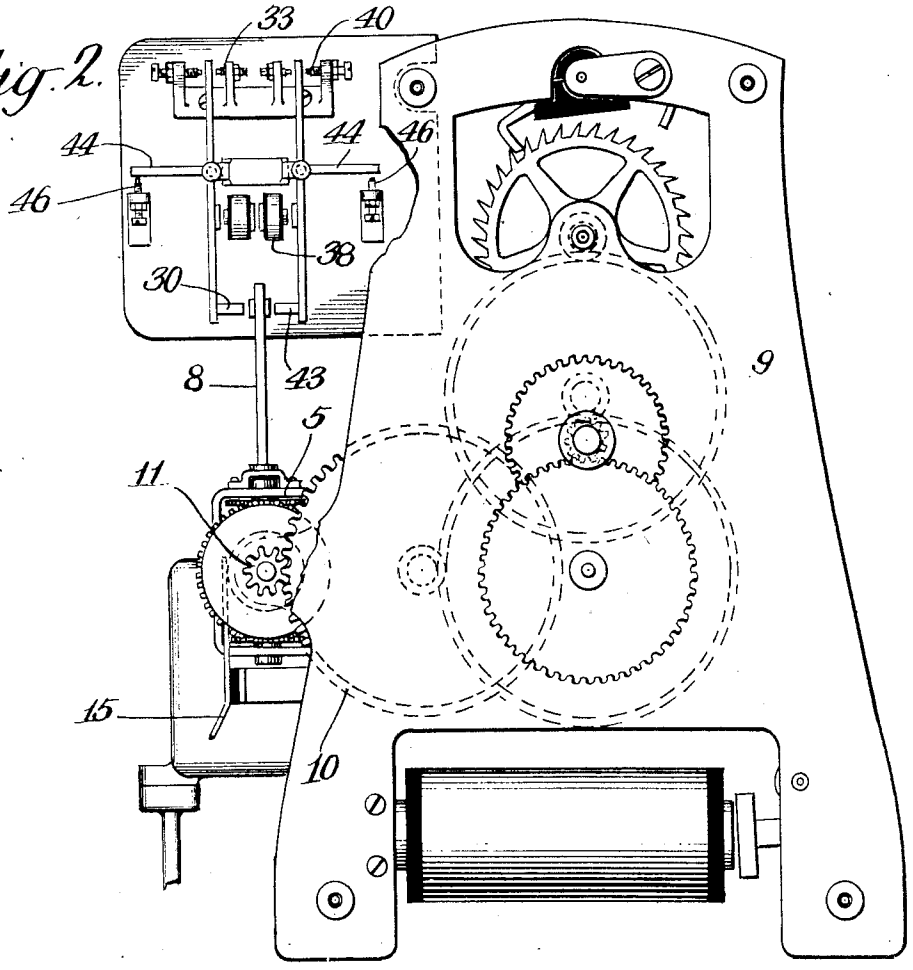
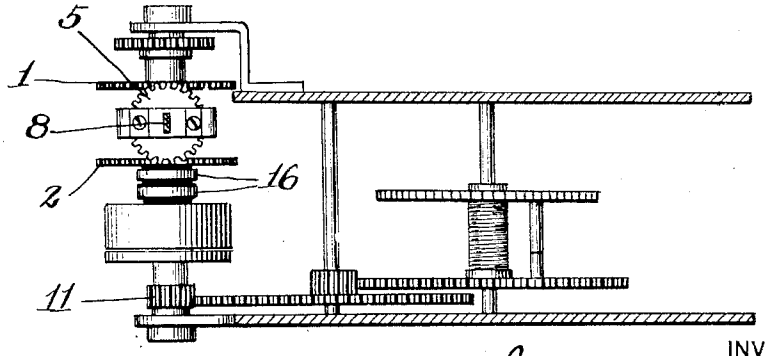


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

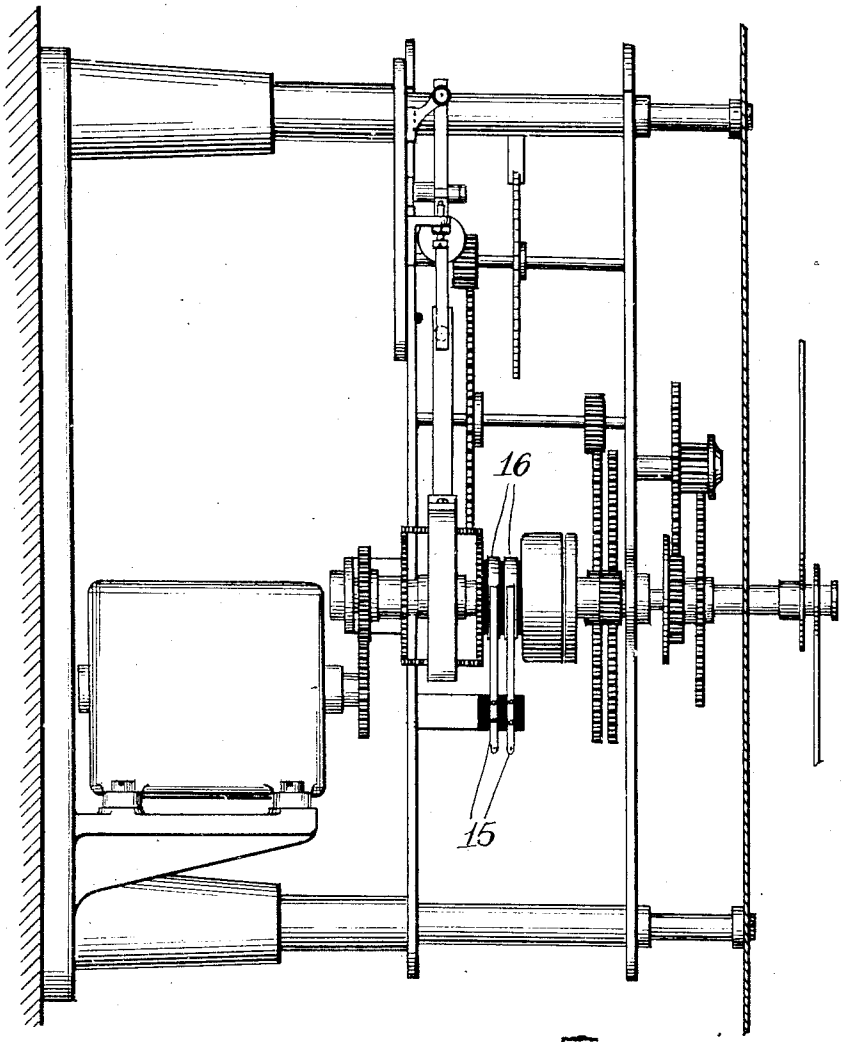


Fig. 5.

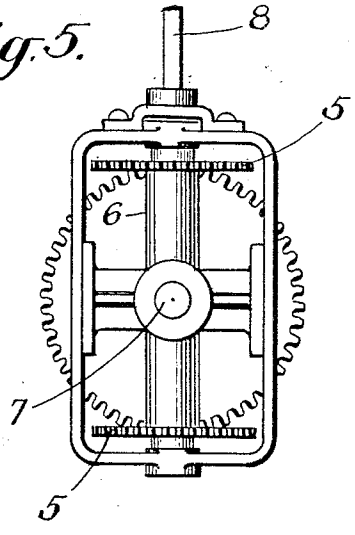
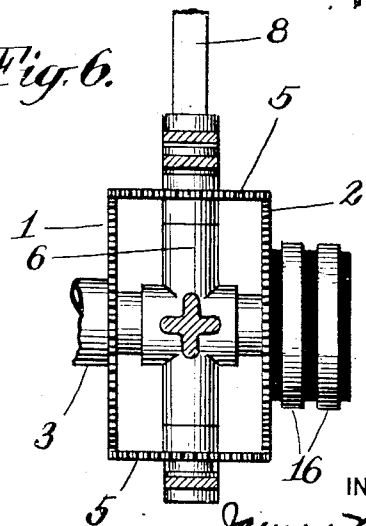


Fig. 6.



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UNITED STATES PATENT OFFICE.

JAMES W. BRYCE, OF BINGHAMTON, NEW YORK, ASSIGNOR TO INTERNATIONAL TIME RECORDING COMPANY OF NEW YORK, A CORPORATION OF NEW YORK.

SYNCHRONOUS CLOCK SYSTEM.

1,310,781. Specification of Letters Patent. **Patented July 22, 1919.**

Application filed June 22, 1918. Serial No. 241,357.

To all whom it may concern:

Be it known that I, JAMES W. BRYCE, a citizen of the United States, residing at Binghamton, in the county of Broome and State of New York, have invented certain new and useful Improvements in Synchronous Clock Systems, of which the following is a full, clear, and exact description.

The invention, subject of this application for Letters Patent, is an improvement in synchronizing clock systems for use in time recording and similar operations, and is designed to meet certain conditions which are encountered in the practical use of the same and which interfere with or impair their efficiency.

In explanation it may be stated that in a large manufacturing plant there may be a plurality of recording mechanisms for printing or impressing cards with the starting and finishing time of the jobs which the workmen are called upon to perform, and that each requires a clock mechanism which, to be of any value, must keep correct time. To secure this result I employ a master clock, the driving mechanism of which is run either electrically from a constant source, by a spring or by a weight, and in conjunction therewith I employ a synchronous alternating current motor and generator, the latter of which is run by a direct current motor deriving its energy from any available source such as an ordinary municipal power or lighting circuit.

The problem involved is to run the alternating current generator at a constant and fixed speed, so that its alternations may be transmitted either to synchronous motors at each recording device or other means for utilizing the alternations, and there used to run the clocks not only at the same rate, but at a rate which will be exactly that of the master clock. If the direct current from the main source were absolutely uniform, the accomplishment of this result would not be attended by any serious difficulty, but such currents are subject to constant changes in value, with the result that the direct current motor which drives the alternating generator is subject to constant changes in speed, which, of course, means that the rate of alternations is likewise subject to corresponding change.

To avoid this the synchronous motor drives in the master clock one side of a differential gear at a rate dependent upon the frequency of the alternations. The clock mechanism drives the other side of such differential, and so long as both driving means are the same in result no change takes place, but should the motor driven side of the differential run faster or slower than that of the clock then, by the means hereinafter to be described, one or another circuit is closed that throws resistance into the armature circuit, or weakens the field magnetization, or in any other known way influences the direct current motor causing it to run either slower or faster, as the case may be, so as to drive the alternating current generator at a more exactly uniform rate.

In the drawings hereto annexed I have illustrated the master clock only, showing merely the circuit running from the alternating current generator, with branches to the recording devices. The latter are not shown, because any well known form of instrument having time indicating disks from which impressions may be taken can be operated either by synchronous motors or by the alternations from the generator in any well understood and usual manner. The invention, in other words, is not concerned with the recording devices, nor with the special manner in which these may be operated, but with the production and supply for running them of an alternating current of a fixed and uniform rate of frequency.

For this purpose Figure 1 is a diagram illustrating the system, more particularly the master clock and its relation thereto. In this figure the differential is shown, not in its true position (which is in a vertical plane at right angles to the position shown in the figure), but in longitudinal section in the vertical plane of the axis of the central shaft 7 of the movement, this being for the purpose of better illustrating certain structural features of the movement as well as certain circuit and contact arrangements.

Fig. 2 is a front view in elevation of the master clock.

Fig. 3 is a horizontal sectional view of the same immediately above the differential.

Fig. 4 is a side view in elevation of the master clock, and

Figs. 5 and 6 are details of the differential.

The differential is a well known device and in itself is not new. It comprises two

gears, 1 and 2, on sleeves 3 and 4, which are connected across at top or bottom or both by gears 5. The latter are fixed to a vertical hub 6, on the central shaft 7, which carries also the sleeves 3 and 4, and extending from said hub is a contact arm 8.

It is sufficient for present purposes to point out that if the gears 1 and 2 rotate at exactly the same speed the hub and contact arm remain stationary, but should one of said gears rotate at a faster or slower rate than the other, then the hub will be moved about the spindle or shaft 7.

Referring to Figs. 2 to 4, the clock mechanism 9, driven as above intimated by any suitable means, has a gear member 10, which engages with a pinion 11 on a sleeve 12 on the spindle 7 and rotates the sleeve at a uniform and fixed rate. Intermediate to a disk 13 on sleeve 12 and the gear wheel 2 is a magnetic clutch 14, which is adapted to be energized by a current secured through brushes 15, bearing on contact rings 16, and to thereby connect the clock driving mechanism with one side of the differential.

On the sleeve 3 is a pinion 17, which is engaged by a gear 18, driven by a small synchronous motor 19, which, when supplied with current, rotates the other side of the differential. The above described mechanism is substantially all that is required in the device except such means as are required for controlling and utilizing the currents.

Referring to Fig. 1, the wires 20 are assumed to run from any source of direct current, it being assumed in this case that an alternating current source is not available. Connected with this circuit is a direct current motor 21, the shunt field circuit being represented by 22. This circuit contains a circuit controller 23, and a resistance 24 around the contact 25 of said controller. The main or armature circuit also contains a controller 26, and has a resistance 27 around the same and its contact 28. The nature of the other devices employed will be understood most readily from the following description of operation:

The direct current motor 21 drives an alternating current generator 29, and the current therefrom is led to the synchronous motor 19. If the direct current is of the proper strength and uniform, this motor 19 drives its half of the differential at the same rate of speed as the clock drives the other half, and no action results, but should the motor 21 vary its speed then a corresponding variation in the speed of the gear 1 results with a consequent movement of the contact arm 8. Let it be assumed although its true movement is not illustrated in the drawings, which are largely diagrammatic, that the arm 8 is moved by the differential between the two contacts 30 and 43, and that it is moved thereby into engagement with contact 30. As a result current flows from one wire of the circuit 20 by a suitable connection 31 to the arm 8, thence by contact 30 through the pivoted lever 32 to a stop 33, and through a wire 34 including a magnet 35, and to a circuit controller 36, and stop 37, to the other wire of the supply circuit 20.

The magnet 35 being thus energized operates the controller 26 and throws the resistance 27 into the armature circuit, and thus brings about the correction in the speed of the motor thereby called for, that is to slow it down.

In the circuit of wire 34, is an electromagnet 38, which under the conditions just described becomes energized and attracts a lever 39 similar to lever 32 over onto stop 40 connected by wire 41, including a magnet 42 with one of the line wires 20. At this moment the lever 8 is in contact with the stop 30 and the range of movement of the lever 39 is not sufficient to bring it into contact with the arm 8. The conditions established by the contact of arm 8 and stop 30 continue until the motor 21 has slowed down and the gear 1 rotates at the same speed as gear 2. The arm 8 therefore moves over to the right to neutral position and comes in contact with the stop 43 on lever 39. This establishes the circuit from the main through magnet 42, wire 41, stop 40, lever 39, and arm 8, back to line. The circuit controller 36 is thereby operated to break the circuit through the magnet 35, and in order that all sparking may be confined to the point of separation of the controller 36 and stop 37, the following arrangement is provided:

The levers 32 and 39 have arms 44 with insulated ends to which lead wire connections 45. The wire 34, for example, is always connected with the right hand arm 44. Under the arms 44 are contact stops 46, connected by wire 47 with the side of the main circuit with which the arm 8 is connected. Hence when, for example, the lever 39 is shifted by magnet 38, its arm 44 is brought in contact with its stop 46, and the circuit is maintained from one side of the main through wire 47, and back through wire 34 to line even after the contact between the arm 8 and the stop 30 has been broken.

The description of the operation given above will make it clear that a similar action takes place when the motor 21 runs too slow and the arm 8 is shifted onto contact 43, and it will be seen that the function of the apparatus is to keep the alternating current generator 29 running at exactly constant speed. This accomplished, its alternations having a perfectly uniform rate may be used to move the hands and other mechanism of a plurality of secondary clocks, recording mechanisms or the like.

It will be observed that when no current is driving the motor 21, no current is fur-

nished by the generator 29, and hence the magnetic clutch disconnects the master clock from the differential.

The invention does not reside in details of mechanism, and any means that will secure the same results or perform similar functions may be employed.

What I claim is:—

1. In a system of the kind described the combination with a source of continuous current, of a direct current motor operated thereby; means for varying its speed of rotation; an alternating current generator driven by said motor; a synchronous motor operated by said generator; a master clock; a differential operated by the clock on the one hand and the synchronous motor on the other hand; circuits and circuit connections therein controlled by the operation of the differential due to variations in the relative speed of the master clock and the synchronous motor; and means included in the thus-controlled circuits for controlling the speed varying devices of the direct current motor whereby the speed of the latter may be maintained uniform, as and for the purposes stated.

2. A combination of elements such as specified in claim 1 in which the circuits and circuit connections are arranged to confine all final interruptions of current to a point outside of the controlling apparatus.

In testimony whereof I hereunto affix my signature.

JAMES W. BRYCE.