

Sept. 7, 1926.

1,598,595.

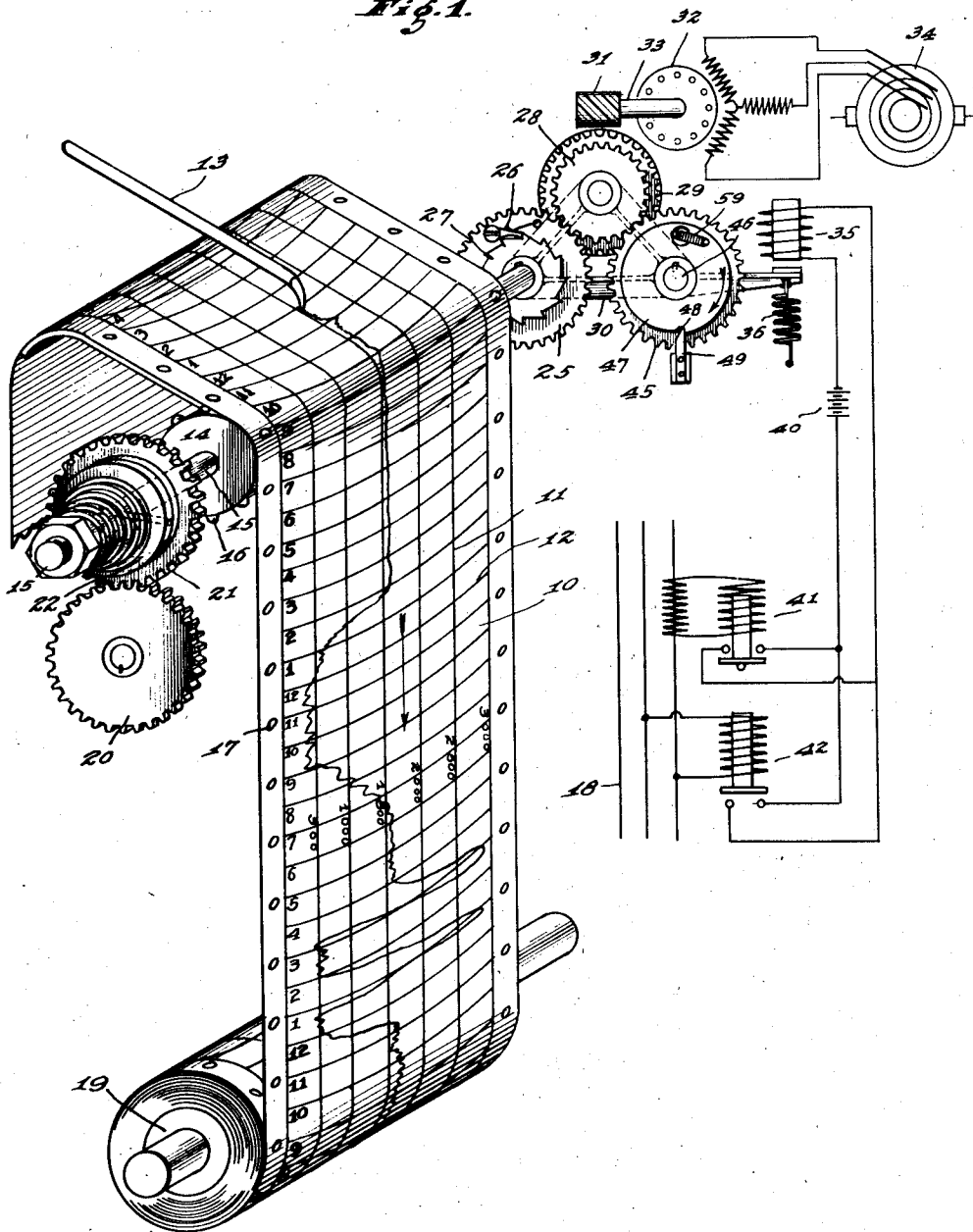
D. J. ANGUS

RECORDING METER

Filed March 19, 1926

2 Sheets-Sheet 1

Fig. 1.



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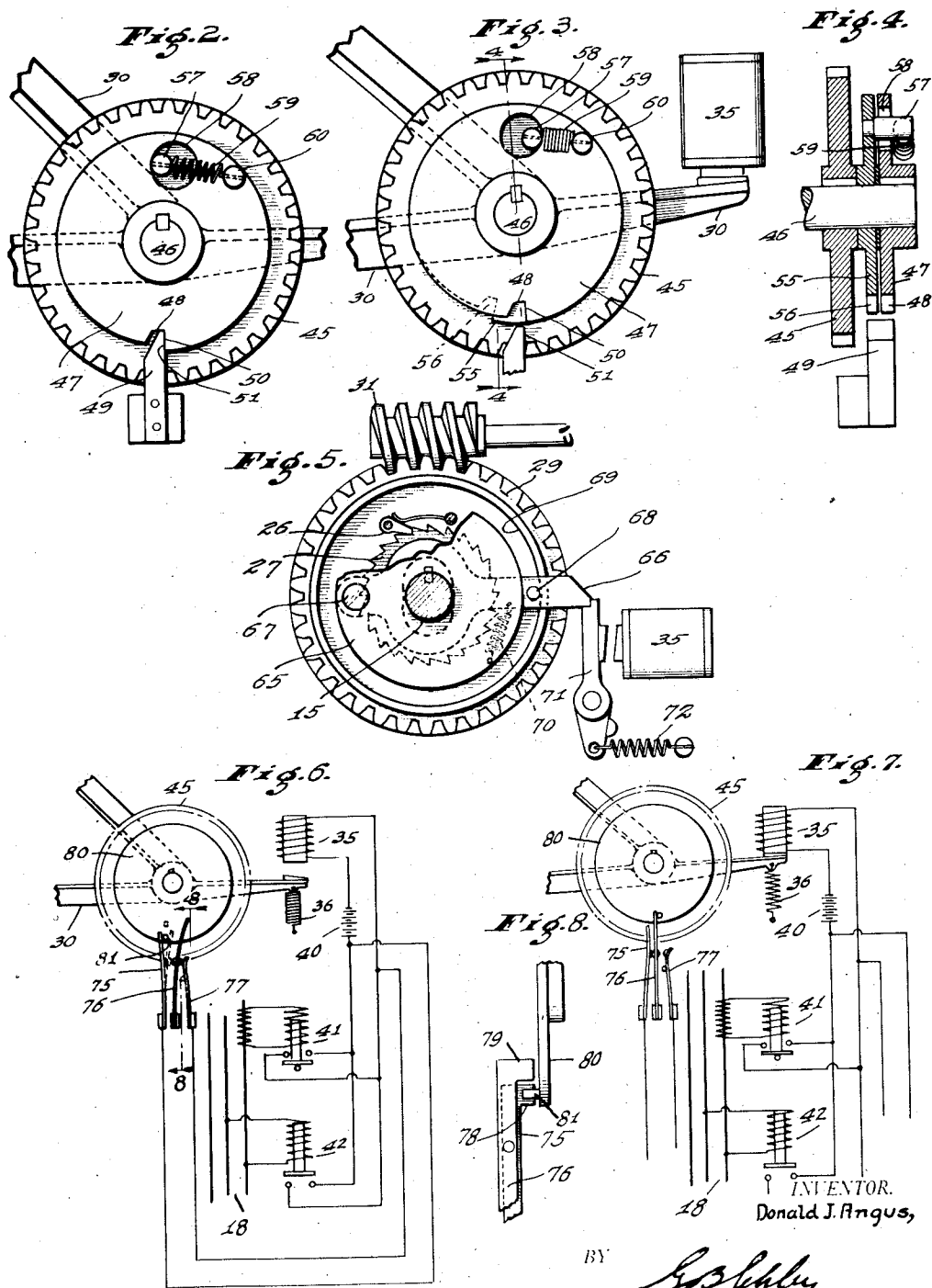
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RECORDING METER

Filed March 19, 1926

2 Sheets-Sheet 2



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RECORDING METER.

Application filed March 19, 1926. Serial No. 95,826.

In the ordinary operation of graphic meters, an entirely adequate record may be obtained on a slow-moving chart; for the variations from second to second, or even from minute to minute, are ordinarily of comparatively slight import.

In emergencies, however, especially, in the larger electric supply systems in which many stations and generators are interconnected, what happens from second to second, or even in fractions of seconds, becomes extremely important; and the things which happen in the very beginning of the emergency, and especially during the first small fraction of the first second, are often of the greatest importance. The detail of such happenings which occur within a few seconds is completely lost in the record on the ordinary slow-moving chart; and it is information regarding such detail, and especially regarding the detail of the happenings in the first fraction of the first second, that is frequently most desired.

In my prior Patent No. 1,545,078, granted July 7, 1925, I have described a graphic meter in which the chart ordinarily operates at a desired slow speed; but in which upon the occurrence of an emergency the chart starts at once to operate at a predetermined higher speed, to give in minute detail the record of what occurs during the emergency.

The apparatus shown in that patent is very effective. It is found, however, that there are some emergencies which are of such short duration that they are over before the chart, with that apparatus modified, has been driven at high speed sufficiently far to enable the high-speed drive to remain effective for the desired predetermined time; so that upon such exceedingly short emergencies the chart-drive drops back almost at once to low speed and the desired detail record is not secured. This is because, with the unmodified apparatus that patent shows, the chart must have moved a certain distance at the high speed before the emergency ceases in order to permit the high-speed drive to continue for the desired predetermined period.

It is the object of my present invention to provide a meter which in general operates in the manner of the meter set forth in my aforesaid prior patent; but which upon a shift of the chart-drive from low speed to

high speed upon the occurrence of an emergency acts independently of any prerequisite high-speed movement to prevent such chart-drive from returning to low speed until after the chart has had a predetermined movement at high speed, even though the emergency is of too short duration to maintain such shift in chart-drive effective for the desired predetermined turn with the unmodified apparatus shown in my aforesaid prior patent. That is, it is my object to effect the change from low speed to high speed, not only in minimum time so that the chart will be moving at the high speed very early in the first second of the emergency, but without possibility of interrupting the high-speed drive and destroying the high-speed record until the desired predetermined movement at high-speed has been accomplished.

The accompanying drawings illustrate my invention: Fig. 1 is a semi-diagrammatic view of a meter chart with both the normal or low-speed driving mechanism and an emergency or high-speed driving mechanism arranged in accordance with a preferred embodiment of my invention and applied to an electrical distribution; Fig. 2 is a fragmentary detail of the stop mechanism of the high-speed drive of Fig. 1, showing such high-speed drive in stopped position; Fig. 3 is a fragmentary view similar to Fig. 2, but showing the high-speed drive at the moment of release at the start of the high-speed operation; Fig. 4 is a section on the line 4—4 of Fig. 3; Fig. 5 is a fragmentary view of a modified form of high-speed drive, with some of the parts broken away in order better to show those behind; Fig. 6 is a fragmentary and diagrammatic view of another form of control for the high-speed drive, with the parts in the position they have during the low-speed operation of the chart, or with the high-speed drive ineffective; Fig. 7 is a view similar to Fig. 6, but with the parts in the position they occupy just as the high-speed operation is about to stop; and Fig. 8 is a fragmentary section, substantially on the line 8—8 of Fig. 6.

The chart 10 may be the chart of any graphic meter; and usually has longitudinal lines 11 indicating values of the quantity the meter measures, and transverse lines 12, usually arcs, indicating time. The rec-

ord is made by moving the chart beneath a pen 13, which makes a graph on the chart. The chart 10 is shown as suitably driven by a roller 14 on a shaft 15; which roller has radially projecting pins 16 for meshing with holes 17 along the edges of the chart. After passing the roller 14, the chart is wound up on a wind-up roller 19. The details of how the chart is driven from the shaft 15, how the wind-up roll 19 is operated, and how the pen 13 is operated under the control of the conditions to which the meter is responsive, may be anything desired, depending upon the type of meter used and the thing which the meter is to record. As shown, the meter is assumed to be an electric meter, associated in any suitable way with a supply circuit 18; but it is not necessary to my invention that the meter be an electric meter, or that it be associated with any particular way with the supply-circuit 18 if it is an electric meter.

The shaft 15, which is the driving shaft for the chart 10, has two driving mechanisms. One of these is the normal driving mechanism, for operating the chart 10 at low speed; and may consist of a conventional clock-work mechanism, indicated by a gear 20, driving a gear 21 loose on the shaft 15 but associated with such shaft by a suitable clutch which will permit the shaft 15 and roller 14 to move forward at high speed without corresponding high-speed movement of the gear 21. Such clutch may take any suitable form; but instead of the pawl-and-ratchet overrunning clutch shown in my aforesaid prior patent, although that or any other suitable form of overrunning clutch may be used, the form I now prefer is a simple friction clutch 22 of which the friction is sufficiently greater not to let the clutch slip when the drive of the shaft 15 is from the gear 21 at low speed but sufficiently small to let the clutch slip when the high-speed drive is in operation. The nature of the normal driving mechanism is immaterial, and the clock-work mechanism is mentioned and indicated only because it is a simple and ordinary driving mechanism for meter charts.

The other driving mechanism for the chart-moving shaft 15 is the emergency driving mechanism, for driving the shaft 15 at high speed. For this, in the preferred form in which I have illustrated my invention in Fig. 1, the shaft 15 has loose thereon a gear 25; which, like the gear 21, is connectible to the shaft 15 by a suitable overrunning clutch, here shown, as a pawl 26 carried by said gear 25 and engaging a ratchet wheel 27 fixed on said shaft. The gear 25 meshes with a pinion 28, which is fixed to a worm-wheel 29 to rotate therewith. The pinion 28 and worm-wheel 29 are carried by a frame 30 pivoted on the shaft

15, so that such frame and the parts carried thereby may be moved about the shaft 15 as a pivot without disturbing the meshing of the gear 25 with the pinion 28. The gear 25, pinion 28, and worm-wheel 29 are normally stationary. The worm-wheel 29 is one member of a normally open clutch, the other member of which is a constantly rotating worm 31. The worm 31 is desirably operated at substantially constant speed, continuously, so that it is always ready to start into action in moving the chart 10, without the necessity for any period of acceleration. While various mechanisms may be used for obtaining this continuous constant operation of the clutch-member or worm 31, I desirably obtain it by a continuously running motor 32, the shaft 33 of which carries the worm 31. Desirably the motor 32 for operating the worm 31 is supplied from a source of current separate from the main supply circuit 18, as from a special generator 34; so that such motor 32 will not be affected by what happens to the main supply-circuit 18.

The two clutch-members 29 and 31, as already stated, are normally out of mesh with each other; so that while the clutch-member 31 is continuously rotated at constant speed, the clutch-member 29 is normally stationary. These two clutch-members 29 and 31 are moved into mesh upon the occurrence of an emergency; as by an electro-magnet 35 acting on the frame 30 to tilt it and the parts it carries in a counter-clockwise direction to lift the worm-wheel or clutch member 29 into engagement with the worm or clutch-member 31. The frame 30 is normally spring-pressed in a clock-wise direction, as by a spring 36, to de-mesh the two clutch-members 29 and 31; but when the electro-magnet 35 is energized, it moves the frame 30 against the spring 36 to produce meshing of the two clutch-members. Upon such meshing of the two clutch-members 29 and 31, the worm-wheel 29, pinion 28, and the gear 25 are at once started into operation; and the movement of the gear 25 is faster than that of the gear 21, so that the overrunning clutch 26—27 takes hold and drives the shaft 15 at the desired higher speed, as permitted by the clutch 22 of the normal driving mechanism.

The electro-magnet 35 may be energized in response to any desired conditions. I shall not attempt to enumerate the various conditions to which it may respond. In the illustration shown, it is supplied from a suitable source of current 40, and is controlled by an overload relay 41 and a no-voltage relay 42 suitably associated with the main supply-circuit 18 to respond to current and voltage conditions therein. With these relays, the electro-magnet 35 is energized to cause the high-speed operation of the chart

10 upon the occurrence of an overload on the circuit 18 or upon failure of the voltage of such circuit.

In addition to means for causing the high-speed driving mechanism to drive the chart during the continuance of an emergency, I provide means for continuing such high-speed driving of the chart after the expiration of the emergency until the total time of high-speed driving is sufficient to produce a high-speed movement of the chart through a predetermined distance, desirably equal to an integral number of minutes, hours, or days of slow movement; and for doing this even though the emergency itself continues for such a small fraction of a second that the shift to the high-speed drive has hardly been completed. This may be done in a number of ways, of which I show three by way of illustration.

In each of these, the arrangement is such that if the emergency lasts long enough to shift to the high-speed drive—and that requires only a very small fraction of a second—it acts independently of any high-speed movement of the chart to prevent the immediate stopping of the high-speed operation. In all these illustrated forms of my invention, there is a quick-acting snap mechanism operated upon the shift to high-speed drive for preventing a shift back to low-speed drive until there has been a predetermined movement of the chart at the high speed; and a resetting of such quick-acting snap mechanism at the end of such predetermined movement.

In the arrangement shown in Figs. 1, 2, and 3, the frame 30 carries a gear 45 which meshes with the pinion 29, and which is therefore tilted when the frame is tilted. On the shaft 46 of the gear 45 there is fixed a disk 47, which has a peripheral notch 48 which co-operates with a fixed stop 49. The co-operating stopping faces 50 and 51 of the notch 48 and stop 49 are desirably substantially radial of the disk, in order to get a positive stopping at a definite position. These faces are in engagement when the stop 49 is in the notch 48 and the frame 30 is lowered, at which time the clutch members 29 and 31 are demeshed; but when the frame is raised to produce meshing of such clutch members, it is held raised with such clutch members meshed by reason of the riding of the unnotched remainder of the periphery of the disk 47 on the stop 49.

In order to prevent the disk 47, when it has once been raised, from dropping immediately back to lowered position before it has been moved far enough to produce disalignment of the stopping faces 50 and 51, if by any chance the emergency which arises is terminated that quickly, I provide a disk 55 which is loose on the shaft 46 and has a limited spring-pressed movement

thereon with respect to the disk 47. The disk 55 lies behind the disk 47, as shown in Figs. 1, 2, and 3; and both disks co-operate with the stop 49. The disk 55 is conveniently substantially like the disk 47, in size and peripheral shape; so that it has a notch 56 which is like the notch 48. To get the limited spring-pressed movement between the two disks, a pin 57 from the disk 55 projects through an arc-shaped slot 58 in the disk 47; and a tension spring 59 acts between such pin 57 and a pin 60 fixed on the disk 47, so that such spring 59 tends to draw the disk 55 in a clockwise direction (Figs. 1, 2, and 3,) with relation to the disk 47, and to move the two notches 48 and 56 out of registry, as is indicated in Fig. 3. With the two notches thus out of registry, the stop 49 is prevented from entering the notch 48, because an unnotched portion of the disk 55 lies over such notch 48 and rides on the end of the stop 49. On the other hand, when the disk 55 is moved in a counter-clockwise direction, from the position shown in Fig. 3 to the position shown in Figs. 1 and 2, and the spring 59 is therefore stretched, the notch 56 may be brought into registry with the notch 48. To permit the stop 49 to catch in the notch 56 and draw it in a counter-clockwise direction with respect to the disk 55—or rather to hold the disk 55 still while the disk 47 advances in a clockwise direction—the periphery of the disk 47 is cut away in a general spiral form for a sufficient distance in advance (clockwise) of the notch 48 so that such cut-away portion angularly overlaps the notch 56 when the two notches are displaced as indicated in Fig. 3.

The operation of the device as a whole is clear. So long as there is no emergency, the chart 10 is driven at low speed, by the clock-work mechanism 20 acting through the clutch 22. During this normal low-speed operation, the frame 30 is in its lowered position, shown in Fig. 1, because the stop 49 is in both notches 48 and 56; which notches are in registry because the disk 55 has been moved against the spring 56 to produce such registry. Therefore, the worm-wheel 29 is out of mesh with the constantly rotating worm 31, the gears 25, 28, and 45 are all at rest, and the overrunning clutch 26—27 merely permits the shaft 15 to turn under the driving force of the low-speed clock-work mechanism. The motor 32 and the worm or clutch-member 31, however, are in continuous operation at the desired speed, in readiness to produce the high-speed operation immediately when the emergency arises; so that upon the occurrence of the emergency no time will be lost for a period of acceleration of the motor 32 and the normally running parts associated therewith. These normally running parts,

including the motor 32, have a relatively high moment of inertia as compared with the gears 25, 28, and 45, the disks 47 and 55, the shaft 15, the chart 10, and the various parts moving with the shaft 15 and chart 10.

When the emergency arises, such as an overload to produce the closing of the relay 41 or a failure of voltage to produce a closing of the relay 42, the electro-magnet 35 is immediately energized. This electro-magnet at once lifts the frame 30, to shift the clutch-member 29 into engagement with the moving clutch-member 31. At the same time, the lifting of the frame separates the notches 48 and 56 from the stop 49. Immediately upon such separation, the spring 59 snaps the disk 55 in a clockwise direction with respect to the disk 47, or to the position indicated in Fig. 3, and thus in effect closes the notch 48 against the immediate re-entry of the stop 49 thereinto, even though the emergency ceases practically at once. This closing of the notch 48 is independent of any rotation of the disk 47. The engagement of the two clutch members 29 and 31, however, at once starts the gear 25 into motion, and the overrunning clutch 26—27 at once begins to drive the shaft 15 and chart 10 at high speed, while the now-slipping clutch 22 merely serves to permit the overrunning of the shaft 15. In other words, the high-speed drive takes the driving of the chart 10 away from the low-speed drive. By reason of having the motor 32 and the clutch-member 31 in continuous rotation, it becomes possible to start the high-speed drive of the chart much more promptly after the rise of the emergency than is otherwise possible.

The emergency usually lasts only a few seconds, and sometimes only a small fraction of a cycle. When the emergency ceases, the electro-magnet 35 releases the frame 30; but this ordinarily does not at once de-mesh the parts 29 and 31 because the peripheries of the disks 47 and 55 ride on the end of the stop 49 and prevent the frame 30 from dropping sufficiently to produce such demeshing. Thus the high-speed drive ordinarily continues for a while. However, when in such high-speed operation the notch 56 in the disk 55 next comes to the stop 49, the side of such notch catches on such stop, as it is permitted to do because of the cut-away part of the disk 47, and thus the forward or clockwise movement of the disk 55 is stopped. The forward movement of the disk 47 continues, however, the spring 59 stretching to permit it, until the notch 48 has come into registry with the notch 56. As the two notches then come into registry, to bring the stopping faces 50 and 51 in line and thus to open the notch 48, the frame 30 drops farther to de-mesh the clutch-members 29 and 31 and thus to stop the high-

speed drive. Thereupon the low-speed drive resumes its driving of the chart.

Thus the high-speed movement of the chart continues for a predetermined distance, or some multiple thereof. This may be any desired distance. Desirably, the gearing 25, 28, and 45 is so proportioned that the disk 47 makes one complete rotation for a travel distance of the chart equal to one day's normal travel. This is a very desirable proportioning, as it permits the high-speed movement of the chart to continue for a distance equal to some integral number of days of normal chart-travel, so that at the end of the emergency the pen 13 will be at the same hour and minute on the chart that it occupied at the time the emergency started, though one or more days later on the chart. With that arrangement, at the end of the emergency the meter will resume its normal low-speed recording operation at a chart-indication corresponding to the actual time of day, and the normal record may be obtained from the chart at the proper hour and minute indications by merely skipping that part of the chart which has made the high-speed record of the emergency. The time required for the emergency or high-speed travel is negligible on the chart at the low-speed travel.

The ratio between the high-speed and the low-speed movement of the chart may be made anything desired, by suitably proportioning the gearing and suitably choosing the speed of the motor 32. While other relations may be used, as set forth in my aforesaid prior patent, the one I prefer is with the high-speed motion 3600 times as fast as the low-speed motion; so that the chart will travel the same distance in a second at the high speed as it does in an hour at the low speed. With this arrangement, the hour-lines 12 on the chart become indications of seconds during the emergency.

In the arrangement shown in Fig. 5, I have shown a modified high-speed drive. Here there is no meshing and demeshing of gears, but merely a clutching action.

The motor 32 drives the worm 31 as before, but this worm is here in constant mesh with the worm-wheel 29. This worm-wheel 29 is here shown as being directly but loosely mounted on the shaft 15, which drives the chart 10. On this shaft 15 there is also loosely mounted a member 65, which is intermediate in the power-train between the worm-wheel 29 and the shaft 15. Between the member 65 and the shaft 15 there is a suitable over-running clutch, such as the pawl-and-ratchet clutch 26—27 already described. (As is indicated by the cross-hatching of the carrying pins thereof, the pawl 26 and its operating spring are carried by the member 65 in front of them in the drawing, although that member is

broken away over such pawl and spring; and are not carried by the worm-wheel 29 which lies behind them in the drawing.) Between the member 65 and the worm-wheel 29 there is a friction clutch, which is ordinarily ineffective but is made effective when an emergency rises and remains effective for a predetermined time extending beyond the termination of the emergency.

This friction clutch may take various forms. I have illustrated it as an arm 66 which is pivotally mounted on the member 65 on a pivot axis 67 displaced from the axis of the shaft 15. This arm 66 extends from its pivot axis 67 across the axis of the shaft 15, and carries a pin 68 which co-operates with an annular rib 69 projecting from the face of the worm-wheel 29. The arm 66 is suitably slotted or notched around the shaft 15, so that such shaft will not interfere with the movement of the arm about its axis 67. Because of the eccentricity of the axis 67 with respect to the shaft-axis, the pin 68 is free from the rib 69 when the arm 66 lies diametrically of the worm-wheel 29; but the arm 66 is spring-pressed in a clockwise direction about its pivot pin 67 with respect to the member 65, by a tension spring 70, so that such spring tends to move the arm 66 out of such diametrical line and thus to force the pin 68 against the inner face of the annular rib 69 to lock the member 65 to the worm-wheel 29. The outer end of the arm 66 co-operates with a pivoted stop-arm 71, which is spring-pressed into the path of such outer end by a spring 72, but may be drawn out of such path by the magnet 35 already described.

When the magnet 35 is not energized, the stop-arm 71 engages the arm 66, and holds such arm in its diametrical position with respect to the worm-wheel 29, with the spring 70 stretched, so that the pin 68 is free from the rib 69 and in consequence the worm-wheel 29 rotates freely without moving the member 65. Under those conditions, the motor 32 and worm-wheel 29 run idly, without affecting the shaft 15, which shaft at that time is being driven by the low-speed drive. These are the normal operating conditions.

Upon the occurrence of an emergency which energizes the magnet 35, the stop arm 71 is drawn out of the path of the arm 66. At once the spring 70 swings the arm 66 about its pivot 67, to produce engagement of the pin 68 with the rib 69. Once the arm 66 has been released from the stop arm 71, it cannot be stoppably re-engaged thereby until the arm 66 has made at least one revolution. The spring-produced movement of the arm 66 just described thus in effect clutches the member 65 to the worm-wheel 21, through the pin 68 and rib 69, and the continued movement of the worm-wheel

29 thus causes the same movement of the member 65, which in turn acts through the overrunning clutch 26—27 to drive the shaft 15 and chart 10 at high speed and thus take the chart-drive away from the low-speed 70 driving mechanism.

When the emergency terminates, the stop arm 71 is released by the electro-magnet 35 and returns to its normal position in the path of the arm 66. The next time the arm 66 comes around, whether that is at the end of the first revolution or of some subsequent revolution in the high-speed drive, such arm 66 strikes the stop arm 71, and is stopped thereby. The worm-wheel 29, however, continues to rotate, and in consequence the arm 66 is swung backward about its pivot 67 to stretch the spring 70 and release the pin 68 from the rib 69, thus stopping the high-speed drive until the occurrence of the next emergency.

However, this stopping of the high-speed drive cannot occur after the occurrence of an emergency until the shaft 15 has made at least one revolution under the high-speed drive, no matter how short the emergency is, just so long as the emergency is of sufficient length to swing the stop-arm 71 out of the path of the arm 66; for immediately thereupon the spring 77 snaps the arm 66 forward, and such arm cannot be reset in clutch-releasing position until the shaft 15 has made at least one revolution.

In the arrangement shown in Figs. 6, 7, and 8, the clutch in the high-speed drive 100 is held in clutching position electro-magnetically, instead of mechanically as in the other arrangements. In this arrangement, the gearing is the same as is shown in Fig. 1, with the gears 25, 28, 29, and 45 carried by the tiltable frame 30, which is normally spring-pressed by a spring 36 to de-mesh the worm-wheel 29 from the constantly running worm 31 but may be lifted by an electro-magnet 35 to produce meshing of the worm-wheel 29 with the worm 21 to make the high-speed drive effective. Because these gears are all the same as is shown in detail in Figure 1, I have illustrated only the gear 45 and a fragment of the frame 30 in Figs. 6 and 7.

The electro-magnet 35 in the arrangement shown in Figs. 6 and 7, however, not only serve to hold up the frame 30 during the continuance of the emergency, but in addition holds such frame up after the termination of the emergency until the movement of the chart at high speed has continued for a predetermined time.

To this end, I provide three spring-contact members 75, 76, and 77, which together constitute a switch which is in shunt to the switches controlled by the overload relay 41 and the underload relay 42, so that the electro-magnet 35 will remain energized as

long as the switch 75—76—77 is closed. The wires leading to the last-named switch lead to the contacts 75 and 77, so that for the closing of the switch it is necessary that all three of the contacts be in contact with each other, and the switch will be open if the middle contact 76 is out of engagement with either of the two outer contacts 75 and 77. The free ends 78 and 79 of the two contacts 75 and 76 are bent towards a disk 80, which is fixed to the gear 45 to rotate therewith. The disk 80 carries a pin 81 which may cooperate with the bent end 79 of the switch arm 76 when the frame 30 is raised, and with the bent end 78 of the switch arm 75 when the frame 30 is lowered; but clears the bent end 79 when the frame 30 is lowered, and clears the bent end 78 when the frame is raised. That is, the two bent ends 78 and 79 are offset from each other, as is perhaps best shown in Fig. 8, so that the pin 81 will miss one of them if it strikes the other.

In normal operation, the parts are as shown in Fig. 6, with the frame 30 lowered and the chart being driven at low speed. At this time, the pin 81 lies against the bent end 78 of the spring-contact member 75, and holds that contact member out of engagement with the contact member 76; so that there is no circuit through the switch 75—76—77 even though the spring-contact member 76 is against the spring-contact member 77.

When an emergency occurs, such as an overload or a failure of voltage, the relays 41 or 42 closes the circuit of the electromagnet 35. That magnet at once lifts the frame 30, to put the high-speed drive into operation by meshing the worm-wheel 29 with the worm 31. This lifting of the frame 30 disengages the pin 81 from the bent end 78 of the spring-contact member 75, and such spring-contact member 75 at once springs into engagement with the intermediate spring-contact member 76, as is indicated in dotted lines in Fig. 6. This completes the circuit through the switch 75—76—77, to maintain the circuit of the electro-magnet 35 even though the circuit through the relay 41 or 42 is immediately broken.

Upon the meshing of the worm-wheel 29 with the worm 31, the high-speed drive starts into operation, to drive the chart at the desired high speed as already explained. When the disk 80 has about completed one revolution, the pin 81 carried thereby strikes the bent end 79 of the intermediate spring-contact member 76. This swings both contact members 75 and 76 towards the left, to separate the intermediate contact member 76 from the right-hand contact member 77, as is clear from Fig. 7. Fig. 7 shows this condition at the very moment it occurs, before the frame 30 has dropped, although the electro-magnet 35 is de-energized by this

opening of the switch 75—76—77 unless one of the relays 41 or 42 remains closed. If such relay remains closed, the pin 81 continues in its clockwise movement, and merely snaps past the spring-member 76, to permit the latter to return into contact with the member 77. However, if at the time the spring-contact member 76 is moved to the left (Fig. 7) the relays 41 and 42 are both open, the electro-magnet 35 is deenergized, so that it permits the frame 30 to drop to demesh the worm-wheel 29 from the worm 31 and thus stop the high-speed drive. As the frame 30 thus drops, the pin 81 drops below the bent end 79 of the intermediate spring-contact member 76, and lets such intermediate spring-contact member swing over towards the right into engagement with the spring-contact member 77, to the position shown in Fig. 6. However, while the pin 81 drops out of the path of the bent end 79 of the intermediate contact member 76, it drops into the path of the bent end 78 of the left-hand spring-contact member 75; and so prevents such left-hand spring-contact member 75 from springing over toward the right, and thus disengages it from the intermediate contact member 76. This leaves the parts in the position shown in Fig. 6, in which they were during the normal low-speed operation; and the parts remain in this position until the next emergency occurs.

I claim as my invention:—

1. In a graphic meter, the combination of a chart, a marking device for the chart, a low-speed driving mechanism for normally driving the chart, a high-speed driving mechanism for driving the chart at a higher speed, said high-speed driving mechanism being normally ineffective to drive the chart, and means controlled by the occurrence of an emergency for making said high-speed driving mechanism effective to drive the chart and for maintaining the high-speed drive effective immediately thereupon and continuously thereafter for a predetermined time independently of the cessation of the emergency meanwhile.

2. The combination set forth in claim 1, with the addition that said high-speed driving mechanism includes a continuously moving driving device.

3. In a graphic meter, the combination of a chart, a marking device for the chart, a low-speed driving mechanism for normally driving the chart, a high-speed driving mechanism for driving the chart at a higher speed, said high-speed driving mechanism containing a continuously moving driving device and a normally open clutch between said continuously moving driving device and said chart, and means including a snap-action device for closing said clutch on the occurrence of an emergency and maintaining such clutch closed immediately thereup-

on and continuously thereafter for a predetermined time regardless of the discontinuance of the emergency.

4. In a graphic meter, the combination of
 5 a chart, a marking device for the chart,
 a low-speed driving mechanism for normal-
 ly driving the chart, a high-speed driving
 mechanism for driving the chart at a higher
 speed, said high-speed driving mechanism
 10 containing a continuously moving driving
 device and a normally open clutch between
 said continuously moving driving device and
 said chart, and means for closing said clutch
 on the occurrence of an emergency and
 15 maintaining such clutch closed immediately
 thereupon and continuously thereafter for a
 predetermined time regardless of the dis-
 continuance of the emergency.

5. In a graphic meter, the combination
 20 of a chart, a marking device for the chart,
 a low-speed driving mechanism for normal-
 ly driving the chart, a high-speed driv-
 ing mechanism for driving the chart at a
 higher speed, said high-speed driving mech-
 25 anism including a continuously moving
 driving device and a normally open clutch
 between said continuously moving driving
 device and said chart, means for closing said
 clutch on the occurrence of an emergency,
 30 and a snap-action device for preventing the
 opening of said clutch following its clos-
 ing until a predetermined movement at high
 speed has been given the chart.

6. In a graphic meter, the combination
 35 of a chart, a marking device for the chart,
 a low-speed driving mechanism for normal-
 ly driving the chart, a high-speed driving
 mechanism for driving the chart at a higher
 speed, said high-speed driving mechanism

being normally ineffective to drive the chart, 40
 and means controlled by the occurrence of
 an emergency for making said high-speed
 driving mechanism effective to drive the
 chart, said means including a device acting
 independently of any prerequisite high- 45
 speed movement for maintaining the high-
 speed drive even though the emergency
 ceases.

7. The combination set forth in claim 6,
 with the addition of means whereby said 50
 maintaining device is automatically ren-
 dered ineffective after a time following the
 cessation of the emergency.

8. In a graphic meter, the combination of
 a chart, a marking device for the chart, a 55
 low-speed driving mechanism for normally
 driving the chart, a high-speed driving
 mechanism for driving the chart at a
 higher speed, said high-speed driving
 mechanism being normally ineffective to 60
 drive the chart, and means controlled by
 the occurrence of an emergency for mak-
 ing said high-speed driving mechanism ef-
 fective to drive the chart, said means includ-
 ing a spring-pressed member which is re- 65
 leased by the shift to the high-speed drive
 and acts upon such release to maintain such
 high-speed drive, and said means also in-
 cluding a member for resetting such spring-
 pressed device and stopping such high- 70
 speed drive at a time subsequent to the ces-
 sation of the emergency.

In witness whereof, I have hereunto set
 my hand at Indianapolis, Indiana, this 17th
 day of March, A. D. one thousand nine hun- 75
 dred and twenty-six.

DONALD JAMES ANGUS.