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RECORDING DEVICE

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Our invention relates to recording devices. More particularly it relates to a recording device in which a plurality of operations are recorded at substantially the same time by a single printer operating on a single sheet of recording paper.

We are aware that numerous recording instruments are in use. In most cases these recorders indicate the operation of a single device. In some instances a plurality of separably operated instruments record the operation of a plurality of devices on a single strip of paper. Our invention is to be distinguished from recorders of the prior art by the fact that a single printing device is arranged with a plurality of cam operated elements whereby the operation of a multiplicity of devices may be recorded on a series of separate tracks by a single printer. Our instrument, which will be more fully described in connection with the accompanying drawing which shows a schematic embodiment of our invention, may be used to simultaneously record a plurality of radio facsimile transmissions.

One of the objects of our invention is to provide means for recording the operation of a plurality of devices.

Another object is to provide means for separately indicating the operation of a plurality of devices on a single recording sheet by means of a single recording device.

A further object is to simultaneously operate a rotating helical member and a plurality of cam operated switches whereby the helical member is in effect divided into a plurality of operating portions corresponding to a plurality of recording tracks.

A still further object is to provide means for simultaneously recording, on a single recorder, a plurality of separate radio facsimile transmissions.

In the accompanying figure, a roll of recording paper 1 and a roll of carbon or transfer paper 3 are mounted on a suitable support 5. Springs or other suitable retarding means may be used to frictionally engage the rolls to prevent the paper from unwinding too rapidly. The carbon side of the sheet of roll 3 is placed next to the recording paper and the two papers are fed through the feed rolls 7, 9. The feed roll may be knurled or suitably coated with rubber to provide a positive means for uniformly feeding the two sheets of paper across the printing cylinder 11. The printing cylinder carries a single, raised, helical element 13. This helix is preferably a uniform spiral arranged so that a single turn is just completed around the circumference and

substantially within the length of the printing cylinder 11.

The shaft carrying the printing cylinder is extended to carry a plurality of cams 15. Each of the cams respectively operates one of the switches 17 whose circuit connections will be described below. The cams are arranged to engage the switch so that the "on" contact portion of each switch corresponds with a definite portion or angular position of the helical element 13. The several switches 17 are preferably arranged so that their contacts are completed in succession. The printing cylinder and cams are rotated by means of a motor 19, which may include reducing gears. The motor is preferably energized by an alternating current of constant frequency. If such power supply is available, we prefer to use a synchronous motor which is especially suitable for facsimile reproduction. This motor also drives a pulley 21 which is coupled by a reversed belt 23, or the like, to a pulley 25 which is in turn connected to the feed roll 7.

A printer motor 27 is suitably supported by brackets, which are not shown, so that the printer bar 29 on each downward stroke engages the carbon paper which in turn presses on the recording paper and helical member 13, at the point of intersection of 13 with the plane of the bar. The power for driving the printer motor is preferably derived through the following circuit connections:

Each of the switches 17, which may have their common terminals engaged by the cams, are connected to a lead 31. This lead is connected to the input circuit of an audio frequency generator represented by 33. This generator may be a thermionic oscillator, electromagnetic machine, or the like. The other input terminal to the generator is connected to the common lead of a plurality of devices 35 whose operations are to be recorded. The other terminal of the devices under test are each respectively connected to the remaining terminals of the cam operated switches 17.

By way of example, the devices under test may be the make and break contact of a thermostat, the make and break contacts of a bank of elevators or any plurality of devices which either have in themselves an electrically operated circuit or which may be arranged to include an off and on switch. The output of the audio frequency generator is connected to a suitable amplifier 37 whose power supply is represented by reference numeral 39. The output of the amplifier is connected to the printer motor 27.

Having described the essential elements of our invention, we shall now describe its mode of operation. It will be assumed that the power supply circuit of motor 19 has been completed and that the motor is driving the feed rolls and the cylinder carrying the helical member at a suitable rate of speed. While the speed of these members is not critical, we prefer to operate the feed rolls at a small fraction of the speed of the recording cylinder. This may be accomplished by properly selecting the reduction gears contained within motor 19. One of the gears may be used to suitably reduce the speed of the cylinder 11 and the other to affect a much greater reduction between the motor and pulley 21. Alternately, or in addition, the ratio of the diameters of pulleys 21 and 25 may be selected to provide suitable speed reduction for the feed rolls. It will be seen that the contacts of the several switches 17 are successively closed and opened by the operation of the cams 15. If the device under test is in operation and if its connected cam switch is in the "on" contact position, the completion of the circuit through or by the device under test will energize or complete the circuit of the audio frequency generator. The output of the generator will then be amplified by the amplifier 37. The amplified output operates the printer motor 27 to thereby drive the printer bar 29 up and down along the axis of the printer 11. On each downward stroke the printer bar will press the papers against the helical member 13 at the point at which the helical member intersects the plane of the printer bar. This will cause the carbon paper to leave an impression, or "dot", on the recording paper at that point, provided the device under test is in operation. If the device under test is not in operation, the audio frequency currents are not fed to the amplifier and the printer motor 27 does not operate. The recording paper nevertheless continues to traverse the recording cylinder. Since the device under test can only operate when the cam operated switch is closed it will be apparent that the printer motor can only leave the record on that portion of the helical member which corresponds to the closing of the cam switch.

The shape and size of each "dot" or impression made by the down-stroke of the printer bar is determined by the nature of the area of contact at the point of intersection of the lower surface of the printer bar and the surface of helical member 13. Helical member 13 may have a rounded surface, and since it intersects the plane of the printer bar at an appreciable angle the point of contact is quite small and may appear as a single "dot". Since the motion of the printing cylinder 11 and the paper 1 is small with respect to the frequency of vibration of the printer bar, adjacent points or "dots" may overlap and merge into a substantially uniform area. The angle that the transverse edge of this area makes with the edge of the paper depends on how far the paper travels during each revolution of helical member 13. Since for reasons of paper economy the paper travel is preferably very slow, the areas recorded appear to be substantially rectangular.

By offsetting the cams as shown the entire helical member can be divided into separately operating portions corresponding to the separate devices under test. If, for example, the devices under test are thermostatically controlled ovens the printed record will not only show relative periods when the ovens are being heated but it

will also show whether any of the thermostatically operated elements are erratic in their operation.

Inasmuch as the paper may be fed at a uniform rate which, by way of example, may be one inch per minute, it is not necessary to print a time interval scale. However, if exact time intervals are desired a timing device such as a clock operated switch 38 may be substituted for one of the devices under test. This clock operated switch will leave a uniform series of marks and spaces corresponding to the record 41 on the recording paper. It is obvious that these intervals may be equivalent to one or two minutes or any other suitable time scale. The operation of the other devices may be compared to the time scale if time intervals are the essence of the test in question. In many cases, we have found that the exact timing is not of prime importance but merely irregularities of operation are of interest. In the drawing, the tracks 43 parallel to the edges of the recording sheet are each a record of irregular operation. The track, 45, remote from the standard track, indicates regular operation.

Thus we have described a simple recording mechanism in which a single printing motor and a single recording sheet are used to simultaneously indicate the operation of a plurality of devices. It should be understood that while we do not limit our devices to any particular arrangement we have found that the audio frequency generator may be operated at a frequency of 1000 cycles. By using a frequency of this order the amplifier construction is very much simplified. It should also be understood that the plurality of cam operated switches permit the use of a single generator, amplifier and printer motor. If the generator can be operated at a high current level and controlled by the device under test, the amplifier is not essential. It should also be understood that instead of operating the printer motor by an alternating current it may be operated by direct current. We have found that the preferred form of alternating current operation prevents sticking of the printer motor. Instead of using carbon paper for recording it is within the skill of those familiar with this art to substitute an ink recording means. For example, an inked ribbon such as is used on a typewriter may be substituted for the roll of carbon paper, as shown in Fig. 6 of U. S. Patent No. 2,046,328, issued July 7, 1936, to E. E. Kleinschmidt et al.

We claim as our invention:

1. A recording system comprising a helical member, means for rotating said helical member, means for feeding a recording sheet across said helical member, a printer motor, a printer bar, means coupling said printer bar and printer motor, means for energizing said printer motor to thereby move said bar toward said helical member, and means including a plurality of cam operated devices for dividing said recording into a series of separate tracks substantially parallel to the sides of said sheet.

2. A recording system comprising a helical member, means for rotating said helical member, means for feeding a recording sheet across said helical member, a printer motor, a printer bar, a connection between said printer bar and said printer motor, means for energizing said motor whereby said bar is moved in the direction which will cause said sheet to engage said helical member, and record said engagement, a plurality of cams operated in synchronism with said

helical member, a plurality of switches operated by said cams and circuit connections for limiting the operation of said printer motor to intervals corresponding with the contacting periods of said switches.

5 3. A device for indicating the operation of a plurality of devices including in combination a helical member, a plurality of cam operated switches having off and on contacts, a plurality of cams for operating said switches, means for rotating said helical member and said cams, means for feeding a recording sheet over said helical member, and a movable printer bar and marking means for recording on said recording sheet the operation of said plurality of devices in accordance with the on contact of said switches.

4. A device of the character described including in combination a helical member, a plurality of cam operated switches having off and on contacts, cams having switch operating positions differentially spaced about the axis of the helical member for operating said switches, means for rotating said helical member and said cams, means for feeding a recording sheet over said helical member, a plurality of devices whose operation is to be recorded, means connecting each of said devices with different switches of said plurality, and a movable printer bar and marking means for recording on said recording sheet the operation of said plurality of devices in accordance with the on contact of said switches.

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