

April 25, 1961

F. M. BENDER
PRINT WHEEL STOP

2,981,178

Filed March 7, 1958

2 Sheets-Sheet 1

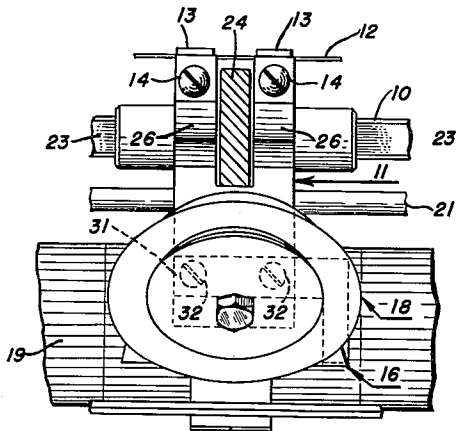


Fig-1

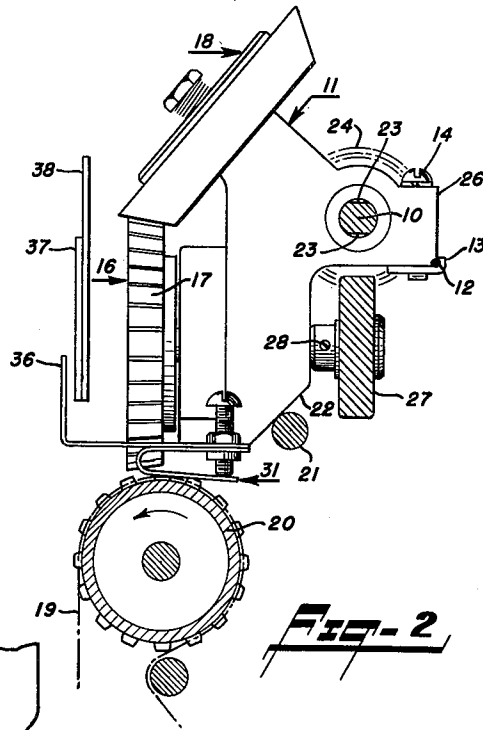


Fig-2

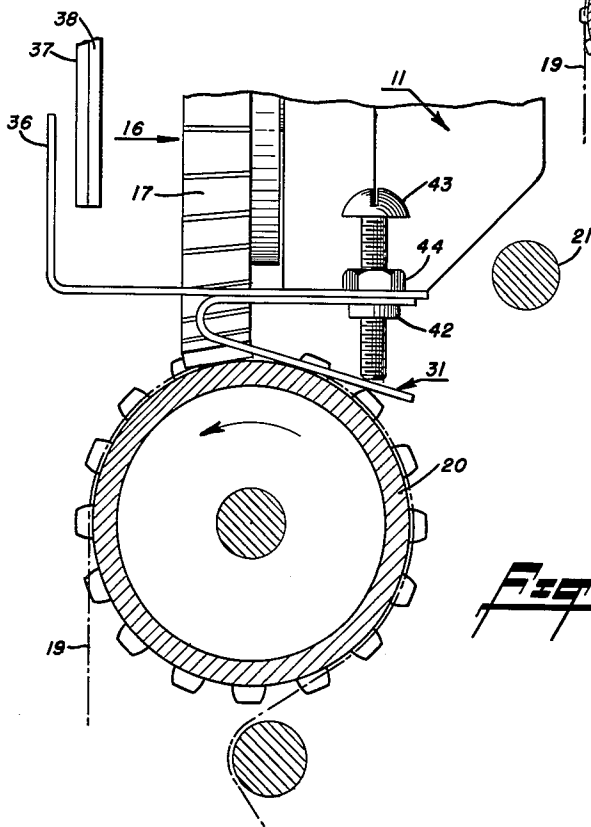


Fig-3

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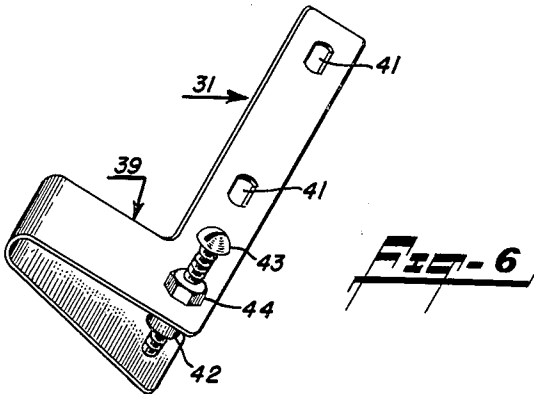
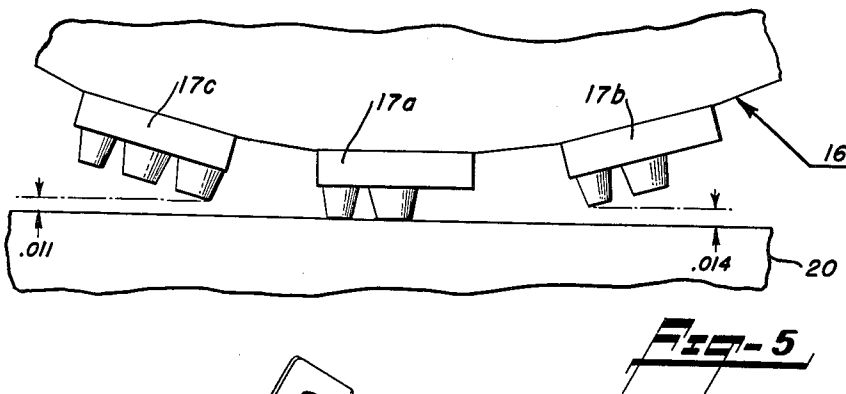
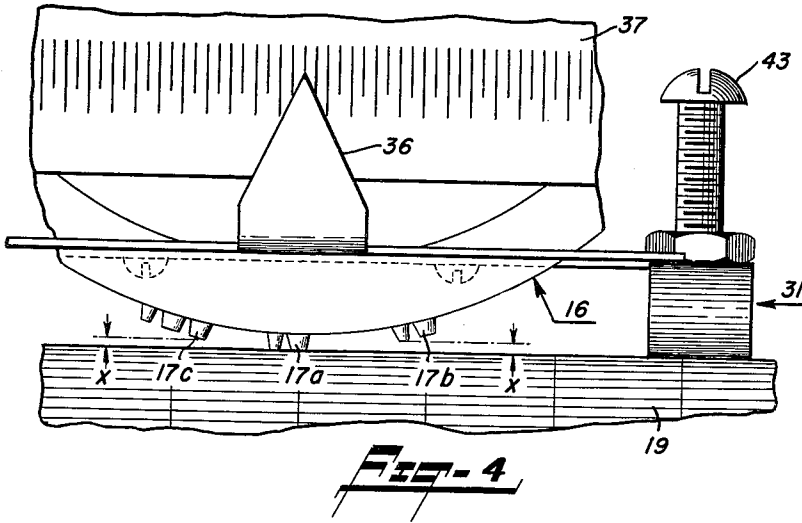
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2 Sheets-Sheet 2



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1

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PRINT WHEEL STOP

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Filed Mar. 7, 1958, Ser. No. 719,895

3 Claims. (Cl. 101—94)

This invention relates to a self-balancing type recording instrument and more particularly to an adjustable print wheel stop for a multiple point recorder.

In multiple point recorders, a printing mechanism is often used which includes a print wheel carriage having a print wheel rotatably supported thereon. The print wheel includes a plurality of printing characters at the periphery thereof. A chart upon which a record is to be made is positioned adjacent the print wheel carriage, and the printing characters are normally maintained out of recording engagement with the chart. The print wheel carriage is moved to a recording position corresponding to the value of a condition under measurement. (If the temperature is being measured, for example, thermocouples may be connected to the input of the instrument.) A printing operation is performed by bringing a printing character on the print wheel into engagement with the chart. Thereafter, the print wheel is raised off the chart, rotated to bring an adjacent printing character into proper position for a subsequent printing operation, and another thermocouple switched to the input of the instrument. Generally, a printing operation for each thermocouple input is either performed cyclically, or is performed substantially immediately following a balanced condition of the instrument. An ink wheel having one or more ink pads secured thereto is associated with the print wheel, and is rotatably supported on the print wheel carriage; the ink pad, or pads, being brought into engagement with the printing characters, or type, prior to the time each record is made.

Often, during the printing operation, when one of the printing characters on the print wheel is compressed upon being brought into engagement with the chart, the printing characters, or type, on the print wheel immediately adjacent the point being printed (that is, the printing characters either leading or lagging the point being printed in the printing cycle) also come into engagement with the chart. The resultant "side printing" which is inherent in many multiple point recorders results in a chart record which is difficult, if not impossible, to read, especially when the value of the various inputs are similar and are therefore printing relatively close together, if not directly superimposed. Side printing of multiple point recorders is substantially eliminated by the use of the adjustable print wheel stop of my invention, which may be attached to the print wheel carriage of the recorder. The stop is made of resilient material and contacts the chart during a portion of each printing cycle. The inertia of the moving print wheel during the printing operation is partially absorbed by the resilient stop member thereby reducing the force with which the printing character strikes the chart. In this manner, side printing of the printing characters adjacent the point being printed is minimized.

An object of this invention is the provision of a print wheel stop for use on multiple point recorders which stop member serves to minimize side printing which is inherent in many multiple point recorders.

2

An object of this invention is the provision of a print wheel stop for multiple point recorders for limiting the compression of the printing character, or type, engaging the chart during a print operation.

5 An object of this invention is the provision of a resilient print wheel stop for multiple point recorders for converting a portion of the kinetic energy of the moving print wheel to potential energy during the printing operations and, thereby, reducing the force or impact with which the printing character strikes the chart.

10 An object of this invention is the provision of an adjustable resilient print wheel stop for multiple point recorders which is attached to the print wheel carriage and which engages the chart during each printing operation to limit the contact pressure between printing character and chart.

15 These and other objects and advantages will become apparent from the following description when taken with the accompanying drawings. It will be understood that the drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for the latter purposes to the appended claims.

In the drawings wherein like reference characters denote like parts in the several views:

Figure 1 is a fragmentary top view of the recording mechanism of a multiple point recorder instrument;

Figure 2 is a fragmentary side view of the recording mechanism;

Figure 3 is an enlarged fragmentary side view showing the recording mechanism during a printing operation;

Figure 4 is an enlarged front view showing the recording mechanism during a printing operation;

Figure 5 is an enlarged front view showing the clearing between the chart driving drum and the leading and lagging type during a printing operation; and

Figure 6 is an enlarged perspective view of my novel adjustable resilient print wheel stop.

As is well known, a multiple point recorder is designed to receive a plurality of input variables, and through operation of its circuitry and mechanism, to automatically record on a chart the value of the condition under measurement. If temperature is to be measured, for example, a plurality of thermocouples are sequentially connected to the input terminals of the measuring circuit of the recorder, which measuring circuit is often of the potentiometric type. An error signal from the potentiometer circuit is fed into a balancing circuit which includes a converter for changing the D.-C. error signal to an A.-C. signal suitable for amplification by an A.-C. amplifier. The amplified A.-C. signal is used to drive a reversible motor, also in the balancing circuit. The reversible motor is driven in a direction to rebalance the potentiometer.

Upon actuation of the reversible motor, a print wheel carriage, having a print wheel rotatably supported thereon, is moved to a position above the chart corresponding to the temperature under measurement. A record is then made of this temperature by engagement of the print wheel with the chart. A different thermocouple is then connected to the input of the instrument and the print wheel carriage is moved to a position corresponding to this temperature and another record is made on the chart.

A complete disclosure of a recorder mechanism, including details of the printing mechanism which are not pertinent to the subject matter of the present application, is given in a co-pending patent application of Kurt E. Gronzenbach, Serial Number 667,812, filed June 25, 1957, and entitled Recording Instrument. For purposes of this disclosure, however, only fragmentary views of the recorder mechanism are necessary. Referring, then, to the

fragmentary top and side views of Figures 1 and 2, respectively, the recorder therein shown comprises a carriage supporting shaft 10 rotatably supported between a pair of side members, not shown in the drawings. A print wheel carriage 11 is rotatably and slidably supported upon the carriage supporting shaft 10. A cable 12 is attached to the print wheel carriage 11 by L-shaped clamp members 13, the cable being clamped between the carriage and clamp members upon tightening of bolts 14 extending through apertures in the carriage and threadedly engaging the clamp members. The cable is mechanically attached to the reversible motor in the balancing circuit (not shown). The motor, in addition, is mechanically connected to the movable arm of the potentiometer in the measuring circuit of the instrument. The motor is energized for rotation in one direction or the other to balance the potentiometric network and thereby shift the cable and attached print wheel carriage along the carriage shaft 10. When the potentiometric network is balanced, the motor is deenergized, and the print wheel carriage is located on the carriage shaft 10 at a position corresponding to the value of the condition under measurement.

A print wheel 16, having a plurality of printing characters, or type, 17 positioned on the edge thereof, and an ink wheel 18 are mounted upon the print carriage 11 for rotation about an axis disposed above and substantially normal to the axis of a suitable chart driving drum 20. A printed record of temperature is made by the print wheel upon a chart 19 driven by said driving drum 20. A constant speed chart drive motor, for example, may be used through suitable gearing to rotate the drum at a constant speed.

Periodically, or cyclically, when the potentiometer is balanced, a printing operation is performed by moving the print wheel into printing engagement with the chart. In the drawings, I have illustrated, by way of example, a gravity feed printing mechanism wherein the print wheel moves by action of gravity, into engagement with the chart during each printing operation. The print wheel carriage, and attached print wheel, are normally supported above the chart by operating means such as a rod 21. As best seen in Figure 2, the carriage 11 slidably engages the rod 21 along an inclined surface 22 of the carriage. Periodically, the rod is moved out of engagement with the carriage, and, because the center of gravity of the carriage and attached print and ink wheels is offset to the left of the shaft 10 (as seen in Figure 2), the carriage will pivot about the shaft into a printing position wherein a printing character on the print wheel engages the chart. Immediately following the printing operation, the carriage is raised again by the rod 21 to the normal position shown. On the return movement of the carriage, an indexing operation rotates the print wheel to bring a new printing character into recording position above the chart in preparation for a subsequent printing operation.

The specific manner in which the indexing operation is performed forms no part of my invention. For purposes of illustration, in the recorder shown in the drawings the indexing movement of the print wheel is effected by rotation of the carriage shaft 10. As seen in Figures 1 and 2, the shaft 10 is provided with a pair of flat portions 23. A gear 24 is positioned between parallel arm portions 26 forming a part of the carriage 11, and cooperates with a gear 27 on the end of a shaft 28, upon which shaft the printing wheel 16 is mounted. The rod 21, which supports the printing carriage 11 during the balancing function of the recorder is connected to the shaft 10 through suitable levers, gearing and ratchet and pawl mechanism whereby, upon return movement of the rod 21 to the normal carriage supporting position following a printing operation, the print wheel is rotated a desired amount, properly indexing the same.

Reference is now made also to Figure 3 of the drawings wherein there is shown an enlarged view of the recorder

mechanism with the printing wheel in engagement with the chart 19. As described above, each printing operation is performed by removing the rod 21 from the carriage supporting position shown in Figure 2 to a position displaced therefrom, as shown in Figure 3, whereupon gravity acts to bring the printing character into engagement with the chart. My novel print wheel stop, designated generally by the reference numeral 31, is shown secured to the print carriage, and engages the chart during the printing operation.

Reference is now made to the enlarged front views of Figures 4 and 5 wherein the multiple point recorder is shown at the time of a printing operation. In Figures 4 and 5, the printing characters, or type, 17 are provided with individual reference characters 17a, 17b and 17c, for clarity, which identify the digits 1, 2 and 24, respectively, on the print wheel 16; the digit member 1 being shown in contact with the chart 19, while the digit member 24 leads and the digit member 2 lags the same (for clockwise rotation of the print wheel as viewed in Figure 4). The printing characters are secured to the print wheel by gluing, cementing, or other suitable means. If the multiple point recorder is adapted to record twenty-four (24) separate inputs, twenty four (24) separate printing characters are secured to the periphery of the print wheel. Each printing character includes a small point for printing a dot or a plus to mark the value of the condition under measurement on the chart. Adjacent the point on each type is a reference character, comprising a numeral. For recording twenty four (24) different inputs, the type is provided with consecutive digits from 1 to 24 for individual identification of each point printed.

Under nominal conditions, the clearance, designated x in Figure 4, between the edges of the leading and lagging types 17b and 17c and the chart 19, ranges between .011 and .014 inch, as seen in Figure 5, for a print wheel with twenty-four (24) printing characters thereon and where as here the straight element of the chart engaged by the print wheel can be considered as tangent thereto. It will be understood, then, that with a variation in type thickness of $\pm .005$ inch, for example, and a menial variation in the print wheel eccentricity due to variations in cement thickness, the nominal clearance, x , may be substantially exhausted. In addition, with a printing mechanism which is dependent upon the kinetic energy or inertia of the print wheel mechanism, the actual compression of the type (in an instrument having compressible type made of vinyl plastic, or the like) is not constant, since the compression thereof will vary with the mass of the particular type digit, such as digit #1 contrasted with digit #24. Also, friction in the printing mechanism will effect the compression of the printing characters. Thus, it will be understood that, without my adjustable print wheel stop, side printing of the leading or lagging character (type 17b and 17c in Figures 4 and 5, for example) often occurs.

My novel adjustable print wheel stop 31 counteracts the above described conditions, thereby eliminating side printing. As best seen in Figure 1, the stop 31 is secured to the print wheel carriage 11 by screws 32 which threadedly engage tapped holes in the bottom of the print wheel carriage. It will be understood that the same screws 32 may be used to secure a pointer 36 to the print wheel carriage, the pointer 36 cooperating with a scale plate 37 suitably secured to the front panel 38 of the instrument, which pointer and scale provide a visual indication of the value of the condition under measurement.

Reference is now made to Figure 6 of the drawings wherein there is shown an enlarged isometric view of my novel adjustable print wheel stop 31. The stop comprises a generally L-shaped body member 39 formed from flat spring material and in which the foot portion of the L-shaped member is bent intermediate the ends thereof, in a generally parallel extending manner. A pair of mounting holes 41, 41 are formed in the leg portion of the body

through which the mounting screws 32 (shown in Figures 1 and 4) extend. An internally threaded hub member 42 is suitably secured to the body member 39 and rotatably supports an adjusting screw 43. A lock-nut 44 is provided to lock the screw at any desired position in the hub. The end of the adjusting screw 43 extends through the hub and abuts the free end of the bent foot portion of the body member 39. In the normal position of the body member 39, the opposite ends of the foot portion extend in substantially parallel relation. The body portion 39 of the stop member is made of a sheet of resilient or spring material, therefore, by turning the screw into the hub, the foot portion ends are spread in a diverging manner, and upon removal of the adjusting screw, they return to the substantially parallel position.

Although the function of the adjustable print wheel stop is apparent from the above description and drawings, a brief description thereof follows. As best seen in Figure 2, when the print wheel is in a non-printing position, the foot portion of the print wheel stop 31 is positioned a spaced distance from the chart 19. As viewed in Figures 2 and 3 the chart is driven by a counter-clockwise rotating chart drive drum 20. During the printing operation, when the rod 21 is moved out of supporting relation with the print wheel carriage 11, gravity will rotate the print wheel about the axis of the carriage supporting rod 10. As seen in Figure 3, the foot portion of the stop member between the bend therein and the point where it is engaged by the lower end of the screw 43, engages the chart tangentially of the chart drive drum 20. To avoid smearing of the printed characters by the adjustable stop, contact between the stop and chart lags the time axis of the chart relative to the print wheel type.

During the printing operation, as the print wheel moves toward printing engagement with the chart, by action of gravity, the foot portion of the resilient adjustable stop 31 engages the chart. The stop member engagement with the chart immediately precedes engagement of the printing character and chart. For this reason, a portion of the inertia or kinetic energy of the moving printing mechanism is absorbed by the flexing of the resilient stop member 31. The print character, or type, then contacts the chart in printing engagement, as flexing of the resilient stop member continues. With the adjustable stop taking up a portion of the inertia of the moving printing mechanism, contact pressure between the type 17 and chart 19 is reduced. By proper adjustment of the screw 43, every printing character in the cycle may be made to print without objectional side printing. The padding, or shaving of type to eliminate side printing, which was often resorted to in prior art arrangements, is not necessary with my novel adjustable resilient print wheel stop.

Although my novel resilient print wheel stop member is shown in a recorder utilizing a gravity-type printing mechanism, it will here be understood that other means may be used for initiating a printing operation. For example, the printing wheel may be positively driven, by a solenoid or other suitable means, a predetermined distance in the direction of the chart. Following the initial driving movement, the inertia of the moving mechanism serves to carry the printing wheel into engagement with the chart. It will be understood, then, that the adjustable print wheel stop of my invention may be applied to any multiple point recorder in which there is no rigid, or positive, linkage between the print wheel and print wheel ac-

tuating mechanism during the printing operation to force the printing character into closer engagement with the chart, or to positively limit the extent to which the printing character may move in the direction of the chart. The novel stop is particularly suited to printing mechanisms utilizing the inertia of a moving member to consummate the printing operation.

Having now described my invention in detail, in accordance with the patent statutes, various other changes and modifications will suggest themselves to those skilled in this art. It is intended that such changes and modifications shall fall within the spirit and scope of the invention as recited in the following claims.

I claim:

1. In a multipoint recorder of the type including a frame, a chart-supporting drum rotatably connected to said frame, a movable carriage connected to said frame for reciprocatory movement along an axis parallel to and at a higher elevation than the axis of rotation of said drum, said carriage being also pivotally movable about said axis of longitudinal movement and having its center of gravity displaced herefrom, a print wheel rotatably connected to said carriage for rotation about an axis lying in a plane normal to the axis of said drum, said print wheel having a plurality of closely-spaced printing characters disposed along the peripheral surface thereof, means rotating said print wheel to bring a selected printing character into a printing position relative to the drum, support means normally supporting said carriage in a pivotally elevated position over said drum, and means for periodically removing said support means from said carriage whereby said carriage will be pivoted by gravity downwardly toward said drum to cause the selected printing character thereon to contact said record-carrying drum; the improvement which comprises means reducing the kinetic energy of said carriage and printing wheel immediately prior to printing impact between said wheel and said drum as said carriage and said printing wheel pivotally fall by gravity in the printing direction toward said drum upon removal of said support means comprising a resilient member carried by said carriage and normally spaced from said drum, said resilient member being arranged to engage said drum prior to contact of said selected printing character therewith.

2. The invention as recited in claim 1 wherein said resilient member comprises a reversely-bent leaf spring having one end secured to the lower portion of said carrier and a free portion arranged for engagement with said drum.

3. The invention as defined in claim 2 and further including adjustable means limiting the flexing of the free portion of said leaf spring to a predetermined extent upon engagement of said free portion with said drum as said print wheel moves in the printing direction.

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