United States Patent

Solari

[15] **3,681,913**

[45] **Aug. 8, 1972**

[54] **CARRY-OVER MECHANISM WITH VARIABLE RATIOS**

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[22] Filed: **July 21, 1970**

[21] Appl. No.: **56,856**

[30] **Foreign Application Priority Data**

July 30, 1969 Italy.....60545 A/69

[52] **U.S. Cl.**.....**58/4**, 40/107

[51] **Int. Cl.**.....**G04b 19/24**

[58] **Field of Search**.....58/4–6, 58; 40/107

[56] **References Cited**

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[57] **ABSTRACT**

In a clock provided with means for indicating the days and the months, a carry-over mechanism is governed by a cam or similar element the movement of which is positively connected with the movement of the month indicating means, whereby the change-over mechanism is steadily in phase with both of said indicating means.

2 Claims, 5 Drawing Figures

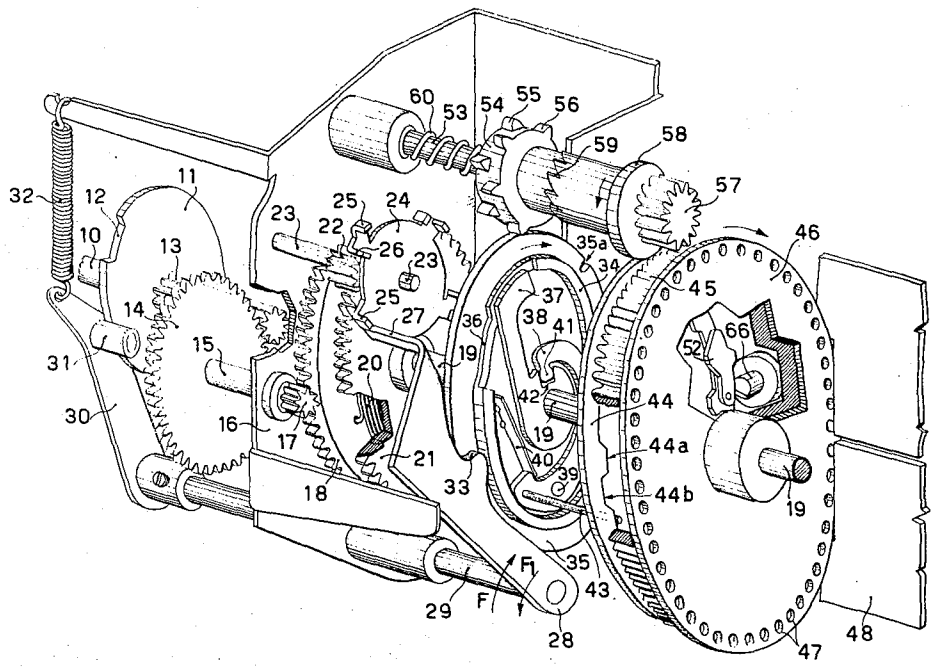

Fig. 5

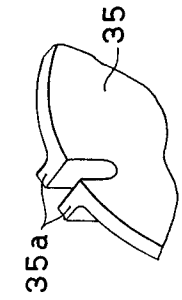

Fig. 1

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Fig. 3

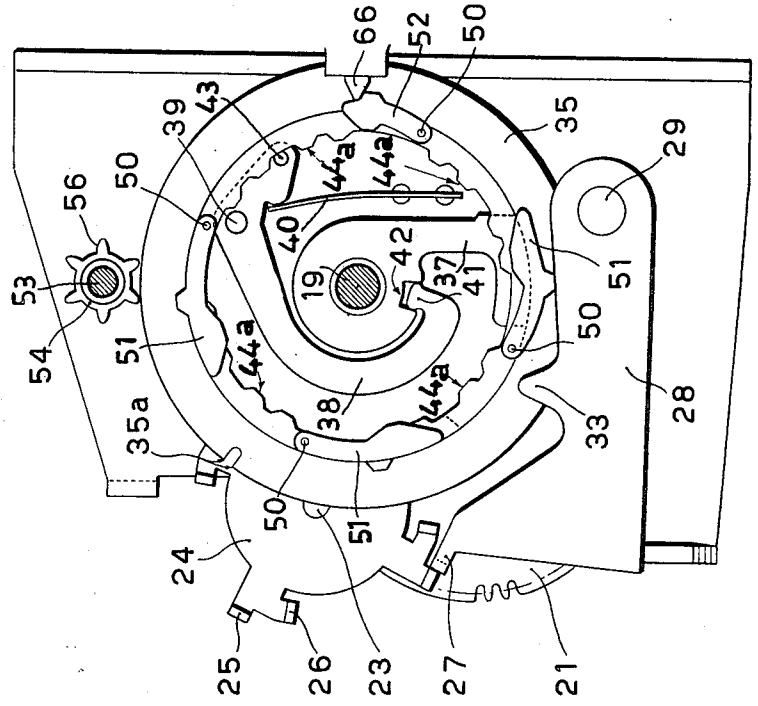

Fig. 2

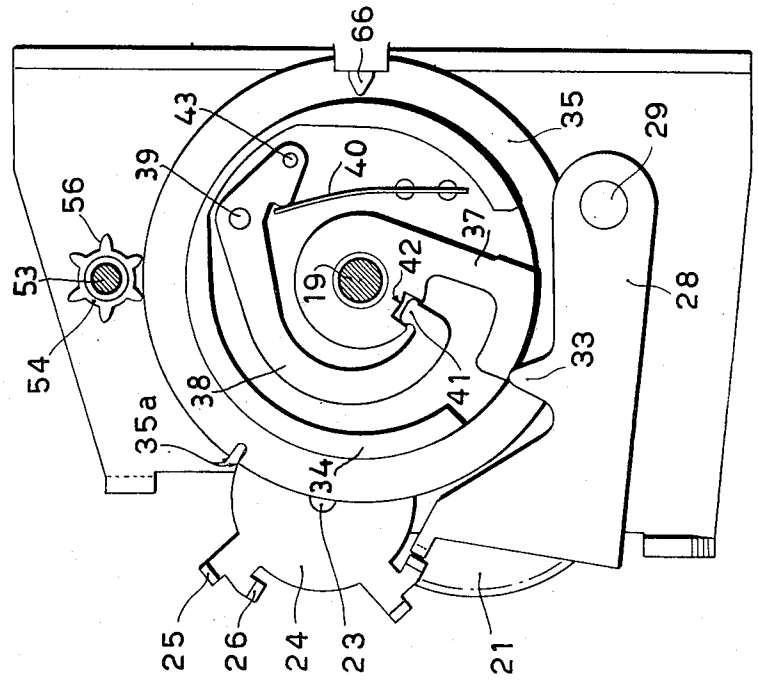

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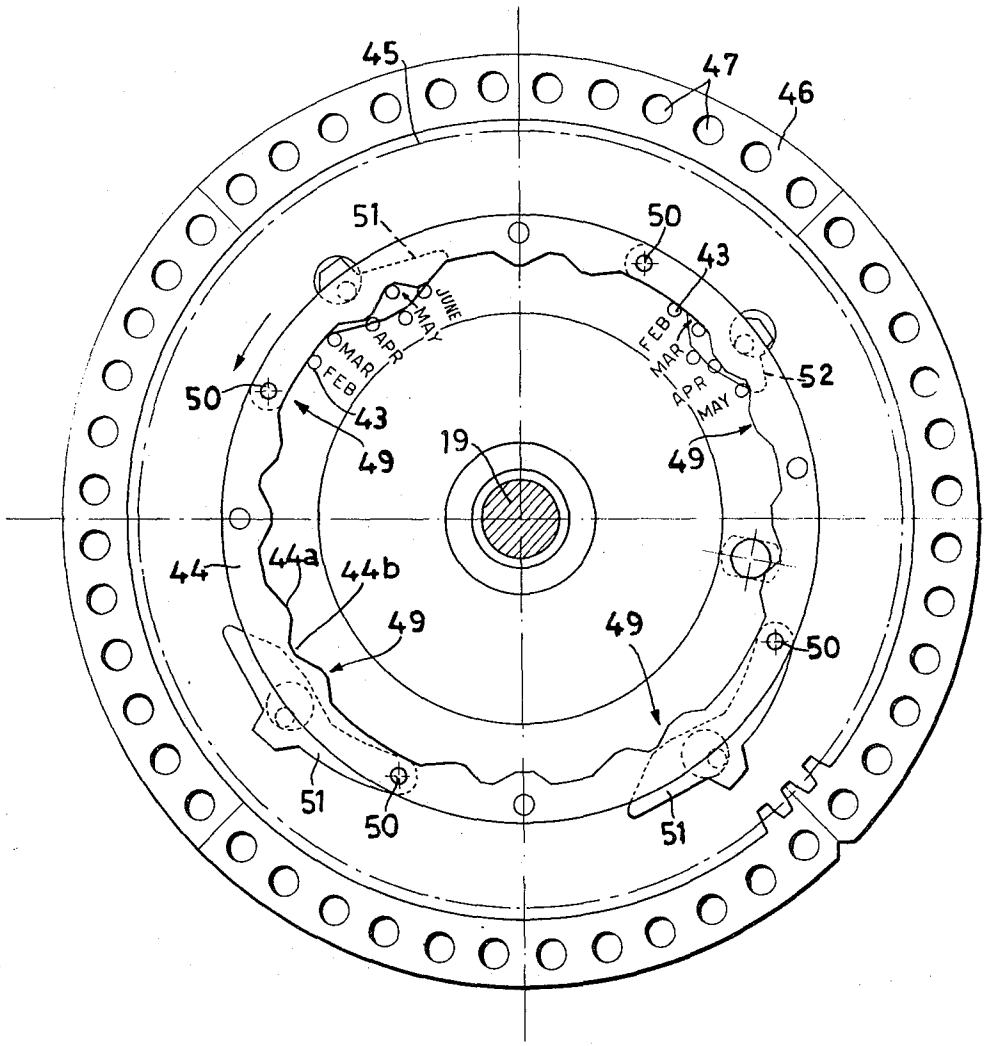
Fig. 4



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CARRY-OVER MECHANISM WITH VARIABLE RATIOS

The present invention refers to a carry-over mechanism with variable ratios for indicators, such as clocks combined with calendars.

Clocks provided with calendars include a mechanism interposed between the day indicating device and the month indicating device, which mechanism actuates the latter device in dependence from the days of each month with a variable ratio because the number of days in each month is variable.

Conventional mechanism, usually ratchet mechanisms, for performing variable ratio carry-over, are synchronized or set in phase with the devices indicating the days and the months at the moment on which the clock is started.

If, at any subsequent moment, the clock stops, for instance during a long storing period, the next operation of the clock requires a manual forward movement of the day and month indicating devices and, moreover, a setting on phase of the carry-over mechanism such as if the clock had been operating since the moment of its first setting on phase.

The object of this invention is to provide a variable ratio carry-over mechanism which is steadily in phase with the day and month indicating devices, even when these are manually displaced independently from the clock gears.

For this purpose a carry-over mechanism operation on variable ratios has been devised which is controlled by a means which moves together with the month indicating device.

This and other features, aims and advantages of the invention will appear more evidently from the following description given by way of non limitative examples, with reference to the attached drawings in which:

FIG. **1** is a perspective view of a mechanism according to the invention, and

FIGS. **2, 3, 4** and **5** show details of the same.

With particular reference to FIG. **1** of the drawings, **10** is a rotating shaft turning by one revolution through 24 hours on which a cam **11** provided with a recess **12** is fixed. A pinion **13** is fixed to the cam **11** coaxially with the shaft **10** and engages a gear wheel **14** fixed on a part of a rotatable pivot **15** extending from one side of a plate **16** forming part of the casing of the mechanism. The other part of said pivot **15** extends from the other side of the plate **16** and carries a pinion **17** fixed thereto and engaging a gear wheel **18** which is loosely supported by a shaft **19** extending from the plate **16** and rotatably carried by the same.

20 indicates a spiral spring the ends of which are respectively fastened to the gear **18** and to the shaft **19**. A gear wheel **21** is fixed on the shaft **19** close to the spring **20**; this gear wheel engages a pinion **22** loosely rotatable on a pin **23** extending from the plate **16**.

24 indicates a disc, fixed to the pinion **22**, on the periphery of which four pairs of stop teeth are placed at an angle at 90° from one another, the said teeth being perpendicular to the disc **24**; each of said pairs is composed of an upper tooth **25** and a lower tooth **26**. These teeth cooperate with the bent end **27** of an arm **28**, the other end of which is fixed on one end of a shaft **29** rotatably supported by the plate **16**. At the other end of this shaft **29** is fixed one end of an arm **30**, the other end of which carries a roller **31** steadily kept in contact with the cam **11** by a spring **32**.

At an intermediate point of said arm **28** there is a nose **33** which can rest on the annular projection **34** of a disc **35** fixed on the shaft **19**, the circumference of which has two gear teeth or notches **35*a***. The circular profile of said annular projection is interrupted through a portion **36**, in correspondence of which the said projection has a smaller radius; this portion can be covered by a sector **37**, which has a radius equal to the radius of the annular projection **34** and is located inside the latter. This sector is pivoted on the shaft **19** and its rotation is governed, in the manner to be explained hereafter, by an arcuate lever **38** pivoted at an intermediate point **39** on the projection **34**; a blade spring **40** acts on one end of said lever **38**, while the other end thereof is connected to the sector **37** through a loose engagement **41–42**. A pin **43** extends from the end of said lever **38** in correspondence of the spring **40**, and the free end of said pin contacts an annular cam **44**.

The cam **44** (FIG. **3**) is fixed to a gear wheel **45** which is in turn fixed to the flange of a reel **46** (only one end of which is shown), loosely mounted on the shaft **19**. The flanges of said reel **46** are provided with a plurality of holes **47** in which conventional blades **48** indicating the months are pivoted.

The said cam **44** is divided into four sectors **49** (FIG. **4**), the profile of each of which has teeth **44*a*** and recesses **44b** and corresponds, as it will be shown further on, to the cycle of one year except the month of February. As it can be seen in FIG. **1**, the cam **44** is fixed to the gear wheel **45** at a suitable distance there from; four cams, one for each of said sectors **49**, are pivoted at **50** (FIG. **3**) between the gear wheel **45** and the cam **44**. Three of said four cams are indicated at **51** and have equal profiles, while the fourth one is indicated at **52** and has a profile slightly different from that of the other three. The three cams **51** correspond to the months of February of 28 days of three successive years, while the cam **52** corresponds to the month of February of 29 days of the fourth year, which is a leap-year.

Said cams **51, 52** are movable between two positions; a first or inoperative position, in which their profile does not interfere with the profile of the cam **44**, and a second or operative position in which their profile overlaps the profile of the cam in correspondence to the February of each year. A tooth **66** fixed to the casing of the mechanism actuates, as it will be described hereinafter, the displacement of the cams **51, 52** from said first to said second position. A shaft **53** is rotatally supported by the plate **16** and carries a slidable and rotatable gear **54** provided with two adjacent staggered rows of teeth **55, 56** adapted to act into the recess **35*a*** of the disc **35**, each of said rows comprising six teeth. On the terminal part of said shaft **53** there is fixed a pinion **57** to which a shagreened roller **58** is secured, said pinion **57** being connected to the gear wheel **54** through a saw-tooth clutch **59**, the function of which will be explained hereinafter.

A spring **60** inserted on the shaft **53** and acting between the plate **16** and a side of the gear **54** keeps the teeth of the clutch **59** normally engaging with each other. Said pinion **57** is coupled with the gear **45**.

The operation of the mechanism described hereabove is the following.

The cam 11 is rotated by a device indicating the hours, of any conventional kind which, therefore, is not described, and charges the spring 20 through the pinion 13, the gear wheel 14, the pinion 17 and the loose gear wheel 18 (to which one end of the spring 20 is connected), since the rotation of the shaft 19 (to which the other end of the spring 20 is connected) is prevented by the engagement between the bent end 27 of the arm 28 and one of the teeth 25 of the disc 24, through the pinion 22 and the gear wheel 21 fixed on the shaft 19.

When the cam 11 has completed its revolution, that is a 24 hours cycle, the roller 31, urged by the spring 32, drops into the recess 12 of the cam 11, without reaching its bottom, however, for the reason explained hereinafter. This movement of the roller 31 into the recess 12 causes, through the arm 30 and the shaft 29, a slight rotation of the arm 28 in the direction shown by the arrow F, this rotation being stopped by the nose 33 abutting the projection 34 of the disc 35, thus preventing the roller 31 from reaching the bottom of the recess 12.

The arm 28, when rotating, disengages its bent end 27 from the tooth 25 of the disc 24, so that the shaft 19 is no more blocked and rotates until the subsequent tooth 26 of the disc 24 (which is rotated by the shaft 19 through the gear 21 and the pinion 22) abutting the end 27 of the arm 28 blocks its rotation again (FIG. 2). This rotation of the shaft 19 causes a rotation of the disc 35 with its projection 34, the profile of which is felt by the nose 33 of the arm 28.

The continuing rotation of the cam 11, transmitted thereto by the aforementioned hour indicating device, causes the roller 31 to climb up from the recess 12 on the circumference of the said cam causing the arm 28 to rotate in the direction indicated by the arrow F_1 so as to bring the arm 28 to its initial position. This rotation disengages the bent end 27 from the tooth 26 (FIG. 2), so that the shaft 19 and the disc 35 with its projection 34, still under the action of the spring 20, will rotate until the subsequent tooth 25 abutting the end 27 of the arm 28 blocks its rotation again.

It will be apparent from the above that the passage of each pair of teeth 25, 26, that is the rotation of the disc 24 by one fourth of revolution, corresponds to a cycle of 24 hours and causes the rotation by one thirty-first of revolution of the disc 35 and of the shaft 19 on which a reel (not shown) is fixed, adjacent to the reel 46, carrying blades similar to the blades 48 and the indicating the date of the month, which blades move forward one after the other at each 31st part of revolution of the shaft 19..

If the instant month has 31 days, at the 30th day, the pin 43 will be on a depressed portion 44*b* and will not be actuated to rotate the sector 37 through the lever 38, so that the portion 36 of the profile of the projection 34 remains entirely circular and the nose 33 of the arm 28 is inoperative. As a consequence, when the disc 35 has accumulated 31 days, its teeth 35*a* will engage the teeth 55, 56 of the gear 54, rotating the latter counterclockwise by one pitch; this rotation, through the clutch 59, the pinion 57 and the gear 45 is transmitted to the reel 46 so as to overturn the blade 48 indicating the following month.

If on the contrary the instant month has 30 days, the rotation of the disc 35 will bring the pin 43 at the 30th day to engage a tooth 44*a*, so that the pin 43 will be actuated to rotate the lever 38 by a predetermined angle against the action of the spring 40, and the lever 38 will in turn rotate the sector 37 to uncover a part of the portion 36 of lesser diameter of the projection 34.

Consequently, when at the end of the 30th day of the month the roller 31 will fall into the recess 12 of the cam 11; the nose 33 coming into contact, as hereinbefore explained, with the projection 34 will meet its portion 36 of lesser diameter, whereby the roller 31 will fall into the recess 12 completely to its bottom, thus causing the arm 28 to accomplish a rotation of the preceding ones. Said rotation of the arm 28 is such as to bring its end 27 out of contact with the teeth 25, 26 of the disc 24 which will begin to rotate.

When the nose 33 climbs up on the projection 34 the end 27 will abut the tooth 26 of the following pair of teeth 25, 26, thus stopping the rotation of the disc 24, of the shaft 19 and of the disc 35. The continuing rotation of the cam 11 transmitted by the hour indicating device will cause the roller 31 to climb up from the recess 12 on to the circumference of the cam 11 and said roller, in the manner as hereinbefore explained, will cause the arm 28 to rotate in the direction of the arrow F_1 to its initial position.

This rotation of the arm 28 disengages its bent end 27 from the tooth 26, whereby the shaft 19 and the disc 35 will rotate until the following tooth 25, abutting the end 27, stops the rotation. During this latter rotation the teeth 35*a* will engage the teeth 55, 56 of the gear wheel 54 causing in the aforementioned manner the blade 48 to overturn to indicate the following month.

It will be understood that in such way, during the rotation of the shaft 19 corresponding to the rotation of the disc 24 from a tooth 25 to the tooth 26 of the following pair the indication of the 31st day has been omitted, or more precisely has been caused to pass very rapidly on the device (not shown) indicating the days with which the shaft 19 is connected.

The operation is similar for the months of February having 28 or 29 days.

In the case of the months of February with 28 days the rotation of the reel 46 by one pitch to pass from the month of January to the month of February will cause the cam 51, in phase with the current year, to be pressed inwardly to its operation position by the tooth 66, so as to bring its profile to overlap the profile of the cam 44 in the sector in which the pin 43 is on the 28th day of the month. Consequently, the pin 43 on the 28th day, engaging the profile of the cam 51, will uncover the portion 36 of the annular projection 34 in the manner hereabove described, but by a predetermined greater part.

Therefore, when the nose 33 falls into the portion 36, the disc 24 will be free to rotate through a whole revolution, that is through a cycle suitable to pass rapidly from the 28th of February to the first of March; during such passage the days 29th, 30th and 31st will rapidly appear on the dial indicating the days, which will eventually indicate the first day of March.

In the case of months of February of 29 days (in leap years) the tooth 66 will urge inwardly the cam 52 in the sector in which the pin 43 is on the 28th day of the month, which cam has a profile slightly different from that of the cams 51 and will cause the disc 24 to rotate by three-fourths of revolution so as to shift rapidly the days 30th and 31st.

From the description of the mechanism carried out according to the invention it will be seen that the manual adjustment of the reel **46** indicating the months can be effected at any moment by merely rotating the wheel **58** counterclockwise independently from the gear wheel **54** through the saw-tooth clutch **59** and independently from the gearings controlling the devices indicating the days and the months, the mechanism and the indicating devices remaining always in correct phase relation.

What is claimed is:

1. A variable ratio carry-over mechanism for indicators, particularly for clocks including a calendar, having a month-indicating device, comprising a means moving together with the month-indicating device, said means including a first cam divided into four sectors equal to one another, the profile of each sector corresponding to the period of one year, and four additional cams each one cooperating with each of said sectors, three of said four additional cams having profiles equal to one another and corresponding to each month of February having 28 days, the fourth of said four additional cams having a different profile corresponding to the month of February of leap years, said four additional cams being movable between a first inoperative position in which their profile does not interfere with the profile of said first cam and a second operative position in which their profile overlaps the profile of said first cam during the month of February of each year, means being provided for shifting said cams into said second operative position.

2. A variable ratio carry-over mechanism for indicators, particularly for clocks including a calendar characterized by being actuated by a means which moves together with the month indicating device, and comprising a disc with an annular projection performing one revolution through every month, a sector rotatably mounted within said projection for varying a portion of its profile according to the number of days of each month, the rotation of said sector being actuated by said means moving together with the month indicating device, and a feeling element following the profile of said projection and controlling the movement of said mechanism.

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