

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN INDICATING DEVICES

(71) We, COPAL COMPANY LIMITED, a Japanese body corporate, of 16-20 Shimura 2-chome, Itabashi-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be preformed, to be particularly described in and by the following statement:

The present invention relates to a flap type indicating device having a low speed rotary flap type indicating assembly adapted to exhibit a first series of indicia upon one revolution thereof and a high speed rotary flap type indicating assembly adapted to exhibit a second series of indicia upon one revolution thereof, the rotary indicating assemblies being driven so that the low speed rotary indicating assembly is actuated to display a succeeding indicia each time a cycle of display of said second series of indicia by the high speed rotary indicating assembly has been completed.

A prior flap type indicating device of the type as described above, such as that embodied in a flap type digital clock which includes a plurality of hour flaps swingably mounted in series along the periphery of an hour drum so as to indicate successively the time in terms of hours and a plurality of minute flaps swingably mounted in series along the periphery of a minute drum coaxially arranged with the hour drum so as to indicate successively the time in terms of minutes, is described hereinafter with reference to Fig. 1 of the accompanying drawings.

The rotary speed is extremely low and, therefore, it is very difficult to exactly set the time at which the respective hour flap is disengaged from a holding member therefor for the next indication in synchronism with the switching of minute indication from 59 minutes to 00 minutes, because very high machining accuracy of the parts and accurate assembly thereof are required

so as to obtain the desired result. Thus, in the prior art indicating device lugs are formed in minute flaps indicating respectively 45 minutes to 59 minutes so as to co-operate with a resilient synchronizing member for ensuring the synchronized operation of the hour and minute flaps. The synchronizing member is interposed between the hour flaps and the minute flaps so as to be actuated by the lugs of the respective minute flaps to cause the synchronizing member to move into the path of movement of the hour flaps for temporarily arresting the hour flap then positioned to be swung for the next indication during the rotation of the hour drum.

In making the flaps, as is evident, press dies and punches for making the flaps having the lugs are very difficult to be manufactured in comparison with those for making the flaps without any lugs, while the lugs on the flaps are liable to be deformed or damaged during the manufacture and the assembly of the flaps and therefore the necessity of using a large number of flaps having the lugs in the prior art has caused difficulties in the manufacture of flap type indicating devices.

In accordance with the present invention a flap type indicating device includes a low speed rotary indicating assembly having a plurality of flaps swingably mounted in series about the periphery of a first drum so that such flaps are successively swung as the drum is rotated by one revolution so as to successively exhibit a first series of indicia on the respective flaps, a high speed rotary indicating assembly coaxially arranged with the low speed rotary indicating assembly adjacent thereto and having a plurality of flaps swingably mounted in series about the periphery of a second drum so that such flaps are successively swung as the second drum is rotated by one revolution so as to

successively exhibit a second series of indicia on the respective flaps, means for rotating said high speed rotary indicating assembly and said low speed rotary indicating assembly in timed relationship so that the low speed rotary indicating assembly can display the succeeding indicia of said first series each time said high speed rotary indicating assembly completes one cycle of display of said second series of indicia, a resilient synchronizing member interposed between said low and high speed rotary indicating assemblies and normally located away from the path of movement of said flaps of said low speed rotary indicating assembly but being movable, upon actuation thereof, into the path of movement of said flaps of said low speed rotary indicating assembly so as to arrest the respective flaps thereof, a cam member interposed between said resilient synchronizing member and said high speed rotary indicating assembly and rotatable in synchronism with said drum of said high speed rotary indicating assembly so as to actuate said resilient synchronizing member for arresting at least some of the respective flaps of said low speed rotary indicating assembly, and a lug formed on the last one of said flaps of said high speed rotary indicating assembly for indicating the last of said second series of indicia, said lug being so arranged that it actuates said resilient synchronizing member to keep the respective flap of said low speed rotary indicating assembly arrested when said last flap comes into the position exhibiting the indicia borne thereon, the angular orientation of said cam member being so determined that it actuates said resilient synchronizing member to arrest the respective flaps of said low speed rotary indicating assembly by the rotation of said drum of said high speed rotary indicating assembly during a period beginning prior to the completion of one cycle of display of said second series of indicia of said high speed rotary indicating assembly and ending after said lug of said last flap of said high speed rotary indicating assembly comes into the position to actuate said resilient synchronizing member but prior to the completion of one cycle of display of said second series of indicia of said high speed rotary indicating assembly and the fall of said last flap thereof.

The cam member may be arcuate and may be formed integral with or fixedly attached to the second drum of the high speed rotary indicating assembly, and positioned concentrically with the axis of rotation of the drum and having an inclined leading edge for facilitating the engagement thereof with the resilient synchronizing member.

By the device of the present invention as described above, it suffices to provide only one flap having a lug, thereby permitting the troublesome working and assembling of the flaps inherent to the prior art to be widely avoided and the manufacturing cost to be reduced while high accuracy in operation is positively achieved.

The present invention will be further described with reference to a preferred embodiment thereof embodied in the form of a flap type digital clock illustrated in the accompanying drawings, in which:

Fig. 1 is a front view showing the main parts of a prior art flap type digital clock;

Fig. 2 is a front view similar to Fig. 1 but showing the main parts of the flap type digital clock embodying the present invention in one rotational position of the minute drum;

Fig. 3 is a schematic side view showing the relative positions of the cam member and the synchronizing member shown in Fig. 2;

Fig. 4 is a front view similar to Fig. 2 but showing another rotational position of the minute drum;

Fig. 5 is a schematic side view showing the relative positions of the cam member and the synchronizing member shown in Fig. 4;

Fig. 6 is a front view similar to Fig. 2 but showing a still another rotational position of the minute drum; and

Fig. 7 is a schematic side view similar to Fig. 3 but showing the relative positions of the cam member and the synchronizing member shown in Fig. 6.

Referring to Fig. 1 showing a prior art flap type digital clock, hour flaps TA_{0-1} , TA_{0-2} , TA_{1-1} , TA_{1-2} , . . . TP_{11-1} , TP_{11-2} are swingably mounted in series along the periphery of an hour drum T to form an hour indicating assembly (low speed rotary indicating assembly) while a minute indicating assembly (high speed rotary indicating assembly) is formed by a plurality of minute flaps M_{00} , M_{01} , . . . M_{59} , M_{60} swingably mounted in series along the periphery of a minute drum M. The drums T and M are supported on a shaft G. The respective hour flaps TA_{0-1} , TA_{0-2} , . . . TP_{11-1} , TP_{11-2} and the respective minute flaps M_{00} , M_{01} , . . . M_{59} , M_{60} are successively disengaged from a holding member Kt and a holding member Km, respectively, as the drum T and the drum M are rotated in timed relationship with each other so that the respective flap is swung downwardly to indicate the time, such as 4.59, by suitable indicia on the hour and minute flaps exposed for the indication. Since the switching of the time indication is governed by the relative positions of the top edge of the flap and the tip of the holding member in each of the

hour and the minute indicating assemblies, it is extremely difficult to synchronize the switching of the hour indication from 4 o'clock to 5 o'clock, for example as shown, with the switching of the minute indication from 59 minutes to 00 minutes in order to avoid false indications such as 4.00 or 5.59 after elapse of 4 hours 59 minutes, thus requiring a synchronizing mechanism for avoiding false indications of the time.

In the prior art synchronizing mechanism as shown in Fig. 1, lugs M45' to M59' are formed on the respective minute flaps M45 to M59 indicating respectively 45 minutes to 59 minutes, and a resilient synchronizing member S is interposed between the drum M and the drum T. A bent portion Sb at the free end of the member S is normally held away from the path of movement of the hour flaps but is displaced into the path of movement of the hour flaps by engagement of the lugs M45' to M59' with the resilient synchronizing member S. The synchronizing member S is actuated by the respective lugs M45' to M59' of the minute flaps M45 to M59 when they approach the positions to be arrested by the holding member Km during the rotation of the drum M so that the synchronizing member S arrests the hour flap held by the holding member Kt and exposed for the indication during the time beginning at 45 minutes and ending at 59 minutes. The time at which the holding member Kt is disengaged from the now exposed hour flap is so determined that the hour flap is disengaged from the holding member Kt before the minute flap M59 indicating 59 minutes is disengaged from the holding member Km to switch the minute indication to 00 minutes but after the lug M45' of the minute flap M45 actuates the synchronizing member S so as to arrest the hour flap presently exposed. Thus, the exposed hour flap is held in its indicating position by the synchronizing member S until the minute flap M59 is disengaged from the holding member Km for switching the indication to 00 minutes and the lug M59' of the minute flap M59 is disengaged from the synchronizing member S for releasing the synchronizing member S, thereby permitting the exposed hour flap, already disengaged from the holding member Kt, to be swung for the next indication in synchronism with the swinging of the minute flap M59.

In the above described synchronizing mechanism of the prior art, since a plurality of lugs on the minute flaps is required, the manufacture of such minute flaps having lugs is very difficult and expensive and such flaps are liable to be deformed or damaged during the manufacture and assembly thereof.

Figs. 2 to 7 show an embodiment of the

present invention which avoids the above described disadvantages of the prior art.

The general construction of the embodiment shown in Figs. 2 to 7 is similar to that of the prior art shown in Fig. 1 except that lugs of the minute flaps M45 to M58 are dispensed with leaving only the lug M59' of the last minute flap M59. Instead, an arcuate cam member C having an inclined leading edge Ca and a land Cb is integral with or secured to the minute drum M and so configured as to actuate the synchronizing member S as the drum M rotates before the holding member Kt is disengaged from the hour flap presently exposed for the time indication as in the case of the device shown in Fig. 1 but to disengage from the synchronizing member S until the lug M59' is disengaged therefrom.

As seen from Fig. 2, the hour and the minute indication is obtained by the pair of flaps exposed for the indication and the time indication is switched to the next indication each time a flap is disengaged from the holding member to be swung to expose the succeeding pair of flaps bearing thereon the next indication of the time.

Since the number of the minute flaps is 60, the number of the hour flaps is selected to be 48 so as to make the number of the hour flaps to approach the number of the minute flaps and the hour flaps are actuated every 30 minutes so that each two flaps of successive pairs of the hour flaps indicate the same hour during successive intervals of 30 minutes.

The operation of the device of the present invention shown in Figs. 2 to 7 is as follows.

As shown in Figs. 2 and 3, when the indication of the minute flaps approaches 45 minutes, the synchronizing member S slides along the inclined edge Ca of the cam member C in contact therewith and rides on the land Cb thereof so that the bent portion Sb of the synchronizing member S moves into the path of movement of the hour flaps, now arrested by the holding member Kt, so that the bent portion Sb can arrest these hour flaps when the holding member Kt becomes disengaged from the hour flap.

Thereafter, as shown in Figs. 4 and 5 when the indication of the minute flaps reaches 59 minutes, the lug M59' of the hour flap M59 comes in contact with the portion Sa of the synchronizing member S so as to actuate the same.

The land Cb of the cam member C is disengaged from the synchronizing member S while the indication of 59 minutes is displayed by the minute flaps as shown in Figs. 6 and 7, so that the synchronizing member S is held in its actuated position solely by the lug M59' of the minute flap

M59.

Thereafter, when the minute flap M59 is disengaged from the holding member Km and is swung downwardly for the next indication of 00 minutes, the synchronizing member S is disengaged from the lug M59 to release the member S thereby permitting the hour flap then arrested by the bent portion Sb of the member S to be disengaged from the bent portion Sb and to swing downwardly for the next indication in synchronism with the switching of the minute indication from 59 minutes to 00 minutes.

The above operation is repeated every hour when the minute indication reaches 45 minutes.

The cam member C has been described as being integral with or fixedly secured to the drum M. However, the cam member C may be secured to a rotatable member which is rotated in coupled relationship with the drum M.

The present invention has been described as being embodied in a flap type digital clock. However, the present invention can be embodied in any indicating device such as a clock calendar which displays the hour and date or the hour and the day of the week or other device insofar as it includes a low speed rotary indicating assembly and a high speed rotary indicating assembly, wherein the low speed indicating assembly is actuated for the next indication each time the high speed indicating assembly completes the cycle of indication thereof.

In the case described above in which two successive flaps of the low speed rotary indicating device have the same indicia, e.g. a twenty four hour clock having forty-eight hour flaps, only the second of the two flaps with the same indicia is retained by the resilient synchronizing member since the 30 minute flap (not shown) of the high speed rotary indicating device does not have a lug and since the timing of the fall of the first of said two flaps with the same indicia is not critical.

WHAT WE CLAIM IS:

1. A flap type indicating device including a low speed rotary indicating assembly having a plurality of flaps swingably mounted in series about the periphery of a first drum so that such flaps are successively swung as said drum is rotated by one revolution so as to successively exhibit a first series of indicia on the respective flaps, a high speed rotary indicating assembly coaxially arranged with said low speed rotary indicating assembly adjacent thereto and having a plurality of flaps swingably mounted in series about the periphery of a second drum so that such flaps are successively swung as said second

drum is rotated by one revolution so as to successively exhibit a second series of indicia on the respective flaps, means for rotating said high speed rotary indicating assembly and said low speed rotary indicating assembly in timed relationship so that said low speed rotary indicating assembly can display succeeding indicia of said first series each time said high speed rotary indicating assembly completes one cycle of display of said second series of indicia, a resilient synchronizing member interposed between said low and high speed rotary indicating assemblies and normally located away from the path of movement of said flaps of said low speed rotary indicating assembly but being movable, upon actuation thereof, into the path of movement of said flaps of said low speed rotary indicating assembly so as to arrest the respective flaps thereof, a cam member interposed between said resilient synchronizing member and said high speed rotary indicating assembly and rotatable in synchronism with said drum of said high speed rotary indicating assembly so as to actuate said resilient synchronizing member for arresting at least some of the respective flaps of said low speed rotary indicating assembly, and a lug formed on the last one of said flaps of said high speed rotary indicating assembly for indicating the last of said second series of indicia, said lugs being so arranged that it actuates said resilient synchronizing member to keep the respective flap of said low speed rotary indicating assembly arrested when said last flap comes into the position exhibiting the indicia borne thereon, the angular orientation of said cam member being so determined that it actuates said resilient synchronizing member to arrest the respective flaps of said low speed rotary indicating assembly by the rotation of said drum of said high speed rotary indicating assembly during a period beginning prior to the completion of one cycle of display of said second series of indicia of said high speed rotary indicating assembly and ending after said lug of said last flap of said high speed rotary indicating assembly comes into the position to actuate said resilient synchronizing member but prior to the completion of one cycle of display of said second series of indicia of said high speed rotary indicating assembly and the fall of said last flap thereof.

2. A flap type indicating device as claimed in Claim 1, wherein said cam member is formed integral with or fixedly attached to said second drum of said high speed rotary indicating assembly and is of arcuate shape and positioned concentrically with the axis of rotation of said drum.

3. A flap type indicating device as 130

M59.

Thereafter, when the minute flap M59 is disengaged from the holding member Km and is swung downwardly for the next indication of 00 minutes, the synchronizing member S is disengaged from the lug M59 to release the member S thereby permitting the hour flap then arrested by the bent portion Sb of the member S to be disengaged from the bent portion Sb and to swing downwardly for the next indication in synchronism with the switching of the minute indication from 59 minutes to 00 minutes.

15 The above operation is repeated every hour when the minute indication reaches 45 minutes.

The cam member C has been described as being integral with or fixedly secured to the drum M. However, the cam member C may be secured to a rotatable member which is rotated in coupled relationship with the drum M.

25 The present invention has been described as being embodied in a flap type digital clock. However, the present invention can be embodied in any indicating device such as a clock calendar which displays the hour and date or the hour and the day of the week or other device insofar as it includes a low speed rotary indicating assembly and a high speed rotary indicating assembly, wherein the low speed indicating assembly is actuated for the next indication 30 each time the high speed indicating assembly completes the cycle of indication thereof.

In the case described above in which two successive flaps of the low speed rotary indicating device have the same indicia, e.g. a twenty four hour clock having forty-eight hour flaps, only the second of the two flaps with the same indicia is retained by the resilient synchronizing member since 45 the 30 minute flap (not shown) of the high speed rotary indicating device does not have a lug and since the timing of the fall of the first of said two flaps with the same indicia is not critical.

50 WHAT WE CLAIM IS:

1. A flap type indicating device including a low speed rotary indicating assembly having a plurality of flaps swingably mounted in series about the periphery 55 of a first drum so that such flaps are successively swung as said drum is rotated by one revolution so as to successively exhibit a first series of indicia on the respective flaps, a high speed rotary indicating assembly coaxially arranged with said low speed rotary indicating assembly adjacent thereto and having a plurality of flaps swingably mounted in series about the periphery of a second drum so that such 65 flaps are successively swung as said second

drum is rotated by one revolution so as to successively exhibit a second series of indicia on the respective flaps, means for rotating said high speed rotary indicating assembly and said low speed rotary 70 indicating assembly in timed relationship so that said low speed rotary indicating assembly can display the succeeding indicia of said first series each time said high speed rotary indicating assembly completes one cycle of display of 75 said second series of indicia, a resilient synchronizing member interposed between said low and high speed rotary indicating assemblies and normally located away 80 from the path of movement of said flaps of said low speed rotary indicating assembly but being movable, upon actuation thereof, into the path of movement of said flaps of said low speed rotary indicating assembly 85 so as to arrest the respective flaps thereof, a cam member interposed between said resilient synchronizing member and said high speed rotary indicating assembly and rotatable in synchronism with said drum 90 of said high speed rotary indicating assembly so as to actuate said resilient synchronizing member for arresting at least some of the respective flaps of said low speed rotary indicating assembly, and a lug 95 formed on the last one of said flaps of said high speed rotary indicating assembly for indicating the last of said second series of indicia, said lugs being so arranged that it actuates said resilient synchronizing member 100 to keep the respective flap of said low speed rotary indicating assembly arrested when said last flap comes into the position exhibiting the indicia borne thereon, the angular orientation of said cam member 105 being so determined that it actuates said resilient synchronizing member to arrest the respective flaps of said low speed rotary indicating assembly by the rotation of said drum of said high speed rotary indicating 110 assembly during a period beginning prior to the completion of one cycle of display of said second series of indicia of said high speed rotary indicating assembly and ending after said lug of said last flap of said 115 high speed rotary indicating assembly comes into the position to actuate said resilient synchronizing member but prior to the completion of one cycle of display of said second series of indicia of said high 120 speed rotary indicating assembly and the fall of said last flap thereof.

2. A flap type indicating device as claimed in Claim 1, wherein said cam member is formed integral with or fixedly 125 attached to said second drum of said high speed rotary indicating assembly and is of arcuate shape and positioned concentrically with the axis of rotation of said drum.

3. A flap type indicating device as 130



claimed in Claim 2 wherein said cam member has an inclined leading edge for facilitating the engagement thereof with said resilient synchronizing member.

- 5 4. A flap type indicating device as claimed in any of Claims 1 to 3 wherein the number of flaps of the low speed rotary indicating assembly is an integral multiple of the number of different indicia of the
- 10 first series, like indicia being on successive flaps only the last of which is arrestable by

said resilient synchronizing member.

5. A flap type indicating device constructed and adapted to operate substantially as herein described with reference to 15 and as illustrated in Figs. 2 to 7 of the accompanying drawings.

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