

ALARM MECHANISM

The present invention relates to an alarm mechanism,
e.g. of an alarm clock.

An alarm mechanism is known to the Applicants
in which cam grooves are formed in either an hour
5 hand wheel gear or an alarm wheel gear that are located
coaxially with respect to each other, and cam pawls
are formed on the other gear. When the alarm time
which has been set is reached, the cam pawls are
introduced into the cam grooves by means of a spring,
10 thereby closing an alarm switch and so detecting
the set alarm time. An alarm hand is force-fitted
onto the distal end of a tubular portion of the alarm
wheel gear, and a hour hand is force-fitted onto
the distal end of a tubular portion of the hour hand
15 wheel gear.

In such an alarm mechanism, when installing
the hands of the wheel gears, it has been necessary
to fit the cam grooves and the cam pawls together
by operating a hand rotating knob, thereby respectively
20 force-fitting the alarm hand and the hour hand onto
the tubular portion of the alarm wheel gear and the
tubular portion of the hour hand wheel gear in a
predetermined positional relationship, and subsequently
further adjusting the positional relationship between
25 the alarm hand and the hour hand by effecting a hand

rotating operation. Since this adjustment involves,
for instance, the refitting of the hour hand, the
adjustment is very complicated and consumes time,
so that it has been a major problem in the assembly
5 of alarm clocks.

In view of this situation, in Japanese Patent
Application No. 298313/1985, the present Applicants
have proposed an alarm mechanism which is capable
of facilitating the said adjustment and whose alarm
10 accuracy is high. In the said application, the arrangement
is such that cam grooves are formed in one of two
skirt portions which abut against the alarm hand
and the hour hand, while cam pawls are formed on
the other skirt portion, and the cam grooves and
15 the cam pawls are fitted together when these members
in the skirt portions are disposed opposite to each
other, thereby to detect the alarm time.

Even in the construction of Japanese Patent
Application No. 298313/1985, however, the alarm hand
20 and the hour hand are both fitted onto the respective
tubular portions in their skirt portions, and the
cam pawls slide on the surface of the skirt portion.
Therefore, the force-fitting of the side skirt portion
of the alarm hand and the tubular portion, must be
25 firmly effected so as not to be interlinked with

the rotation of the hour hand. For this reason, there is a possibility of a crack occurring in the skirt portion. Moreover, force-fitting of the alarm hand is required.

5 Accordingly, an object of the present invention is to simplify the assembly of an alarm mechanism and to reduce the number of parts thereof.

 According to the present invention, there is provided an alarm mechanism comprising an alarm hand
10 member and an hour hand member which respectively have annular portions which are coaxial with each other, each annular portion having a respective hand integral therewith, adjacent parts of the annular portions respectively having cam grooves and cam
15 pawls which are adapted and arranged to fit into each other; and an alarm pinion formed integrally with a part of the annular portion of the alarm hand member which is axially spaced from the said adjacent part thereof.

20 Preferably, the said members are rotatably mounted and are relatively movable axially, means being provided for urging the said members axially towards each other, relative rotation of the said members in a given rotational direction causing the cam pawls
25 to enter and subsequently to withdraw from the cam

grooves so as to cause relative axial movement of the said members, and means responsive to said relative axial movement for energising and de-energising an alarm.

5 Each of the cam grooves and cam pawls is preferably provided with a cam surface which is inclined with respect to the axial direction, the said cam surfaces being adapted to engage each other so that rotation of one of said members relative to the other causes
10 relative axial movement thereof.

Each of the cam grooves and cam pawls is also preferably provided with an axially extending surface, the said axially extending surfaces contacting each other when the cam pawls are fully inserted into
15 the cam grooves.

The annular portion of the hour hand member may be force-fitted on an hour hand tubular member which is rotatably mounted within the annular portion of the alarm hand member.

20 A minute wheel tubular member may be rotatably mounted within the hour hand tubular member.

A seconds hand shaft may be rotatably mounted in the minute wheel tubular member.

The invention is illustrated, merely by way
25 of example, in the accompanying drawings, in which:-

Fig. 1 is a cross-sectional view of a preferred embodiment of an alarm mechanism according to the present invention;

Fig. 2 is an enlarged front elevational view
5 of an alarm hand forming part of the alarm mechanism of Fig. 1;

Fig. 3 is a top plan view of the said alarm hand;

Fig. 4 is an enlarged front elevational view
10 of an hour hand forming part of the alarm mechanism of Fig. 1;

Fig. 5 is a bottom view of the said hour hand; and

Figs. 6A-6C illustrate the operation of cam grooves and cam pawls in annular portions of the
15 hour hand and the alarm hand, respectively.

Referring now to the accompanying drawings, a preferred embodiment of an alarm mechanism according to the present invention will be described hereunder.

As shown in Fig. 1, an alarm mechanism according
20 to the present invention comprises a seconds hand wheel 3 which is driven by a driving source (not shown) and which is disposed between an upper plate 1 and an intermediate plate 2. The seconds hand wheel 3 drives a minute hand gear 5a via an intermediate
25 wheel 4. The minute wheel gear 5a and a minute wheel

tubular member 5b are coupled to each other via a slip mechanism (not shown).

A transmission wheel 6 is rotatably supported by a support column 7a formed integrally with a lower plate 7. The transmission wheel 6 meshes with a pinion 5c of the minute wheel tubular member 5b and also meshes with an hour wheel gear 8 so as to transmit thereto the drive from the minute wheel tubular member 5b. The minute wheel tubular member 5b is fitted coaxially about an axial or shaft portion 3a of the seconds hand wheel 3, and an hour hand tubular member 8a forming part of the hour wheel gear 8 is fitted coaxially about the outer periphery of the minute hand tubular member 5b. A stepped portion of the outer peripheral surface of the hour hand tubular member 8a is mounted within a tubular portion 7b of the lower plate 7, whereby the hour wheel gear 8 is prevented from moving upwardly as seen in Fig. 1, and the hour hand tubular member 8a is maintained in a vertical state.

An annular portion 9a of an alarm hand member 9 (best shown in Figs. 2 and 3) is coaxially rotatably fitted about the outer periphery of the hour hand tubular member 8a. The alarm hand member 9 is arranged so that a pointer or hand portion 9b thereof is formed integrally at one end portion (i.e. the upper

end portion) of the annular portion 9a, and an alarm
pinion 9c is formed integrally at the outer peripheral
part of the other end portion (i.e. the lower end
portion) of the annular portion 9a. An inner peripheral
5 surface 9d of the annular portion 9a is mounted rotatably
and slidably about the outer peripheral surface of
the hour hand tubular member 8a, while an inner peripheral
surface 9e of the alarm hand member 9 adjacent the
alarm pinion 9c is fitted rotatably and slidably
10 about the outer peripheral surface of the tubular
portion 7b which is integral with the lower plate 7.
A portion of a lifting lever 10 urged by an urging
spring (not shown) may be brought into contact with
the annular portion 9a, i.e., the rear-end surface
15 of the alarm hand member 9, and the annular portion 9a
is thereby urged outwardly (upwardly in Fig. 1) of
the lower plate 7.

An alarm transmission wheel 11 meshes with the
alarm pinion 9c. An axial portion 11a of the alarm
20 transmission wheel 11, which has a collar 11b at
its distal end, is provided on the alarm transmission
wheel 11, and this axial portion 11a is provided
with a groove 11c. The axial portion 11a snap fits
in a through hole 7c provided in the lower plate 7,
25 and the alarm transmission wheel 11 is thereby supported

by the lower plate 7 so as to be undetachable therefrom
but rotatable with respect thereto. An annular projection 7d
disposed adjacent to the alarm transmission wheel 11
so as to be disposed opposite to the latter is provided
5 on the lower plate 7, and the alarm transmission
wheel 11 rotates while frictionally sliding on the
projection 7d. The alarm transmission wheel 11 meshes
with an alarm setting pinion 12, which is rotated
unidirectionally by the rotation of a hand rotating
10 shaft 13.

As best shown in Figs. 4 and 5, an hour hand
member 14 has an annular portion 14a which is force-
fitted onto the distal end of the hour hand tubular
member 8a and which has a pointer or hand portion 14b
15 formed integrally therewith. The oppositely disposed
portions of the annular portion 9a of the alarm hand
member 9 and the annular portion 14a of the hour
hand member 14 are respectively provided with cam
pawls 9f, 9g which project from the upper surface
20 of the annular portion 9a, as best shown in Figs. 2
and 3, and cam grooves 14c, 14d which are provided
on the lower surface of the annular portion 14a,
as best shown in Figs. 4 and 5. The cam pawls 9f, 9g
and the cam grooves 14c, 14d are respectively formed
25 at different diameters from the axial centres of their

respective members, and in this example the front surfaces of the cam pawls 9f, 9g and cam grooves 14c, 14d, when viewed in the advancing direction of the hour hand member 14, are constituted by vertical, i.e. axially extending, surfaces which contact each other when the cam pawls 9f, 9g are fully inserted into the cam grooves 14c, 14d. In addition, the cam pawls 9f, 9g and the cam grooves 14c, 14d are fitted to each other simultaneously in a face-to-face relationship in a positional relationship in which the pointer or hand portions 9b and 14b are superposed on each other.

In assembly, after the parts other than the alarm hand member 9 have first been assembled on the upper plate 1, the intermediate plate 2, and the lower plate 7, the alarm hand member 9 is assembled last. In other words, the annular portion 9a is fitted around the outer peripheral portion of the hour hand tubular member 8a from the outside of the lower plate 7 with the side of the alarm pinion 9c facing inwardly. The inner peripheral surface 9e adjacent to the alarm pinion 9c is fitted onto the outer periphery of the tubular portion 7b, and the alarm pinion 9c meshes with the alarm transmission wheel 11. Subsequently, the hour hand member 14

is force-fitted onto the hour hand tubular member 8a.

In other words, the annular portion 14a, with which the pointer or hand portion 14b has been formed integrally, is force-fitted onto the hour hand tubular member 8a.

5 This completes the assembly. The hour hand member 14 can thus be installed without the need to have regard to the direction of the pointer or hand portion 14b, and the minute hand (not shown) is positioned and installed in its relationship with the pointer or
10 hand portion 14b of the hour hand member 14, and the seconds hand (not shown) is fitted onto the seconds hand shaft 3a.

When the time approaches the alarm set time, the cam grooves 14c, 14d move in the direction of
15 the arrow a from the position shown in Fig. 6A to that shown in Fig. 6B so as to be aligned with the cam pawls 9f, 9g. Since the annular portion 9a of the alarm hand member 9 has been pushed by the lifting lever 10 and has thus been urged in the direction
20 of the arrow b, the cam pawls 9f, 9g are respectively introduced into the cam grooves 14c, 14d and the alarm switch (not shown) is thereby closed.

Subsequently, after a predetermined lapse of time, the cam pawls 9f, 9g and the cam grooves 14c, 14d
25 slide with respect to each other on their respective

inclined surfaces which are inclined with respect to the axial direction, as shown in Fig. 6C, and the annular portion 9a is displaced in the direction of the arrow c in opposition to the resilience of the lifting lever 10, thereby opening the alarm switch. That is to say, rotation of the hour hand member 14 in the direction of the arrow a causes axial movement of the alarm hand member 9 in the direction of the arrow c.

When setting the alarm time, the alarm setting pinion 12 is rotated by rotating the hand rotating shaft 13 in a predetermined direction. Since this rotation is transmitted to the alarm pinion 9c via the alarm transmission wheel 11, the alarm hand member 9 rotates and a desired alarm time is set. Since the slip torque of the alarm transmission wheel 11 in relation to the lower plate 7 is set to a predetermined magnitude owing to such factors as the distance between the through hole 7c and the axial portion 11a, the length of the axial portion 11a, and the height of the projection 7d, the annular portion 9a will not rotate, i.e. it will not follow the rotation of the hour hand 14a. Consequently, the alarm transmission wheel 11 enables the alarm hand member 9 to be retained in a desired position.

As shown, since the alarm hand member 9 is arranged so that its pointer or hand portion 9b and the alarm pinion 9c are formed integrally with the annular portion 9a thereof, the number of pieces used can be reduced, and the work of force-fitting the alarm hand can be eliminated, so that the need for accurate control of the dimensions of the interfitting parts of a skirt portion of an alarm hand and a tubular portion of an alarm wheel becomes unnecessary, whereby both production and assembly are simplified. In addition, the structure is simple, a reduction in costs can be attained, and the alarm accuracy can be enhanced.

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CLAIMS

1. An alarm mechanism comprising an alarm hand member and an hour hand member which respectively have annular portions which are coaxial with each other, each annular portion having a respective hand
5 integral therewith, adjacent parts of the annular portions respectively having cam grooves and cam pawls which are adapted and arranged to fit into each other; and an alarm pinion formed integrally with a part of the annular portion of the alarm hand
10 member which is axially spaced from the said adjacent part thereof.
2. An alarm mechanism as claimed in claim 1 in which the said members are rotatably mounted and are relatively movable axially, means being provided
15 for urging the said members axially towards each other, relative rotation of the said members in a given rotational direction causing the cam pawls to enter and subsequently to withdraw from the cam grooves so as to cause relative axial movement of
20 the said members, and means responsive to said relative axial movement for energizing and de-energizing an alarm.
3. An alarm mechanism as claimed in claim 2 in which each of the cam grooves and cam pawls is provided
25 with a cam surface which is inclined with respect to



the axial direction, the said cam surfaces being adapted to engage each other so that rotation of one of said members relative to the other causes relative axial movement thereof.

5 4. An alarm mechanism as claimed in claim 3 in which each of the cam grooves and cam pawls is also provided with an axially extending surface, the said axially extending surfaces contacting each other when the cam pawls are fully inserted into the cam
10 grooves.

5. An alarm mechanism as claimed in any preceding claim in which the annular portion of the hour hand member is force-fitted on an hour hand tubular member, which is rotatably mounted within the annular portion
15 of the alarm hand member.

6. An alarm mechanism as claimed in claim 5 in which a minute wheel tubular member is rotatably mounted within the hour hand tubular member.

7. An alarm mechanism as claimed in claim 6 in
20 which a seconds hand shaft is rotatably mounted in the minute wheel tubular member.

8. An alarm mechanism as claimed in any preceding claim in which the alarm pinion is formed at the rear end portion of the annular portion.

25 9. An alarm mechanism substantially as hereinbefore described with reference to and as shown in the accompanying drawings.