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"TIMEPIECE"

This invention relates to timepieces and in particular to analogue timepieces.

Conventionally, bottom frames or plates, bridges etc. of analogue timepieces are made of metal, while the use of plastics material has been limited to parts of a calendar mechanism or for electrically insulating electronic circuitry. Even if the bottom plate is made of plastics material, it is common to use metal for parts of the bottom plate where a high degree of precision is required, for example, parts supporting a gear train. Therefore the advantages stemming from the use of plastics material has not been fully realised in the construction of analogue timepieces.

According to one aspect of the present invention there is provided a timepiece comprising: a first frame and a second frame, a gear train, circuitry and a setting mechanism being located between the first and second frames; a dial; and a calendar mechanism located between the dial and the second frame, the first and second frames being secured by screw means from the side of the second frame adjacent to the dial.

In the preferred embodiment the gear train comprises an intermediate bridge disposed between the first and second frames, a centre wheel and pinion located between the intermediate bridge and the second frame, and a fourth wheel and pinion located between the intermediate bridge and the first frame. The first

frame may comprise a metal portion reinforcing a plastics portion, the fourth wheel and pinion being guided in the radial direction by the plastics portion and in the thrust direction by the metal portion.

5 Preferably the second frame has a plastics portion reinforced by a metal portion. Thus the gear train may include a minutes wheel rotatably supported by the first and second frames, and an hours wheel engaged with the minutes wheel, the plastics portion of the second frame including a stem for supporting the
10 hours wheel.

 The setting mechanism may include a winding stem guided by an exposed part of the metal portion of the second frame.

 The calendar mechanism preferably includes a day star off-centre with respect to the centre of the timepiece and guided
15 by a guide plate of a date dial or date jumper lever, a snap for the day star being attached to an hours wheel.

 Preferably the first and/or second frame has a metal portion reinforcing a plastics portion, the plastics portion having raised and recessed portions, the plastics portion having separate regions
20 for the gear train, circuitry and setting mechanism.

 Said regions of the plastics portion may be separated by exposing the metal portion.

 Holes for the gear train are preferably formed in the plastics portion.

25 In a preferred embodiment a metal bush or jewel for a part

of the gear train or motor is positioned so as to contact the metal portion.

According to a further aspect of the present invention there is provided a timepiece comprising: a first frame and a second frame, the first frame comprising a metal portion reinforcing a plastics portion; a dial adjacent the second frame, the first and second frames being secured by screw means from the side of the second frame adjacent to the dial; a calendar mechanism located between the dial and the first frame; and a gear train, circuitry and a setting mechanism located between the first and second frames, the gear train comprising a fourth wheel and pinion which is guided in the radial direction by the plastics portion of the first frame and in the thrust direction by the metal portion thereof.

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

Figure 1 shows the basic construction of one embodiment of a timepiece according to the present invention;

Figure 2 is a plan view of the timepiece of Figure 1;

Figures 3 to 7 are cross-sections of the timepiece of Figure 2 showing various parts in greater detail;

Figure 8 is a view similar to Figure 2 showing a calendar mechanism of the timepiece in greater detail;

Figure 9 shows the obverse side of a plate of the timepiece of Figure 2;

Figure 10 shows the reverse side of the plate of Figure 9; and

Figure 11 is a cross-section of the plate of Figure 9.

Throughout the drawings like parts have been designated by the same reference numerals.

Referring first to Figure 1, there is illustrated one
5 embodiment of an analogue timepiece according to the present invention.

The timepiece shown in Figure 1 has a battery and circuitry
2, a gear train and a motor 3, a centre wheel bridge 4 and a
setting mechanism 5 disposed between a first frame plate 1,
10 which is a base of the timepiece and a second frame or bridge 6.
A calendar mechanism 7 is located on the bridge 6, and the whole

construction is secured by screws from a dial side of the bridge 6. In this construction, the parts are assembled sequentially from one direction, the plate 1 being the base for all the components.

5 Plastics material is utilised to the full in the timepiece of Figure 1 to prevent leaning of the component parts and thereby assembly is simplified. Moreover, plastics material reduces the need for oiling of the contact surfaces between rotating or sliding parts. The gear train which requires a precise distance between the plate 1 and the bridge 6 which should not be subjected to
10 external shocks is concentrically disposed at the centre of the timepiece. Rigidity is imparted to the gear train to reduce or prevent deformation, by making the centre wheel bridge 4 of metal, whilst flexibility is provided in the region of the circuitry and the periphery of the timepiece, so that the deformability of
15 plastics material is positively utilised. Thus, the construction shown in Figure 1 effectively makes the most use of the advantages of using metal and plastics material in an analogue timepiece.

Referring now to Figures 2, 3 and 4, the gear train is rotatably supported by bearings 10a, 10b of a plate 10 which has
20 a metal portion 8 and a plastics portion 9, and bearings 13a, 13b, of a bridge 13 which has a metal portion 11 reinforcing a plastics portion 12. The gear train comprises a fifth wheel and pinion 14, a third wheel and pinion 15, a minutes wheel 16, a centre wheel and pinion 19, rotatably supported by the bridge 6 which is
25 located by sleeves 17, 18 for bridge screws 21, 22 respectively,

between the plate 10 and the bridge 13 and a stem portion 13c of the bridge, and a fourth wheel and pinion 20, its lower end 20a being rotatably supported by a bearing 10c of the plate 10 and its upper end being rotatably supported by a centre bore 19a of the centre wheel and pinion 19. In this embodiment, the end 20a of the fourth wheel and pinion 20 abuts the metal portion 8 of the plate 10 in order to prevent wear of the bearing 10a due to load produced when a seconds hand (not shown) rotates. An end 20b of the fourth wheel and pinion 20 is determined by an end 19b of the centre wheel and pinion 19. Since the centre wheel bridge 6 serves also as a guide for assembling the gear train it is provided with guide holes 6a, 6b, 6c, having a minimum clearance with respect to the respective part of the gear train and bevelled surfaces 6d, 6e to aid assembly of the gear train. The bearings are also bevelled because during assembly the parts of the gear train may lean at an angle to the vertical. Locating members 10d, 13d sandwich the centre wheel bridge 6 and the assembly is retained by bridge screws 21, 22 and the respective sleeves 17, 18. As a result, the gear train is rigid and is resistant to external forces tending to distort the plate 10. The centre wheel and pinion 19 has a centre wheel 10c and a pinion 19d frictionally secured to each other in order that force is not transmitted to a stepping motor when the minutes wheel 16 is rotated by a clutch wheel 54 of a setting mechanism described in detail hereinafter, when hands (not shown) of the

timepiece are set.

The stepping motor is best seen in Figure 3 and has a rotor 25 rotatably supported by jewel bearings 23, 24 provided in the plastics portion 9 of the bottom plate 10 and in the plastics portion 12 of the bridge 13, a stator 27 located by sleeves 26, 17 for bridge screws 37, 21 respectively, a coil 29 located by sleeves 26, 28 for bridge screws 37, 36 respectively, and a magnetic shielding plate 30. As well known, the rotor 25 of the stepping motor is rotated through a predetermined angle by a driving signal applied to the coil 29 each second. In this embodiment, the bearing 24 has a oil storage recess 24a facing the rotor which makes it possible to insert the rotor easily by utilising the sliding surface of the recess 24a. The bearings 23, 24 are forced into stepped holes in the plate 10 and in the bridge 13 respectively so as not to slip out of position during assembly. The stepped holes are provided with bevelled surfaces 10e, 13e respectively for oiling. The bearing 24 is driven into the stepped hole in the bridge 13 until its top surface is substantially co-planar with the top surface of the metal portion 11 of the bridge. Thus it is possible to prevent the bearing from being dislodged if the plastics portion 12 is distorted by creep.

The coil 29 consists of turns of thin conductive wire 32 wound on a magnetic core 31, the ends of the conductive wire being connected to a coil plate 33. The coil plate 33 is

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electrically connected to an output terminal of a circuit block 34 adjacent the sleeve 28. As shown in Figure 3, the sleeve 28 is formed, for example, by a knurling tool to have a portion 28a so that it can be force fitted into the plate 10 and can be removed by pulling it in the direction of the bridge 13. When tightened, the bridge screw 36, even though the thickness of the stator 27, the magnetic core 31, the coil lead plate 33, and the circuit block 24 may differ from desired thicknesses due to manufacturing tolerances, the sleeve 28 may be lifted from the hole in the bottom plate 10 so that the parts of the stepping motor such as a stator 27 can be firmly secured between the collar 28b of the sleeve 28 and the magnetic shielding plate 30 and the metal portion 11 of the bridge 13. The sleeve 26 is used to secure the plastics portion 9 of the plate 10, the stator 27 and the magnetic core 31 together, a plurality of projections 10g being formed on the plate 10 in order to take account of manufacturing tolerance to prevent the generation of gaps between the parts. When tightening the bridge screw 37, the metal portion 11 of the bridge 13 is bent until it engages the sleeve 26 and the projections 10g, which are preformed to be slightly longer than necessary, are deformed to prevent the generation of gaps between the stator 27 and the magnetic core 31.

Referring now to Figures 2 and 5, the circuit block 34 comprises a thin plastics plate on which a quartz crystal vibrator 30 and a MOS integrated circuit 41 is provided and is

located by the sleeve 28 and the bridge screw 36 between plastics portions 9, 12 of the plate 10 and the bridge 13 respectively.

Time accuracy is regulated by selectively breaking logic regulation wiring 39a, 39b of the MOS integrated circuit 41.

- 5 Time accuracy of a quartz crystal vibrator can alter if it is subjected to a severe shock. As shown in Figure 5, the quartz crystal vibrator 40 is held between a plastics portion 10i of the plate 10 and a recess 13f of the bridge 13. The quartz crystal vibrator is disposed adjacent the outer periphery of the plate 10.
- 10 As the result, the plastics portion 10i is deformed to engage the quartz crystal vibrator so that there is no gap and it is securely held. Thus, the quartz crystal vibrator 40 has good shock resistance.

- As shown in Figure 4, the end of a reset lead plate 42
- 15 resiliently contacts with a reset pattern portion 39c (Figure 2) of the circuit block 34. The lead plate 42 is located by pins 10m, 10n of the bottom plate 10, and held between those pins and the bridge 13. One bent end of the reset lead plate 42 is in contact with a contact portion 53c of a yoke 53 and is earthed
- 20 upon operation of a winding stem 50 in order to reset the circuit block 34 when setting the hands of the timepiece. A portion 42a of the lead plate contactable with the yoke is usually in contact with the gear train. So the bending angle need not be particularly accurate and it is possible to locate accurately the portion 42a
- 25 by bending it a little more than actually required. As the result,

it is possible to reset the circuit block 34 at a desired timing by operation of the winding stem.

As shown in Figure 6, one end of a battery lead plate 43 resiliently contacts with the negative side of a battery 44.

5 The other side of the battery lead plate 43 is fitted on guide pins 10h, 10g of the plate 10 and the bridge 13 to be in contact with a negative electrode of the circuit block 34. A positive lead terminal 45 is secured by a screw 35 (Figure 2) and resiliently contacts a positive terminal of the circuit block.

10 The winding stem 50, best shown in Figure 5, has a base portion 50a rotatably supported by the plate 10 and a pointed end 50b is rotatably held in a horizontal aperture 11a formed by bending the metal portion 11 of the bridge 13. Conventionally, a horizontal aperture has been formed in a metal plate for guiding
15 the winding stem. This has the disadvantage that the aperture has to be formed by a thin drill which wears rapidly and so manufacturing cost is increased. In this embodiment of the present invention an aperture to guide the winding stem is formed in the metal portion 11 of the bearing plate by a pressing
20 operation and is subsequently bent. As a result, it is possible to keep cost to a minimum.

A setting lever 51 interlocked with the winding stem is rotatable about the axis of a pin 52 which is rotatably supported in the plate 10. The yoke 53 has a click or ratchet portion 53a.
25 When the ratchet portion 53a is engaged with the setting lever 51,

the yoke is interlocked with the setting lever, with a plastics pin 10j of the plate 10 as the axis of rotation. The yoke also has a setting portion 53b engageable with the fifth wheel and pinion 14 and the contact portion 53c engageable with a reset terminal. The setting lever and the yoke move in the space between the plate 10 and the bridge 13.

A clutch wheel 54 has a tooth 54a engageable with the minutes wheel 16, a tooth 54b engageable with a date dial 62 and a tooth 54c engageable with a day corrector 60. The clutch wheel is interlocked with the yoke 53.

The minutes wheel 16 comprises a pinion 16a and a toothed wheel 16b, and is rotatably supported between the plate 10 and the bridge 13. An hours wheel 55 made of plastics material has a toothed portion 55a engaged with the pinion 16a, and a toothed portion 55b engaged with a day/date driving wheel 61. The hours wheel is guided by the stem portion 13c which is made of plastics material. Thus, since the hours wheel 55 is guided by the stem portion without touching the centre wheel and pinion 19, it is possible to restrain any components which would cause swinging of the hands of the timepiece. Furthermore, since the plate 10 and bridge 13 receive directly the force produced by thrust of the seconds hand, distortion of the gear train bearings etc. can be prevented.

A setting lever spring 56 (best seen in Figure 6) comprises a resilient portion 56a for holding down the setting lever 51 and

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a resilient portion 56b in contact with the side of the battery
44 to act as an electrical contact. Positive potential is thus
fed to the terminal 45 through the metal portion 11 of the
bridge 13. The setting lever spring 56 is located by plastics
5 pins 13g, 13h formed in the bridge 13 and secured to the plate 10
through the bridge by a screw 38. One end of the setting lever
spring 56 is provided with raised portions 56c, 56d whereby its
strength is improved and the reliability of contact with the
battery is also improved. More particularly, the strength in the
10 horizontal direction is increased by providing the raised portions
56c, 56d and it is possible to prevent floating of the setting
lever spring caused by forces exerted on it by contact with the
battery. As a result, the reliability of the electrical connection
between the setting lever spring and the metal portion 11 of the
15 bridge 13 is increased, and stability of contact pressure between
the setting lever spring and the battery is increased.

Referring now to Figures 5 and 8, a calendar mechanism is
placed between the bridge 13 and a dial 70. The calendar mechanism
comprises the day corrector 60 guided by plastics pins 13i, 13j
20 forming part of the bridge 13. The day corrector is biased to a
rest position by a reset spring portion 60a. An engaging portion
60b of the day corrector engages the tooth 54c of the clutch wheel
54. An engaging portion 60c engages with a day star and is
reciprocated about pins 13i, 13j by operating the winding stem to
25 cause correction for advancing a day indication. The day/date

driving wheel 61 comprises a date finger 61a and a day finger 61b integral with one another. The day/date driving wheel 61 is engaged with the hours wheel 65.

5 The date dial 62 made of metal, rotates along a plastics guide surface of the bridge 13. Since the date dial is moved over this plastics guide surface friction is reduced so it is possible to eliminate conventional problems such as retarding or stopping of the timepiece during advancement of the date indication. This advantage contributes to increased reliability.

10 A date dial guard 63 consists of a date jumper spring for controlling movement of the date dial 62 in the horizontal direction and a date dial guard portion 64 fixed to the date jumper spring by means such as a caulking chisel. The date dial guard is guided on pins 13j and 13m on the bridge 13 and is fixed to
15 the plate 10 through the bridge 13 by screws 21, 22.

A day star 65 with a dial disk 66 is guided by a portion 63a (Figure 3) of the date jumper spring 63 and is actuated in well known manner by a snap for the day star. The portion 63a of the date jumper spring is off-centred from the centre of the
20 timepiece.

Since the day star is guided by the portion 63a of the date jumper spring, the radial force on the day star is not transmitted to the hours wheel 55. In the conventional construction for guiding a day star, the hours wheel is subjected to a radial
25 force on the day star so that there are various quality problems

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such as the timepiece stops if the hours hand touches the dial or the minutes hand. On the other hand, this illustrated embodiment of the present invention overcomes such problems.

As described above, each part is simplified and the same or a greater number of functions than conventional can be achieved using a smaller number of components. Furthermore, it is possible to assemble the timepiece in one direction, and this is effective for reducing the number of assembly steps and ease of repair.

In Figures 2, 5 and 8, a first position of the winding stem 50 is shown and in Figure 7 a second position of the winding stem is shown. As shown in Figure 8, in the first position of the winding stem, the ratchet portion 53a of the yoke 53 and the setting lever 51 are interlocked, the tooth 54a, the tooth 54b and the tooth 54c of the clutch wheel 54 are not engaged with the minutes wheel 16, the date dial 70 and the day star 65 respectively. thus the hours wheel is not rotated with rotation of the winding stem.

Next, a calendar setting operation where the winding stem is pulled out by one step will be described. When the winding stem is pulled out by one step, the setting lever 51 and the yoke 53 are actuated in well known manner, an end 53d (Figure 4) of the yoke contacting with a plastics pin 10m of the plate 10 to determine the position of the hours wheel (shown in Figure 2).

In this embodiment the tooth 54b of the clutch wheel 54 and the date dial 62 are meshed and the tooth 54c of the clutch

wheel and the day corrector 60 are meshed (shown in Figure 3). Thus rotation of the winding stem 50 in the clockwise direction causes the date dial to rotate in the counter clockwise direction to effect correction of the date indication. Though the tooth 54c of the clutch wheel is also engaged with the day corrector 60 when the latter is given an upward force (shown by arrow Z in Figure 7), the tooth 54c is released from engagement with the day corrector 60 by virtue of the shape of the slanting surface of the tooth and the resilient portion of the day corrector to prevent movement of the day corrector.

Next rotation of the winding stem in the counterclockwise direction causes the engaging portion 60c of the day corrector 60 to engage with the day star 65 whereby correction of the days indication is performed. When the engaging portion 60b of the day corrector is out of the locus of motion of the tooth 54c of the clutch wheel, the day corrector is returned to its normal position by a reset spring. Though tooth 54b of the clutch wheel is also engaged with the day corrector, the date dial 62 is removed in the direction indicated by arrow Y shown in Figure 8 by the slanting surface of the tooth 54b and the shape of the rear surface of the date dial. As a result, the tooth 54b is released from engagement with the date dial 62 to prevent the date dial from rotating in the clockwise direction. In this embodiment, the date dial is moved in a horizontal direction but there is no contact between the date dial and the day star 65. This is because

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the day star is off centre in the direction to which the date dial is moved with respect to the centre of the timepiece.

Next, advancement of the day and date indications is described. Conventionally various constructions have been proposed for advancing the day and date indication in a timepiece. However, these constructions have a large number of components and are complicated and unreliable so that there are various disadvantages such as damage of parts.

In the illustrated embodiment of the present invention, the day finger 61c and the date finger 61d made of plastics material are provided. The day and date fingers are bent so as to be outside of the locus of motion of the date dial 62 and the day star 65 during advancement of the date indication. Therefore, there is no disadvantage at all.

During the advancement of the day indication, the engagement between the date dial 62 and the tooth 54b of the clutch wheel is released. As a result there is no force generated for turning back the day indication.

When the winding stem 50 is pulled out by a further step, the tooth 54a of the clutch wheel is engaged with the minutes wheel so that the hands can be corrected.

The minutes wheel 16 comprises the pinion 16a having upper and lower guiding pivots and the toothed wheel 16b is rotatably supported by the plate 10 and the bridge 13 as described above.

Therefore, it is possible to reduce the swing or oscillation of

the toothed wheel of the minutes wheel 16 compared to that of conventional constructions wherein the length of guide contact is shorter. As a result, the engagement between the toothed portion 54a of the clutch wheel and the toothed wheel 16a of the minutes wheel is stabilised. Thus it is possible to prevent the gear train from being displaced during rotation of the hands. Further, since the minutes wheel, as well as the gear train, are rotatably supported by upper and lower pivots between the plate 10 and the bridge 13, loss of torque due to friction is reduced compared with the conventional construction. Thus a timepiece of extremely good quality may be constructed.

According to this invention, the sliding parts, day corrector 60, the date dial 62, the day/date driving wheel 61, the yoke 53 and the setting lever 51 etc. make the most of the properties of plastics material used for the plate 10 and the bridge 13 such properties being low coefficient of friction and the ability to be shaped exactly as desired. A contact portion is provided only where sliding movement occurs to reduce friction.

The timepiece illustrated in the drawings comprises a bottom plate 10 and a bridge 13 of plastics material reinforced with metal and the use of plastics material improves manufacture, assembly and reliability. Further it is possible to provide a timepiece wherein each part from gear train to calendar mechanism can be assembled from one direction. As a result, the cost of manufacturing the plate 10 and the bridge 13, which is a large

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part of the cost of a conventional timepiece, can be reduced significantly. Further, automatic assembly starting from the plate 10 and proceeding to the gear train to the calendar mechanism and the case is achieved, consequently mass production of low cost analogue timepieces is possible. Moreover, since only the calendar mechanism is disposed between the bridge 13 and the dial 70, even in the case of non-calendar timepieces, there is no necessity to change parts. Thus there is the advantage that the same parts can be used for various types of timepieces. Moreover, the back of the plate 10 (the opposite side with respect to the side to which parts are interposed) is made flat and no guiding jig for inserting parts is required and there is no recessed and convex portions so that fine external appearance of the timepiece can be achieved.

Referring to Figures 9 to 11, the plate 10 is shown in greater detail. As mentioned heretofore, the plate 10 has a plastics portion 9 made of a synthetic plastics resin and the metal portion 8 to give rigidity to the plastics portion. The locational accuracy of various parts, namely the bearings and the guide pin holes of the gear train and so on is determined by raised and recessed elements of the plastics portion 9. To achieve locational accuracy of the various holes and pins irrespective of shrinkage during moulding, the plastics portion 8 is separated into regions, namely a gear train region A, a setting mechanism region B, a circuit region C, a motor region D and a battery region E, these

regions roughly corresponding to the main functional blocks of the timepiece shown in Figure 1. In addition, the plastics portion is separated as much as possible also in the respective functional blocks as shown by the broken line in Figure 9.

5 This separation can be achieved by making a separating slot 1C thin-walled and by exposing the metal portion 8 as shown by the shading in Figures 9 and 10.

As is already known, when moulding with synthetic plastics resin, a moulding tool which is shaped as the mirror image of the product to be made, is used. In this embodiment of the present
10 invention, the metal portion 8 is clamped in a desired position in the moulding tool by the exposed portions of the metal portion 8 and at the same time locational accuracy of the completed plate 10 can be obtained by preventing the metal portion 8 from deforming
15 by injecting the synthetic plastics material into the mould at high pressure. It is desirable that separating slots 1C are opposite and in substantially the same form holding the metal portion therebetween. However, in this embodiment, as shown in Figure 2, the obverse is thick-walled and the reverse is thin-
20 walled. Thus partial slots 1D, 1E, 1F (Figure 10) positioned to hold the metal portion 8 therebetween and corresponding to the separating slot 1C are used and a similar effect can be achieved.

In addition, the plan position of the gear train region is very important. For example, in the case of a wristwatch, its
25 gear train is very small, i.e. about 0.03 mm to 0.1 mm and it is

easy that engaging efficiency of the gear train is reduced and it fails to rotate due to dispersion of centre distance.

The allowable value of dispersion or tolerance of the centre distance is about 0.02 mm.

5 In the gear train region, pivot bearing holes 1G, 1H etc. and a guiding pin hole 1K of the gear train bridge are composed of plastics material and the metal portion 8 is positioned in the vicinity of the holes, so more certain positioning is achieved. It is very advantageous to guide the metal portion by the plastics

10 moulding tool and to increase the dispersion factor of locational accuracy by using both the metal portion and the plastics material. In addition with respect to cost there is no sense in applying plastics material if processing the metal plate. Moreover, in this invention it is possible to make the bearings non-oiling by

15 making them of plastics material and a stable timepiece can be provided. Locational accuracy of the rotor can be obtained by forming a supporting hole for the jewel bearing 23 with plastics material in the same way as the bearing hole 1G etc. and by positioning the jewel bearing in the same plane as the metal

20 portion 8. Then the sleeve 26 for the bridge screw 37 is guided by the plastics material in the same way as the bearing holes. To prevent the sleeve 26 from biting into the plastics portion it has a collar 26a which is in direct contact with the metal portion 8. This collar may be knurled or chamfered to prevent

25 the sleeve 26 rotating with the bridge screw 37.

The plastics portion 8 is preferably made of a material whose coefficient of thermal expansion and mould shrinkage factor are relatively low. The plastics material may be, for example, polycarbonate, polyphenylene oxide, polyphenylene sulphite or polyacetal. Moreover various resins with fluorine plastics are appropriate in order to obtain non-oiling bearings.

The method described above of making the plate 10 is also applicable to the bridge 13.

As stated above, the plate 10 has raised and recessed elements formed with plastics resin on the metal portion 8 and the plastics portion 9 is divided in accordance with the main functional blocks of the timepiece. Therefore, dispersion of centre distance of bearing holes etc. can be made small.

In addition warpage may be reduced by forming the block divided portion in the manner that the metal portion is exposed. So a wristwatch having a stable quality can be obtained. Moreover, with respect to the bearing holes etc. their accuracy is improved by using the metal plate and by forming all of them of plastics material. Then the non-oiling bearing etc. can be produced.



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CLAIMS

1. A timepiece comprising: a first frame and a second frame, a gear train, circuitry and a setting mechanism being located between the first and second frames; a dial; and a calendar mechanism located between the dial and the second frame, the first and second frames being secured by screw means from the side of the second frame adjacent to the dial.
2. A timepiece as claimed in claim 1 in which the gear train comprises an intermediate bridge disposed between the first and second frames, a centre wheel and pinion located between the intermediate bridge and the second frame, and a fourth wheel and pinion located between the intermediate bridge and the first frame.
3. A timepiece as claimed in claim 2 in which the first frame comprises a metal portion reinforcing a plastics portion, the fourth wheel and pinion being guided in the radial direction by the plastics portion and in the thrust direction by the metal portion.
4. A timepiece as claimed in any preceding claim in which the second frame has a plastics portion reinforced by a metal portion.
5. A timepiece as claimed in claim 4 in which the gear train includes a minutes wheel rotatably supported by the first and second frames, and an hours wheel engaged with the minutes wheel, the plastics portion of the second frame including a stem for supporting the hours wheel.
6. A timepiece as claimed in claim 4 or 5 in which the setting

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mechanism includes a winding stem guided by an exposed part of the metal portion of the second frame.

7. A timepiece as claimed in any preceding claim in which the calendar mechanism includes a day star off-centre with respect to the centre of the timepiece and guided by a guide plate of a date dial or date jumper lever, a snap for the day star being attached to an hours wheel.

8. A timepiece as claimed in claim 1 in which the first and/or second frame has a metal portion reinforcing a plastics portion, the plastics portion having raised and recessed portions, the plastics portion having separate regions for the gear train, circuitry and setting mechanism.

9. A timepiece as claimed in claim 8 in which said regions of the plastics portion are separated by exposing the metal portion.

10. A timepiece as claimed in claim 8 or 9 in which holes for the gear train are formed in the plastics portion.

11. A timepiece as claimed in claim 10 in which a metal bush or jewel for a part of the gear train or motor is positioned so as to contact the metal portion.

12. A timepiece substantially as herein described with reference to and as shown in the accompanying drawings.

13. A timepiece comprising: a first frame and a second frame, the first frame comprising a metal portion reinforcing a plastics portion; a dial adjacent the second frame, the first and second

frames being secured by screw means from the side of the second frame



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adjacent to the dial; a calendar mechanism located between the dial and the first frame; and a gear train, circuitry and a setting mechanism located between the first and second frames, the gear train comprising a fourth wheel and pinion which is
5 guided in the radial direction by the plastics portion of the first frame and in the thrust direction by the metal portion thereof.