THE GMM SERIES OF MODERN SUPERMODELS

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Digital Clock

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Many Meccanomen are interested in clocks and timekeeping mechanisms in general. This model shows hours, minutes and seconds on four dials, and is powered by an 8-pole synchronous motor built entirely from Meccano and Elektrikit parts.

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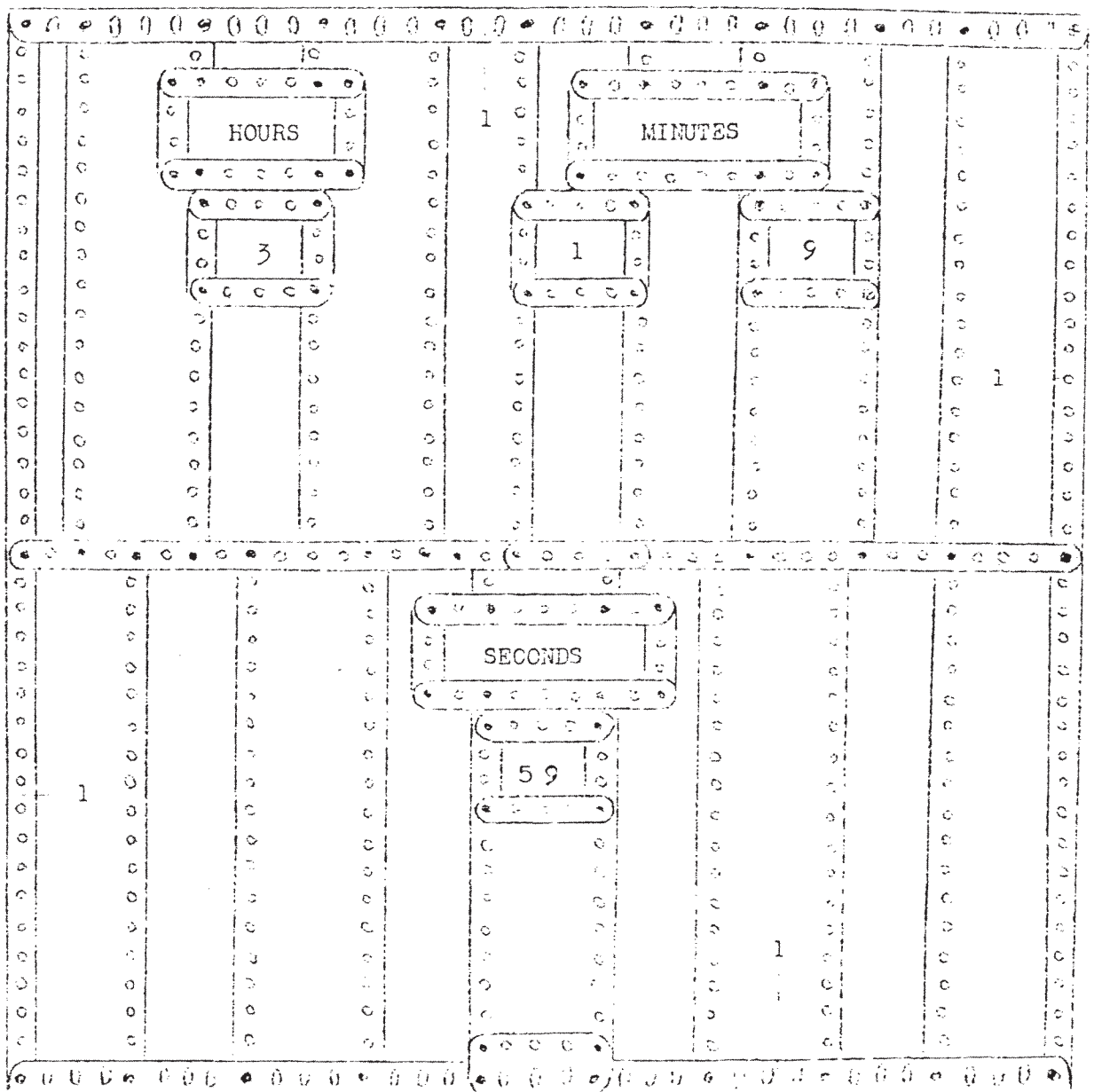FIGURE 1

Framework

The construction of the framework is seen in Figs. 1 and 8.   It consists
chiefly of 18½" angle girders 1 and 2 and 12½" angle girders 3.   Only the
front and sides are shown plated, but it is advisable to cover the top to pro-
tect the mechanism from dust ;   the back may be fitted with a hinged door for
the same purpose.   The plating for the front is shown in Fig. 1 above ;   the
plating for each side consists of nine 12½" x 2½" strip plates.   A stand of
suitable height, built of angle girders, is a useful adjunct.

Synchronous Motor

This is the heart of the mechanism and is seen in Fig. 2 on page 3.   The
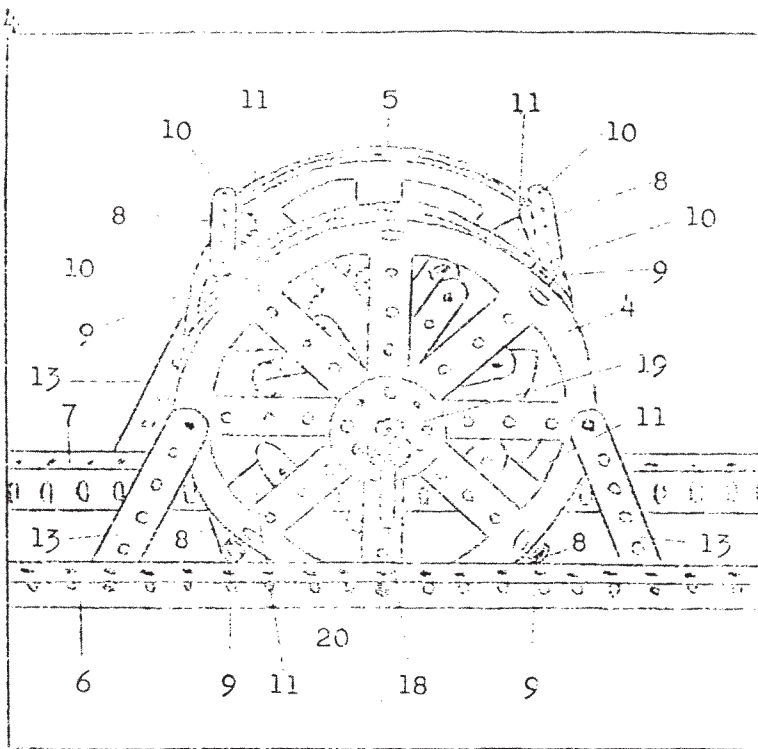motor side frames are hub discs 4 and 5 secured to two transverse 18½" angle

FIGURE 2

girders 6 and 7 (see also Fig. 8 on page 8). The hub discs 4 and 5 are joined by four 2½" strips 8, spaced from the discs by three washers 9 on each 3/2" fixing bolt 10. The electro-magnets are four Elektrikit cylindrical coils 11 with 1" cores ; each coil is secured by two 7/32" bolts to its 2½" strip 8, and 5/8" bolts, each with three washers, hold the cores. The three washers cause the cores to protrude about 1/8" from their coils ; this brings them nearer the armature poles. The coils may be wired in series (or opposite cores may be connected in series-parallel) to two terminals on the 2½" x 2½" insulating plate 12 (see Fig. 3 on page 8).

Four 2½" strips 13 bolted between the hub discs 4 and 5 and the girders 6 and 7 hold the discs rigid.

The armature is shown in Fig. 3. It is made by bolting eight 1½" strips 14 to each of two bush wheels 15, the ends of the strips being connected together by ¾" bolts 16, each of which carries twelve washers 17 to form the poles. The armature is carried on a 4½" rod 18 journalled in five wheel discs 19 on each of the hub discs 4 and 5, to form a solid bearing. Rod 18 carries a ½" pinion 20 spaced from the hub disc 4 by a suitable number of washers ; a collar (with washer) retains the rod at the other end. Care must be taken to see that the armature is as free as possible in its bearings and that its poles do not foul any of the protruding cores.

Reduction Gear

Fig. 4 on page 4 shows the gearbox, the sides of which consist of two 5½" x 3½" flat plates 21 and 22 bolted to four transverse 10½" angle girders 23, 24, 25 and 26 (see also Fig. 8 on page 8, in which girder 25 is not visible). The speed of a

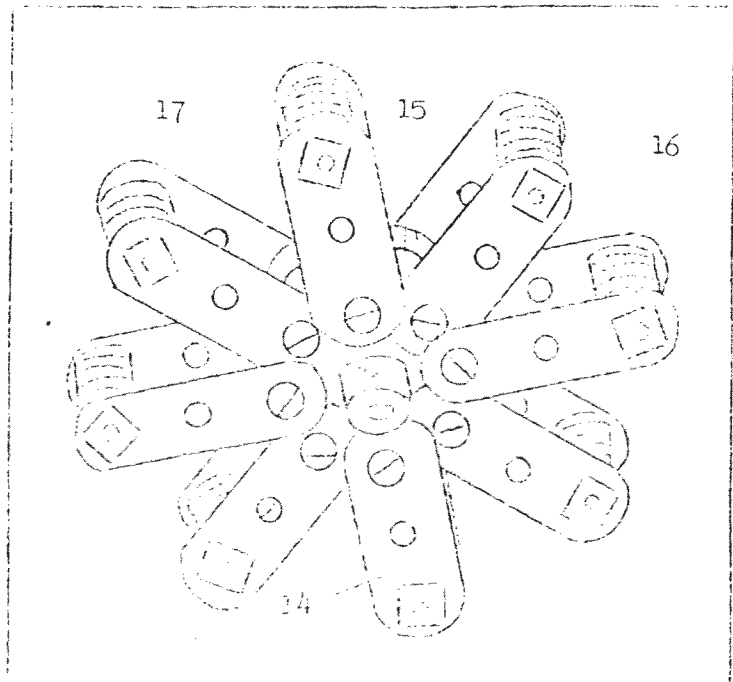FIGURE 3

synchronous motor is found by doubling the frequency of the A.C. mains supply
(a D.C. supply can of course not be used) and dividing this number by the
number of poles on the armature ; this will give the number of revolutions
per second.   For example, if the frequency is 50 cycles per second, then the
calculation is 50 x 2 = 100 ÷ 8 = 12½ ; thus the armature rotates at 12½
revolutions per second or 12½ x 60 = 750 revolutions per minute. Similarly,
if the A.C. frequency is 60 cycles per second, the armature will rotate at
15 revolutions per second, or 900 revolutions per minute.

As the disc indicating seconds must rotate once per minute, a reduction
of 750 : 1 is required (or 900 : 1 if the supply is 60 cycles).   This is
achieved by meshing the ½" pinion 20 on the armature shaft with a 2½" gear
wheel 27 on a 5½" rod 28 ;   rod 28 also carries a second ½" pinion 29 meshing
with a second 2½" gear wheel 30 on a 4" rod 31.   Rod 31 also carries a third
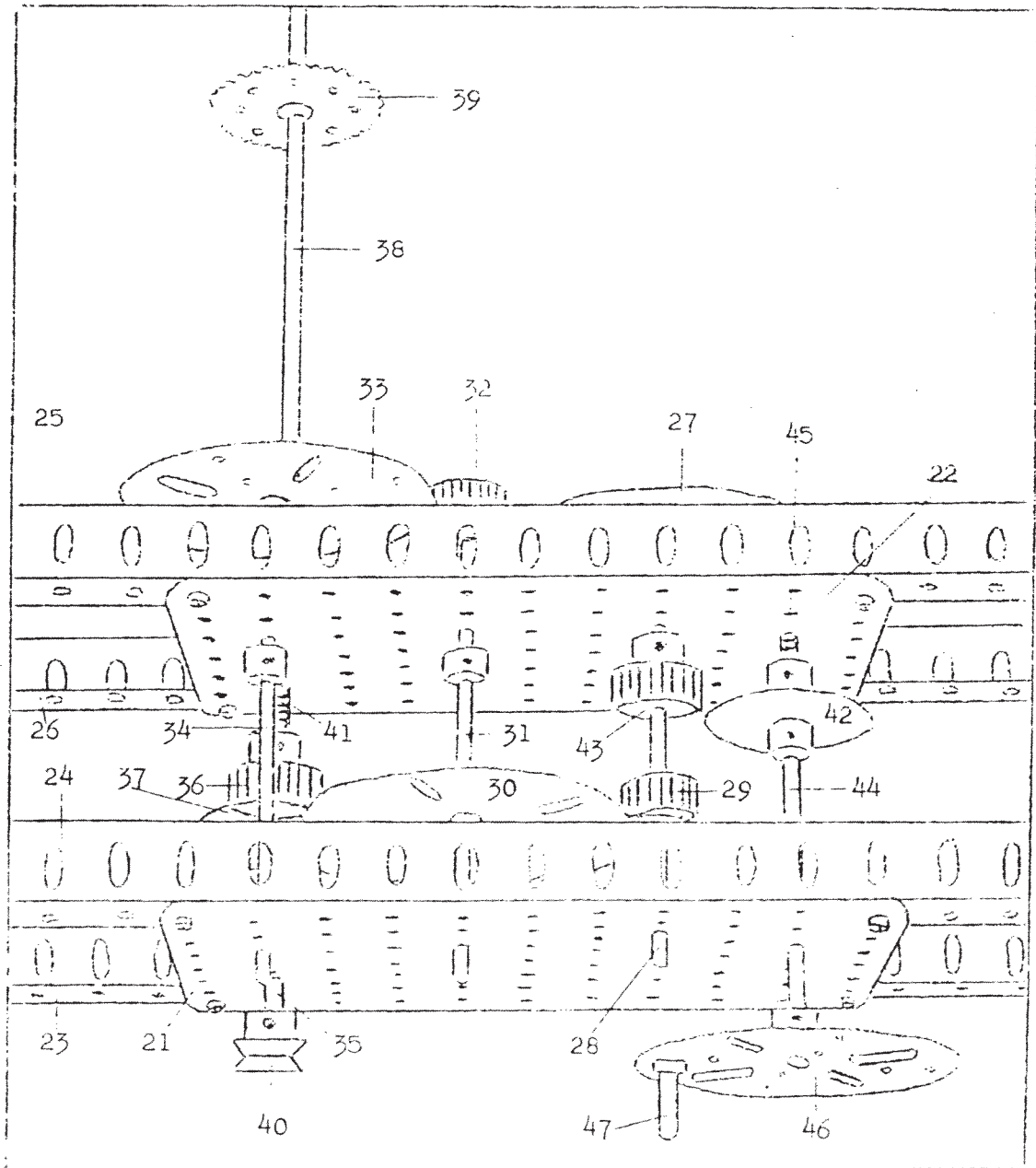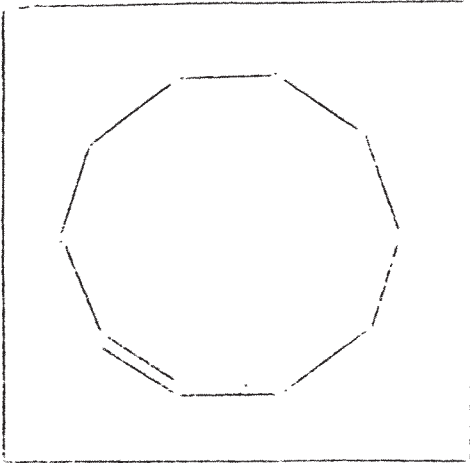

FIGURE 4

FIGURE 6

Also mounted on rod 73 is a 1" pulley with boss 77 fitted with a 1" tyre or rubber ring, a compression spring 78, a collar 79 and a second compound crank 80.

The compound crank 80 consists of a crank with a 3" strip bolted to it ; a short threaded pin 81 is fixed in the end hole of the 3" strip.   Crank 80 operates a second compound wheel like the first, that is to say, it consists of a 6-hole bush wheel 82 fitted with six $\frac{1}{2}$" x $\frac{1}{2}$" angle brackets with a short threaded pin 83 fixed in each.   This compound wheel is mounted on a $6\frac{1}{2}$" rod 84 which also carries a $\frac{3}{4}$" sprocket 85 driving by chain 86 a similar sprocket 87 on a $5\frac{1}{2}$" rod 88.   Rod 88 carries a 25-tooth pinion 89 which meshes with a 50-tooth gear wheel 90 on an 8" rod 91 ; rod 91 also carries a 1" pulley with boss 92 fitted with a 1" tyre or rubber ring and a compression spring 93.   This arrangement permits the hour disc 94 to rotate one twelfth of a revolution for each revolution of the tens of minutes disc ; it also provides reversal of the drive so that the hour disc revolves in the same direction as the other discs.   The hour disc 94 is a 4" diameter circular plate bolted to a bush wheel 95 mounted on rod 91.

The whole of the disc mechanism is mounted in two transverse $18\frac{1}{2}$" angle girders 96 and 97 (see also Fig. 6 on page 8).

Indicator Dials

Fig. 7 below shows the minute, tens of minutes and hour dials.   Each consists of a 4" circle of white card gummed or glued to the 4" diameter circular plates 62, 71 and 94.   The minute dial is divided into ten parts with a protractor ; the tens of minutes dial is divided into six parts by stepping off the radius into the circumference (see any elementary book on geometry) ; the hour dial is also divided into six parts which are then each bisected in turn to give twelve divisions.   The figures are either written by hand or the Letraset or other transfer method used.   The seconds dial is not shown,
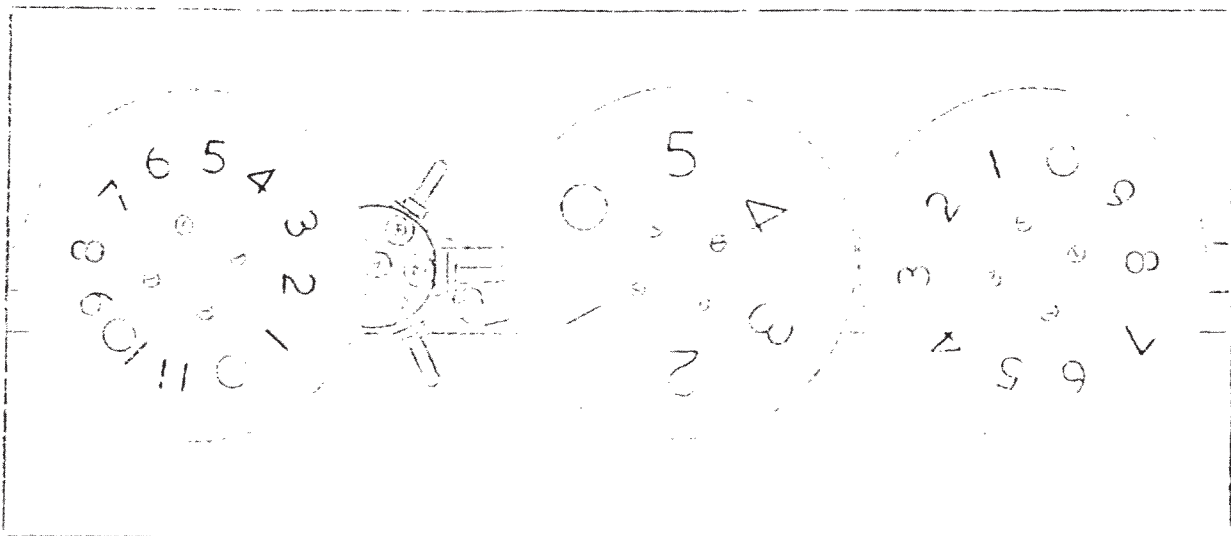

FIGURE 7

but it is similar to the other three ; the circumference is divided into
twelve parts, like the hour dial, but the markings are 0, 5, 10, 15, 20, 25,
30, 35, 40, 45, 50 and 55.

General.

A view of the rear of the model is shown in Fig. 8 below.   Note that
the two transverse 18½" angle girders 48 are bolted to the 12½" side support
angle girders 98 and 99 in the third and eighth holes (counting from the
clock face) respectively ; the two transverse 13½" angle girders 7 and 6 are
bolted to the 12½" side support angle girders 98 and 99 in the twelfth and
eighteenth holes (counting from the clock face) respectively ; the two
transverse 18½" angle girders 26 and 23 are bolted to the 12½" side support

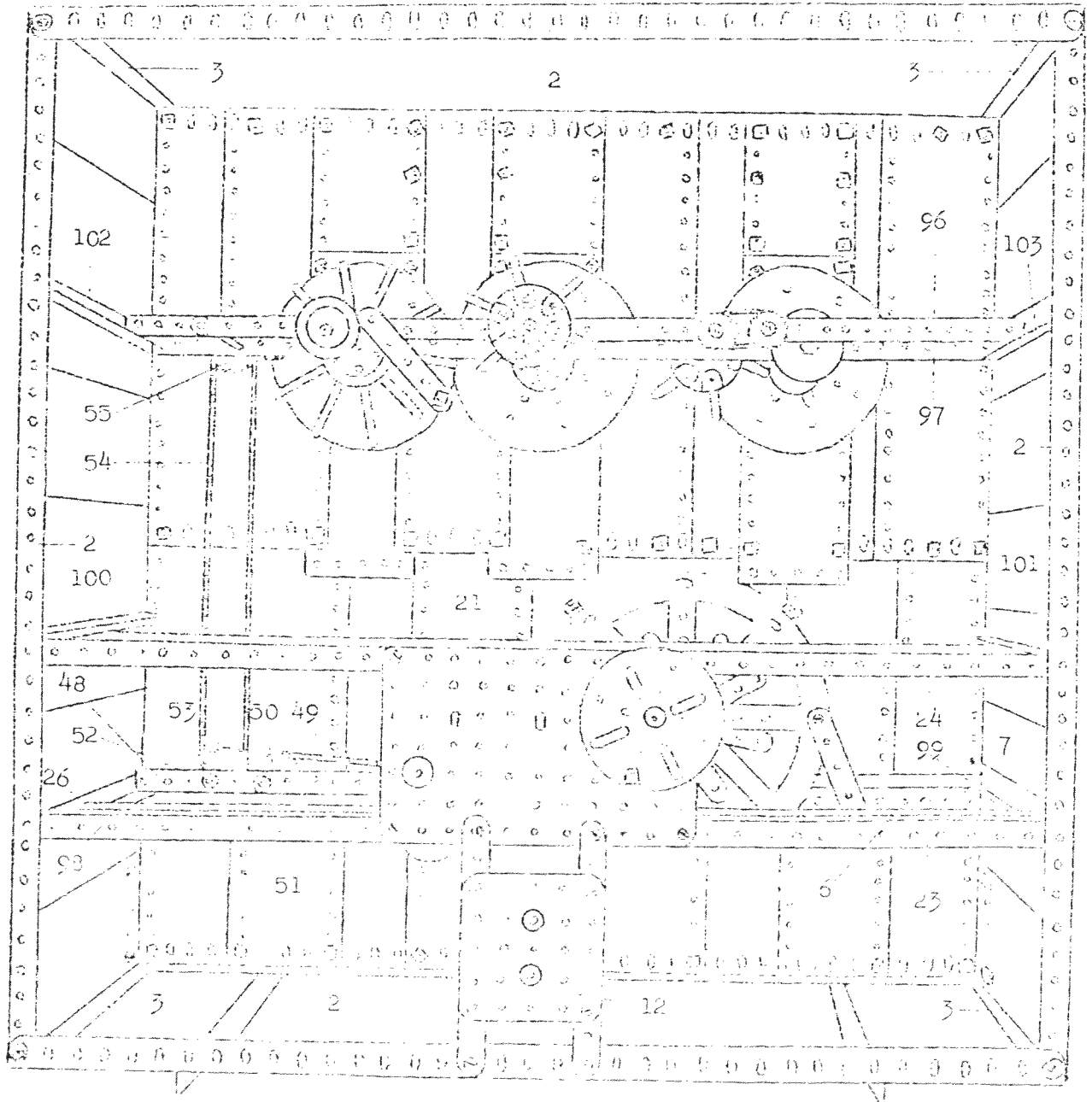FIGURE 8

angle girders 98 and 99 in the twentieth and twenty-fifth holes (counting from the clock face) respectively.

The two transverse 18½" angle girders 25 and 24 are bolted to the 12½" side support angle girders 100 and 101 in the twentieth and twenty-fifth holes (counting from the clock face) respectively.

The two transverse 18½" angle girders 97 and 96 are bolted to the 12½" side support angle girders 102 and 103 in the sixth and fourteenth holes (counting from the clock face) respectively. This arrangement allows ample room for the disc mechanism between girder 97 and the clock face.

If there is no objection to the dials rotating in different directions, the reversing gears may be omitted to simplify the gearing and allow a more compact mechanism.

Lubrication of all moving parts, especially the armature shaft, will be necessary.

PARTS REQUIRED

2 x 1a, 1 x 2, 6 x 2a, 2 x 3, 5 x 4, 14 x 5, 14 x 6, 16 x 6a, 18 x 7a, 10 x 8, 14 x 12, 4 x 13a, 3 x 14, 1 x 14a, 2 x 15a, 4 x 15b, 3 x 16, 3 x 22, 1 x 23a, 7 x 24, 10 x 24a, 2 x 24b, 3 x 25, 4 x 26, 3 x 27, 1 x 27a, 3 x 27c, 4 x 31, 317 x 37a, 247 x 37b, 315 x 38, 2 x 52a, 21 x 59, 3 x 62, 2 x 94, 2 x 95a, 4 x 96, 2 x 96a, 1 x 103f, 1 x 109, 8 x 111, 2 x 111a, 36 x 111c, 16 x 115, 10 x 115a, 2 x 118, 5 x 120b, 4 x 146a, 3 x 155, 4 x 190a, 1 x 191, 3 x 192, 15 x 196, 18 x 197, 1 x 511, 4 x 522, 4 x 528, 2 x 542. Connecting wires, card dials, and parts for top, hinged door and stand if required. Individual differences in constructional detail will naturally lead to modifications in the above list.

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