May 21, 1946. H. WHALLEY ET AL 2,400,860

RADIO RECEIVER

Filed Sept. 21, 1943 3 Sheets-Sheet 1

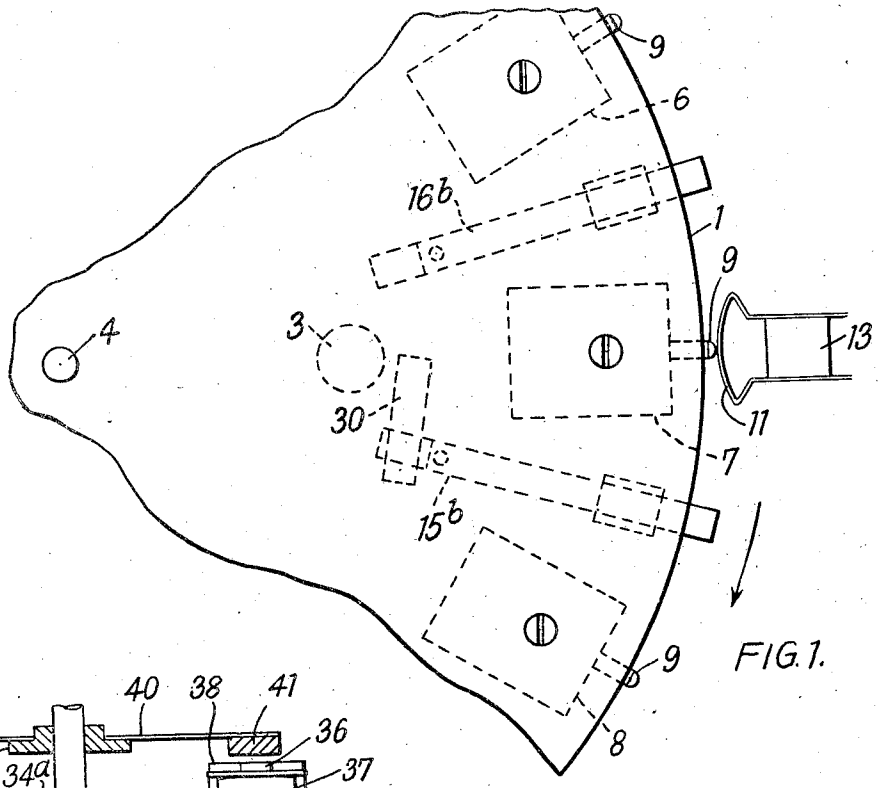


FIG. 1.

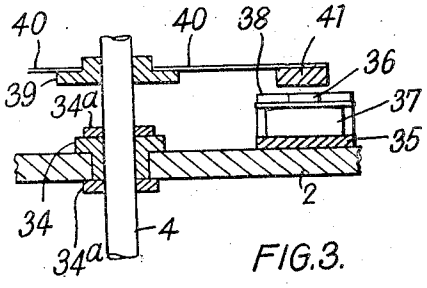


FIG. 3.

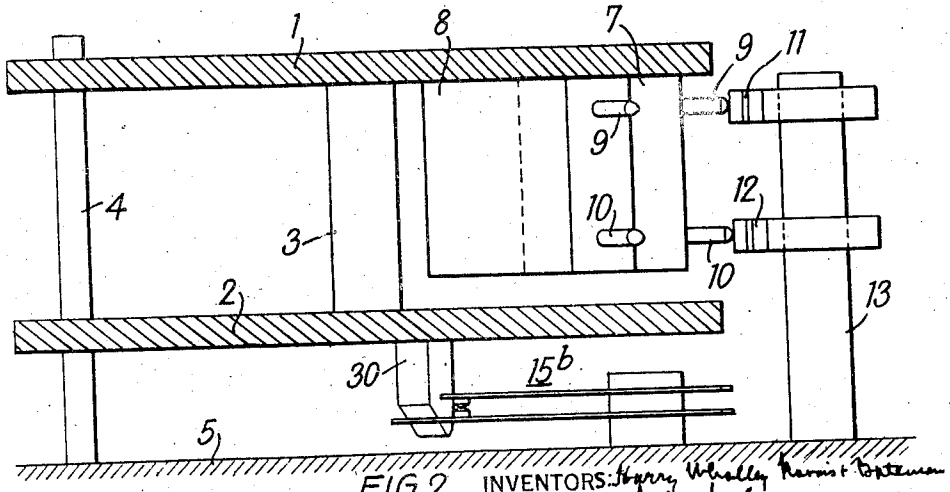


FIG. 2.

INVENTORS: Harry Whalley Harris Bateman
Graham John Scales

ATTORNEYS

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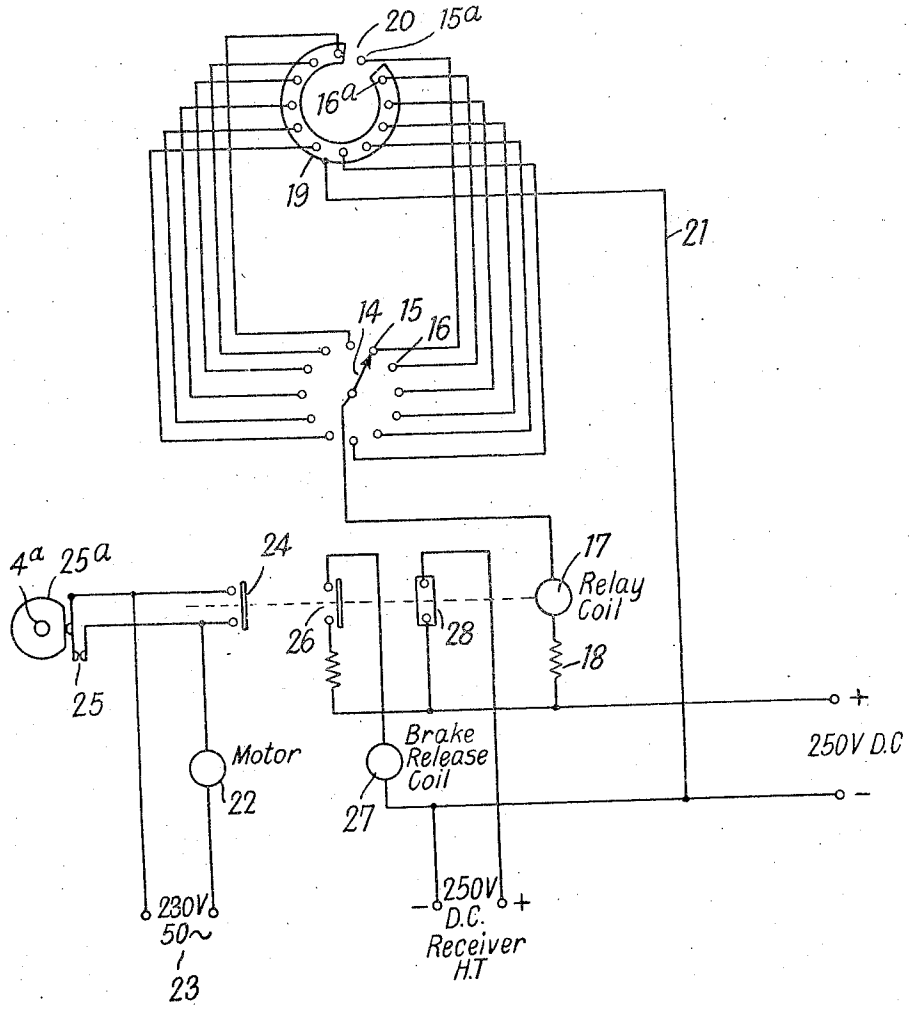


FIG. 4.

INVENTORS

Harry Whalley

Graham John Scales

By Martin Bateman

ATTORNEYS

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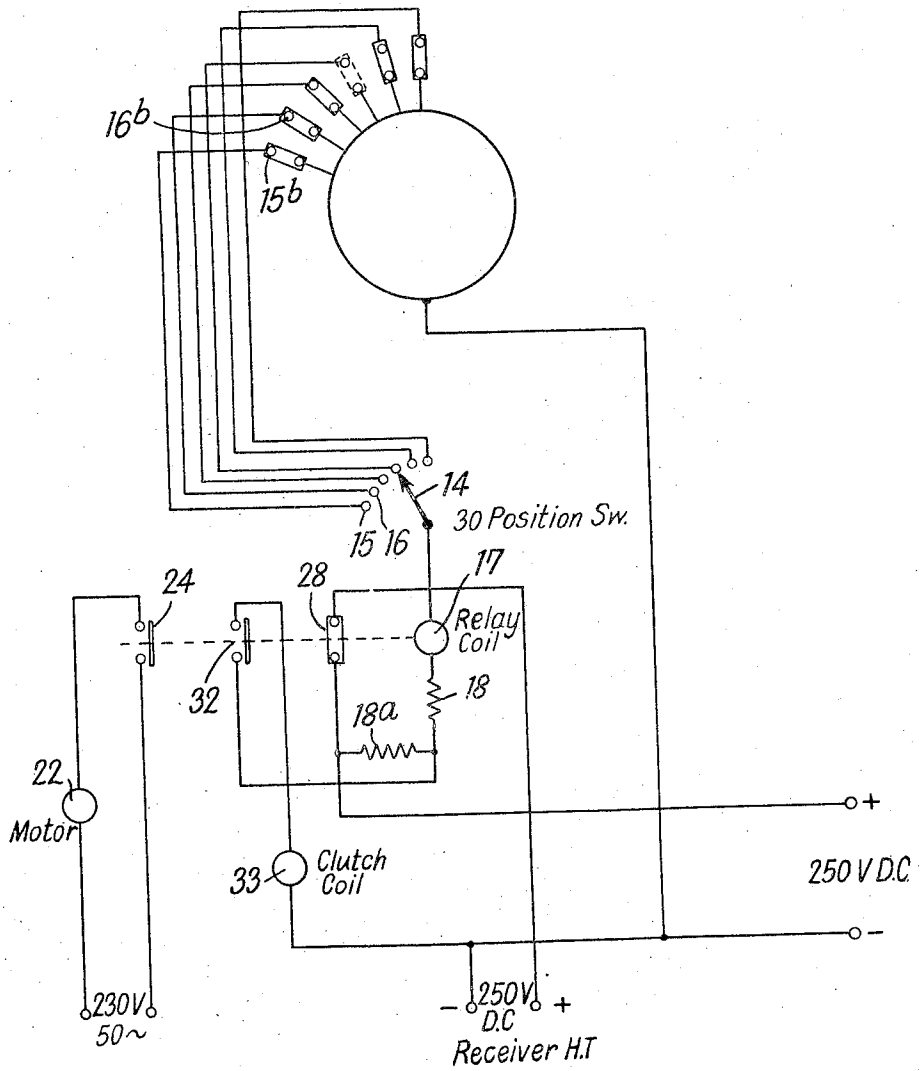


FIG. 5.

INVENTORS
Harry Whalley
Graham John Scales
By Norman L. Pittman
ATTORNEYS

Patented May 21, 1946 2,400,860

UNITED STATES PATENT OFFICE

2,400,860

RADIO RECEIVER

Harry Whalley, Darwen, and Graham John Scoles, East Sheen, London, England, assignors to Metropolitan-Vickers Electrical Company Limited, London, England, a company of Great Britain

Application September 21, 1943, Serial No. 503,274
In Great Britain August 8, 1941

1 Claim. (Cl. 250—40)

This invention relates to radio receivers and has for one of its objects to provide improved arrangements of multi-wave or multi-wave-band radio receivers of the kind wherein a considerable number of different wavelengths or wavebands can be expeditiously selected or searched in, respectively, by successively and/or selectively connecting the terminals of a plurality of different preset tuning condensers and/or inductances or other preset tuning means mounted on a carriage movable in relation to the co-operating terminals of a single set of fixed components comprising in particular valves such as some of the amplifying valves or the oscillator valve or valves and in some cases other devices such as the output indicating device or devices of the receiver; said carriage may be moved rectilinearly but is more conveniently in the form of a continuously rotatable member and is hereinafter for convenience and simplicity referred to only as the "turntable," but it is to be understood that the present invention as claimed includes within its scope as a mechanical equivalent a carriage reciprocated by a rotatable operating member and having the tuning means and their terminals mounted along it.

Heretofore, so far as we are aware, the "turntable" has been operated directly by the manipulation of a knob or the like with an associated dial indicating the wavelengths or wavebands, a spring loaded indexing device being provided for ensuring that the turntable is in proper position for the co-operating contacts to be mated at the different wavelengths or wavebands. When the arrangement is required to provide a relatively large number of wavelengths or wavebands, for example more than six, such manual operation is tedious and tardy especially since the spring loading of the indexing device must be heavy for ensuring the requisite accuracy in the location of the turntable for obtaining precision in tuning, particularly on short wavelengths.

So-called press button tuning has been in common use inter alia in domestic radio receivers, usually comprising motor operated switches or motor driven condensers or both, but such arrangement is not satisfactory where there are many wavelengths or wavebands to be selected, such as from twenty to thirty, for which the present invention provides an arrangement easy to operate, rapid and yet silent in operation and giving precision in indexing.

The present invention is notably but not exclusively applicable to so-called "Panoramic" radio receivers the nature of which was described in "Electronics" June, 1940, and wherein, in brief, a particular waveband or it may be any selected one of a plurality of particular wavebands is continuously scanned from end to end by the automatic variation of a tuning parameter at a rate comparable with the frequency of the persistence of vision, the output or outputs due to any received radio transmissions which may be taking place within the waveband being indicated as resonance or "peak" components perpendicular to a time base waveband component on the screen of a cathode ray tube, the time base component being provided synchronously with the scanning such as by means of a saw tooth type of generator. Provision can be made whereby any selected one of the thus indicated transmissions can be tuned into fixedly and its detected modulation listened to or recorded or otherwise indicated or dealt with. In such a panoramic receiver it has been convenient, for the purpose of the rapid scanning of the waveband, to "wobble" the value of certain tuning components of a frequency changer valve, preferably a second frequency changer of a superheterodyne circuit, whilst to change the scanned waveband it would be convenient to switch-in selectively to a preceding frequency changer, the different tuning elements therefor, for example the main tuning condensers thereof. This switching, particularly if there are many bands, for example twenty or thirty, to be scanned, would involve difficulties and complications (arising particularly by reason of the mass of the turntable) which the present invention minimises or reduces.

According to the invention the several different tuning elements aforesaid of fixed or preset value, or sets thereof, are mounted on a "turntable" and each provided with respective sets of terminal contacts adapted, when the turntable is moved, successively to engage appropriate "fixed" contacts, the turntable being driven by a motor whilst means are provided to ensure that the co-operating sets of contacts when engaged in fixed position are in accurate register as is necessary in the interest of good electrical connection and of avoiding positional inaccuracies which may impair tuning precision, especially on very short wavelengths.

Preferably the turntable motion is effected by a selective remote control type of means such as will avoid undue shock. To this end the turntable is rotated through reduction gearing by a small unidirectional or reversible electric motor, whilst the remote controlled register effect is

automatically obtained in either of the following ways:

(*a*) By the use of the modified Geneva stop mechanism forming the subject of U. S. application Ser. No. 503,275, filed September 21, 1943, or

(*b*) By declutching the motor from the turntable and preferably de-energising the motor, such as in the manner hereinafter described. In respect of this feature of the invention, it will be appreciated that the rotor of the motor, although it may be a small one and may have little mass, has considerable momentum. In either case *a* or *b* the control is preferably of a per se known preselector type, that is to say, wherein by setting by hand a pointer on the front of the receiver panel to any selected one of the plurality of wavelengths or wavebands given on a dial, the turntable is automatically rotated until the corresponding tuning element thereon is in accurate corresponding register, the motor energising circuit being opened. Thus the manual pointer may carry a rotatable switch arm co-operating with a plurality of circularly distributed contacts wired to respective normally closed fixed switches distributed around the turntable and opened successively by a cam on the latter. Instead of these latter switches, there may be a circle of fixed contacts engaged by a circular brush contact carried on the turntable and having a gap in it.

In case *a* aforesaid the modified Geneva stop mechanism arrests the turntable precisely in the preselected position whilst the corresponding cam-operated switch or gapped brush contact de-energises the motor, and preferably brakes it in a manner per se known: an additional motor switch is preferably provided which may be operated by a cam or the equivalent on the driving shaft of the mechanism, the turntable having imparted to it a step-by-step movement, each step conveniently taking place in one second or less, and without shock or noise.

In case *b* there is no need to brake the motor since it is automatically declutched from the turntable. The clutch may comprise a plurality of compact electromagnets fixed to the turntable which is otherwise free on the driving shaft, these magnets co-operating with a magnetic annulus fixed to said shaft with axial resiliency. The coils of the electromagnets are supplied with current through slip rings and brushes.

In both cases *a* and *b* the motor switch is preferably operated through a relay at reduced voltage from the high tension current supply of the radio receiver and in order to economise in the current and in the transformer supplying it, said relay may have normally closed auxiliary contacts which open when the motor is energised so as to cut off the supply to the radio receiver during rotation of the turntable.

The turntable may carry sets of tuning condensers graded in accordance with U. S. application Ser. No. 503,279, filed September 21, 1943.

In the accompanying drawings:

Figure 1 is a plan view of part of the turntable arrangement in accordance with the invention,

Figure 2 is a sectional side elevation of the turntable part and accessories indicated in Figure 1,

Figure 3 is a fragmentary sectional elevation of a clutch through which the turntable indicated in Figures 1 and 2 is driven, according to one arrangement of the invention,

Figure 4 is a circuit diagram indicating one form of control arrangement by which the turntable is operated, and

Figure 5 is a circuit diagram indicating an alternative form of control arrangement by which the turntable is operated.

Referring first more particularly to Figures 1 and 2 of the accompanying drawings, the turntable comprises two discs 1 and 2 fixed together by spacers 3 and the turntable may either be mounted fast on a shaft indicated at 4 or may be loosely mounted thereon (as indicated in Figure 3) so as to be rotatable in relation to the fixed bed plate member 5 of the apparatus, the shaft being rotated through reduction gearing from a relatively small electric motor (not shown in Figures 1, 2 and 3 but indicated in the circuit diagrams, Figures 4 and 5).

Fixed around the periphery of the turntable disc 1 are the plurality of presettable fixed condensers (or other tuning devices) indicated by the rectangles of which three are shown at 6, 7 and 8. Each such condenser or other tuning device or combination of devices has two radially extending terminal contact pairs 9, 10 which upon rotation of the turntable are adapted to be brought consecutively into engagement with respective upper and lower fixed contacts 11 and 12 secured to the supporting pillar 13 fixed to the bed plate member 5. Each contact 11 and 12 is in the form of a spring bow as shown. And as hereinbefore indicated there is no spring loaded indexing device, accurate registration of each pair of contacts 9 and 10 with the contacts 11 and 12 being obtained either by *a* the modified Geneva stop mechanism per se forming the subject of application Ser. No. 503,275 aforesaid, or *b* upon the declutching of the motor as hereinbefore set forth and as will be hereinafter described.

When the registration of the turntable is effected by method *a* the control arrangement shown in Figure 4 is conveniently employed, whilst when the registration of the turntable is effected by method *b* the control arrangement shown in Figure 5 is conveniently employed. In either case, however, the turntable is constituted as so far described.

Referring next to Figure 4 of the accompanying drawings, at 14 is shown the contact arm of the manual preselector which is adapted on rotation of the knob consecutively to engage fixed contacts 15, 16, etc., arranged in a circular row. The arm 14 is connected through the coil 17 of a relay to the positive terminal of a source of electrical supply, which is conveniently the high tension supply of the radio receiver, a voltage dropping resistance 18 being provided as appropriate.

One of the discs 1 or 2 of the turntable has secured to it coaxial with the shaft 4 a circular contact brush 19 which has in it a gap 20. Co-operating with the gapped brush 19 are a plurality of fixed contacts 15*a*, 16*a*, etc., arranged in a circle and wired to the corresponding contacts 15, 16, etc. The gapped brush 19 is connected by the wire 21, such as through a slip ring to the negative terminal of the direct current supply aforesaid. The gapped contact brush 19 and co-operating fixed contacts 15*a*, 16*a*, etc., are not shown in Figures 1 and 2 of the accompanying drawings.

The motor which drives the turntable is shown in Figure 4 at 22 and it is adapted to be connected to a source of electrical supply 23, which may be alternating mains supply, by the normally open relay contacts 24 which are adapted to be closed upon energisation of the relay coil 17 which takes place in any new position of the manual switch

arm 14. Upon energisation of the motor the turntable is rotated until the contact 15a is within the gap 20 of the circular brush 19 whereupon the motor is de-energised by de-energisation of the relay coil 17, this causing the opening of the relay contacts 24. In parallel with the latter is the switch 25, the contacts of which are operated from the shaft 4a of the driving member of modified Geneva stop mechanism, by the cam 25a at each revolution of the turntable, the arrangement being such that whenever the relay contacts 24 are closed the motor 22 will be energised independently of the switch 25, whilst should the follower switch 19, 15a, 16a, etc., open somewhat too soon, such as by reason of mechanical imperfections, the switch 25 will ensure that the motor becomes de-energised at the correct position, whereat the modified Geneva stop mechanism has locked the turntable with the selected pair 9, 10 of contacts in correct register with the contact pair 11, 12. The relay carries further contacts 26 which are normally open but upon energisation of the relay coil 17 connect the coil or coils 27 to the electrical supply for removing mechanical braking from the motor. The "phasing" of the cam 25a on the shaft 4a, and the adjustment of the brake must of course be properly co-ordinated.

Preferably, furthermore, the relay carries further contacts 28 which are normally closed and which upon energisation of the relay coil 17 open the circuit or the high tension supply to the radio receiver with which the present invention is associated.

Referring now to Figure 5 showing in conjunction with Figures 1, 2 and 3 the alternative remote type of control arrangement, the manual contact arm 14 is adapted to co-operate as before with a plurality, for instance thirty, contacts 15, 16, etc., which are wired to the respective contacts of normally closed switches 15b, 16b, etc. of the cam-operated type. The cam which operates these normally closed switches is shown at 30 in Figures 1 and 2 and it will be evident that during the rotation of the turntable the series of cam-operated switches are opened in succession. As in the circuit shown in Figure 4, the arm 14 of the manual switch is connected through the relay coil 17 and through voltage dropping resistance 18 (with 18a in series) to the positive terminal of the direct current supply. The moving member of the relay has normally open contacts 32 by which the one or more clutch coils 33 are adapted to be connected to the direct current supply and it will be seen that the one or more clutch coils 33 will be energised, so as to connect the turntable to the shaft of the motor 22 in every position of the manual switch arm 14 until the turntable has rotated to the position to correspond with the one of the contacts 15, 16, etc., on which the switch arm 14 has been left, this being due to the opening of the corresponding one of the switches 15b, 16b, etc., by means of the cam 30. The otherwise slowly and continuously rotating disc is thereby stopped with the contact pair 9 and 10 in proper register with the contact pair 11 and 12, in preselected position.

Referring now to Figure 3 showing the preferred form of the clutch above referred to in the preceding paragraph, the discs 1 and 2 of the turntable are mounted so as to be freely rotatable with respect to the shaft 4, and in Figure 3 it is the lower disc 2 which is so mounted, being fixed at its centre to a brass bush 34 located between collars 34a fixed to the shaft. Fixed around the disc 2 are the cores of three electromagnets 120° apart, these cores being of the E-type, the base of one of which in Figure 3 is shown in section at 35, and the central limb is shown at 36 around which is disposed the magnet winding 37. A part of one of the outer limbs, namely the far one, is shown at 38. The terminals of the winding 37 are connected to slip rings (not shown) on the shaft 4. Fixed upon the shaft 4 is the flanged collar 39 to which are secured four radial arms 40 of phosphor bronze or other spring material, which have attached to their outer extremities the rigid annulus 41 constituting the armature for the electromagnets, so that upon energisation of the coils 37 the magnetic annulus 41 engages with the cores of the electromagnets and thus clutches the turntable to the shaft 4.

We claim:

Means for selectively changing the waveband of a radio receiver having a tuned circuit, comprising fixed contacts adapted for connection with said tuned circuit, a rotatable disc member carrying a plurality of preset tuning elements, sets of contacts on said disc member associated with the respective tuning elements, said disc member and contacts being so arranged that by rotation of said disc member any selected contacts thereon may be caused to engage the fixed contacts to tune said circuit to a selected frequency, an electric motor for driving said disc member at a relatively slow speed and having an operating circuit provided with means for closing and opening it, mechanical driving means for connecting said motor to and disconnecting it from the disc member, and means for opening the operating circuit of said motor and disconnecting said mechanical driving means when said disc member reaches a selected position, said fixed contacts and contacts on the disc member being engageable with a degree of friction to locate the disc member in selected position.

HARRY WHALLEY.
GRAHAM JOHN SCOLES.