doubt the screwed thread on the knurled ring ensures that.

Measurement of bearing friction is not easy since the ball bearings exhibit a certain amount of viscosity. Here, however, is what I have found by means of a "Correx" gauge, of the friction as seen at the stylus.

Lateral : 0.4 ± 0.1 grams.
Vertical : 1.0 ± 0.2 grams.
(Spring not connected)

These are larger than on my own experimental arm, or on the S.M.E., but compare favourably with most commercial arms.

Mounting on the motor board is by means of a screwed pedestal through a 0.8 in. (20 mm.) hole. A split grommet (half on top and half underneath the board) ensures a certain amount of vibration damping (anti-rumble): a simple device but reasonably effective provided a clearance is maintained between pedestal and hole. Height adjustment is obtained by washers on the pedestal.

On the whole I regard this design as a clever approximation to the ideal and that at a very moderate price. I am willing to wager that those who acquire it will be surprised and gratified by the improvement it effects as compared with the ordinary commercial arm.

P.W.

Quad AMII Tuner. Price: £24 plus £9 P.T. The Acoustical Manufacturing Co. Ltd., Huntingdon, Hunts.

Makers' Specification:

Tuning Range: A.M.11/European. Long wave: 2070-800 metres. Medium wave: 588-185 metres. Short wave: 5.8-18.5 mc/s.
A.M.11/Overseas. Medium wave: 510-1620 kc/s. Short wave 1: 2.2-6.6 mc/s. Short wave 2: 5.8-18.5 mc/s.
Output level: 100mV (Nominal for 30% modulation).
Output resistance: 15,000 ohms.
Filter rejection frequency: A.M.11/European: 9kc/s. A.M.11/Overseas: 10kc/s.
Power requirement: HT 35 mA at 330V. LT 1.2 A at 6.3V.
Power and Signal cable lengths: 40 in. (1m).
Valve complement: EF89, ECH81, EBF89, EM84.
Front panel: Silvered Fawn.
Knobs: Matt Brown.
Dimensions: 10½ in. by 3½ in. by 6 in. (267 by 89 by 153 mm).
Weight: 6 lbs. 2.7 Kg.).

Last month I reported on the Quad FM tuner and to save repetition the description given there regarding appearance and fitting apply also to this new AM tuner. It has been a very interesting experience to investigate these two companion tuners and to make comparisons between them.

For the benefit of some readers who are still uncertain what all this AM and FM business really means, this would seem a good opportunity to point out that there is no particular magic in the use of FM for high quality broadcasting. Its major advantage lies in its comparative freedom from domination by many types of interference. This has led to its adoption where the VHF broadcasting bands are concerned and very good it is, but one should not lose sight of the fact that it is only the comparatively uncongested state of the VHF band which makes the high quality possible and that equal quality is obtainable with AM.

The original Quad AM tuner was produced before the VHF-FM service was available to enable listeners to get the highest possible quality from local broadcasting. As the VHF network grew it was largely superseded by the unit described last month. However there are still areas where there is no VHF service and there are many people who wish to receive broadcasts from overseas; so a new AM tuner was designed with the stated aim of providing high quality reproduction of programmes from a nearby transmitter, but at the same time possessing sufficient sensitivity and selectivity for acceptable reception of distant stations. This new tuner, as can be seen from the specification above, is produced in two versions with wavelength coverage to suit different parts of the world. The description and tests which follow were made with the "European" version.

Basically the Quad AM II is a superheterodyne receiver with a tuned radio frequency amplifier on all wavebands and a variable selectivity intermediate frequency amplifier. It incorporates a low distortion detector, a whistle filter and an electronic "ribbon" tuning indicator. It differs in appearance from the FM unit only in the dial and the addition of two small three-position lever switches, one of which selects the waveband to be used and the other the type of response.

The aerial is coupled to the first stage, a variable μ pentode type EF89, by a tuned transformer. A further tuned transformer passes the signal to the frequency changer which is an ECH81 triode/heptode, the triode being used as the local oscillator. Output from this stage at the intermediate frequency of 470 kc/s is taken via a transformer, in which the coupling can be varied at will by the inclusion of a tertiary winding to alter the coupling and selectivity characteristics, to the I.F. amplifier, the pentode section of an EBF89 double diode pentode. This stage is neutralised to prevent detuning effects when A.V.C. is applied from one of the diodes after the small delay voltage has been overcome. A.V.C. is also applied to the R.F. and mixer stages. A further critically coupled transformer feeds the diode detector and the audio signal is taken from a small part of the diode load to minimise distortion. The whistle filter is a bridged "T" rejector circuit and is so sharply selective that it has negligible effect on the quality of reproduction. In the "Narrow" selectivity position an EM84 tuning indicator is operative to assist accurate tuning. In this position the response of the tuner which, due to the selectivity of the I.F. transformers starts to fall at 3.5 kc/s, is extended to 5 kc/s by an audio frequency tilting circuit. On switching to the next position, "Filter", the audio tilt circuit is removed, the tuning indicator extinguished, the tertiary I.F. transformer winding included—extending the response to 12 kc/s, and the whistle filter brought into circuit. The third position, "Wide", is identical except for the exclusion of the whistle filter.

The internal construction carries on the Acoustical tradition of "multum in parvo" and like the FM is divided into two sections. Firstly the tuning section immediately behind the tuning control knob: this consists of a full-size three-gang tuning capacitor operated by a two-speed nylon/glass cord drive, together with the nine coils and the range switch. The second section is at right angles to the panel and mounts the valves, I.F. transformers and other large components above deck and the many small items below. As usual the layout and construction follow instrument practice with the now typical Quad standards of workmanship.

Many measurements were made on this tuner, but I don't propose to detail them here. Briefly the quoted output is achieved from signals greater than 10 microvolts and the selectivity curves are such that the audio response falls by 3 dB at 5 kc/s and 12 kc/s in the narrow and wide positions respectively.

Listening tests have been made over a period in both daylight and night reception conditions and there can be no doubt of this tuner's very considerable ability to make the best of any signal presented to it. In particular many comparisons have been made of the quality of the London Home Service transmitter at Brookmans Park on 330 metres and the same programme from the VHF-FM transmitter at Wrotham. In the daytime, when the wide position can be used, the difference is barely perceptible and if anything the AM model seems to produce a shade more extreme treble. It is probable that this effect is in the ear of the listener for in fact measurements show the response to be level to nearly 12 kc/s then falling away sharply and it is the rapid cut off which is responsible for the apparent audible change. Similarly in the narrow position the rapid cut off at 5 kc/s gives an impression of adequate treble and produces a much more "listenable" result than is usual: even Radio Luxembourg becomes tolerable with this arrangement! A quick check at around 9 p.m. one evening produced some 45 stations on the medium and long wavelengths which were judged to be of usable quality using a simple vertical aerial dropped about 20 feet from the eaves of the house. There was no trace of image or I.F. breakthrough on medium and long waves and only two faint self-generated whistles. On short waves the R.F. stage showed up to considerable advantage and the tuner has some of the handling characteristics of a communications receiver. Some images were of course apparent, but they were not too troublesome and the two-speed tuning, which seems a trifle slow on the other two wavebands, was invaluable when searching for the American standard frequency transmissions from station WWV as a check on the accuracy of dial calibration!

Testing this tuner has made me realise how quickly we accept new practices before exhausting the possibilities of those of long standing. VHF coverage is now wide, but whilst admitting its superiority from many points of view there will be many people who wish to listen to programmes originating in countries other than their own and for them this tuner will be very welcome, producing as it does excellent quality from local stations together with pleasantly acceptable reception at great distances.

G.E.H.

Rogers HG88 Integrated Stereo Amplifier. Price: £40 (or without case £37 10s. 0d.). Rogers Developments (Electronics) Ltd., 4-14 Barmeston Road, Catford, London, S.E.6.

Maker's Specification:

Frequency response: ± 1dB 30-20,000 c/s.
Power output: 8 watts per channel.
Controls: Input selector (pick-up, sensitivity 4 mv, tape C.C.I.R. 4 mv, radio 40 mv, microphone and auxiliary), Bass and Treble tone controls, Filter, variable between 5 and 20 Kc/s, Volume, ganged 18 step switch, Balance combined with on/off switch, Function switch, stereo, stereo reverse and mono from either input channel.
Finish: Case in figured teak, panel in brushed brass or ivory enamel, knobs ivory with brass centres (also available in chassis form for installation in conventional cabinets.
Valves: 2 × EF86, 3 × ECC83, 4 × ECL82, metal rectifier.
Dimensions: 15½ in. by 10½ in. by 7 in. high.
Power supply: 200-250 v A.C.

In recent years we have witnessed a considerable change in the external appearance of domestic high fidelity equipment. Some manufacturers have always managed to avoid the "knobs on a panel" look of a scientific instrument because their design was in the hands of people whose appreciation of the functions went beyond the selection of suitable electronics and took into consideration the ease of