



FORUM

Control tones on the power mains

Some months ago, we protested against the growing practice by supply authorities of imposing control tones on the power lines of frequency and amplitude such that they produced audible and annoying whistles from equipment involving audio amplifiers.

Conducted by the Editor

Following the protest, we received quite a spate of comment from readers, not all of whom had realised where the mysterious whistles came from.

We had reports of people who had authorised costly but abortive service calls on their television receivers and radiograms, under the impression that they had been sold a faulty piece of equipment.

And we had reports from others in more technical situations who had been plagued by spurious operation of sensing systems controlling charging circuits, emergency supplies and suchlike.

Following a further mention in the June issue, we received a letter from Professor R. M. Huey, of the University of N.S.W. Reproduced opposite, the letter points out that the problem of control tones in audio equipment is part of the total problem of electrical and electronic environment and one which has been subject to a good deal of discussion at academic level.

However, having said as much, and having set out ways in which unwanted tones can penetrate audio and other equipment, Professor Huey agrees that the subject has not received anything like enough scrutiny at the practical level.

In plain terms this reduces to the amplitude and the frequency of the control tones which may reasonably be imposed on the mains, without causing embarrassment to the supply authorities' customers.

Undoubtedly, supply authority engineers would like to reverse the obligation and state a figure for attenuation of spurious tones which equipment designers should meet. However, the fact that audio systems came first might suggest that the problem of compatibility belongs mainly in the authorities' court.

Another reader who modestly failed to reveal his identity, sent through the post a photostat copy of page 190 of our June issue with the sentence marked which read:

"But did they look into the implica-

tions for hundreds of thousands of audio systems connected to their mains, ranging from domestic radiograms and TV sets to large-scale organs and public address systems?"

The copy was endorsed: "Yes, they did. See attached paper."

Unfortunately, for our present purpose, the whole paper is in German and even the title is enough to discourage any enthusiasm for the content by someone whose only knowledge of German is limited to words like Luftwaffe. Laboriously I quote:

"Über Beeinflussungsmöglichkeiten von Deraten und Anlagen der Informationstechnik durch Tonfrequenzrundsteueranlagen."

The author and reference respectively are:

Alfred Dennhardt, Hanover, Elektrizitätswirtschaft, Ig. 67 (1968), Heft 21.

The page numbers I could understand: 644-648.

While a member of our staff is familiar with ordinary German conversation and prose, the time could not be spared which would have been necessary to derive a translation for a lengthy technical paper and coping, in the process, with problems of technical phraseology.

In broad terms, however, the paper does indicate that a survey was made in Europe of the effect of superimposing control tones on the power mains and that, presumably, problems do not arise provided that the amplitude of the tones does not exceed certain levels, depending on the frequency involved.

If I interpret it correctly, a diagram suggests a limit of about 20 volts for control tones between 150 and 500Hz. Above the latter figure, the limit falls progressively to 10V at 1000Hz and 5V at 2000Hz.

This would appear to support the point made in Professor Huey's letter that the problem is intimately related to frequency.

It would also appear that some, if not all, the observations in the above-

mentioned paper were based on the use of lower frequency control tones. The reduced tendency of such tones to couple into signal circuits, plus their lower audibility, could make a very big difference to the result as observed.

So, while I must thank the anonymous contributor for his interest it does not markedly affect what has been said in relation to the local scene.

People in Australia using audio equipment are being plagued by control tones on the mains. Some of the equipment involved is not of peculiarly Australian design but is imported from a variety of overseas countries.

It would be interesting to know how the amplitude of 1000Hz control tones actually imposed on the mains by local supply authorities compares with the 10V figure suggested by Herr Professor Alfred Dennhardt.

Yes, most interesting.

In the meantime, here is a brief extract from a letter which further illustrates the problem as it exists in private homes:

"Dear Sir,

"In the past few months, I have been driven up the wall by control tones superimposed on the 240V AC mains in my area.

"I have been trying hard to record conversational French for private study from records which are available to me for overnight borrowing.

"As it takes about 40 minutes to set up and make a recording, it is inevitable that the tones appear on my copies, sometimes so disturbingly that I have to knock off and start the recording all over again.

"There doesn't seem to be a tone-free period between 5 p.m. and 11 p.m. Or if there is, I haven't discovered it yet.

"I have tried many ways of suppressing these tones but to no avail. They are cutting right across both the pleasure and the utility of expensive equipment."

(R. M., Merewether, N.S.W.)

NOVICE LICENCES: On another subject, we have received a lot of correspondence from individual lads and from school clubs supporting the idea of amateur operator licences at Novice level. In many cases, the letters contain copies of correspondence directed to the Radio Branch of the Postmaster-General's Department and are countersigned by all the members of the individual clubs.

Please understand if we don't reproduce all this correspondence, but we have devoted a good deal of space to novice licences in the past and have helped to keep the discussion moving.

To allow the subject to dominate another "episode" of "Forum" would be to invite the wrath of the many readers who have other interests.

HOW TO LOSE WEIGHT: And what more typically human interest can there be in a prosperous community than the subject of losing weight?

One of our readers, a professional engineer, sends in a clipping from a newspaper circulating in Sydney's western suburbs. It describes a wonderful new electrical machine installed in a clinic which apparently specialises in coping with over-generous figures.

The machine takes all the chore out of exercise. The client simply lies on a comfortable bed in a cubicle and has a number of electrically conductive pads placed in contact with the body in areas where the embarrassment is greatest. The machine attached to the pads does all the work in this new form of "passive exercise," so called. The article goes on to say:

"After the first five minutes of orientation, many ladies starting out with determinedly gritted teeth have been known to slip quietly and blissfully off to sleep."

Why didn't somebody invent this kind of exercise before?

Our engineer-reader expressed himself as willing enough to expose his wife to the benefits of this "passive exercise" but before opening his cheque book, he felt that he should understand, at least in broad terms, what the machine was supposed to do.

This was the paragraph that worried him:

"The currents, a mixture of galvanic, faradic, leduc, high frequency and sinusoidal, are tolerable because the harsher jumpy elements of each current have been removed."

Now that must look very impressive to the layman—or laywoman!

The only trouble was that it didn't mean a thing to our engineer-correspondent and his cheque account is still intact.

The same goes for your Editor.

With the help of a technical dictionary, we had a look at the terms:

GALVANIC ELECTRICITY: An obsolete term for electric current, as opposed to static electricity.

FARADIC CURRENTS: Currents obtained from an induction coil and used for curative purposes.

LEDUC: Unknown to our technical dictionary or to any members of our technical staff.

HIGH FREQUENCY: A familiar term but one whose meaning depends on the context.

SINUSOIDAL: Pertaining to a sine wave.

Towards the end of the article is the statement that:

"One thing required by the clinic if you want to lose excess fat . . . is strict willpower in undertaking their high protein diet for as long as you visit the clinic."

This seems to add a rather contradictory extra dimension to the paragraph which opens the article:

"Ladies can now slim simply by lying quietly on a comfortable bed while harmless electric currents are directed to specific areas of their body."

I can't help but wonder how the clients would fare if they simply obeyed the strict dietary rules without getting involved with the bed, the pads and the currents.

CONTROL TONES . . . one sector of a problem area

Dear Sir:

I was interested to see the comments in Forum ("Electronics Australia," June 1969 issue) concerning the increase of interference by injected control signals in Australian AC mains. I believe you are quite correct in saying that particular problems of this sort have rarely been analysed or "quantised." Nevertheless, the question of audio frequency undesired couplings has received quite a deal of theoretical treatment by professional engineers. This can be seen by reference to the Transactions on Electromagnetic Compatibility of the Institute of Electronic and Electrical Engineers (N.Y.). Their professional group on EMC, as the name is commonly abbreviated, has about 1500 members in the U.S. In Australia, too, one finds more and more professional and technical people encountering what are basically EMC problems. One writer has defined EMC as the art of arranging that dense populations of electrical and electronic apparatus can live together in harmony.

For some time now I have been interested in the technical aspects of EMC, and delivered the guest paper at the I.R.E.E. Exposition held in Brisbane during August, 1968. This I entitled "Electromagnetic Compatibility: or A Fool's Paradise in Australia?." In this I endeavoured to stress the need for appropriate Federal legislation in Australia to preserve a "clean" electromagnetic environment in which might function not only communications and navigational equipment, but also all sorts of other electronics equipment including industrial sensors and controllers, computers, scientific instruments etc. and, last but not necessarily least, the audio equipment to which your own comments referred.

In looking at the electromagnetic spectrum it is not hard to see why the technical problems have not all been solved at audio frequencies. Injection of undesired signals may occur in several ways, among which one may list the following major modes:

- (1) By conduction e.g. by the impedance of common earth paths.
- (2) By capacitive coupling. Such capacitances are usually very small, so the action is to inject a small current into the victim circuit, of a value proportional to frequency, assuming a constant voltage at the offending source. This medium for injecting interference is readily reduced by quite simple arrangements of metallic shielding, at either source or victim equipment.
- (3) By magnetic inductive coupling. In the case of a power supply transformer whose primary carries not only 50Hz but also audio frequency control currents, the leakage magnetic field may couple into inductive components in the victim equipment, or even into single wiring loops. This coupling may be analysed by estimating the mutual inductance between the source and the victim circuits. Assuming a constant current at the source, the voltage generated in the victim circuit would then be proportional to frequency. Unfortunately such stray leakage fields are not at all so readily shielded against as the electrostatic fields mentioned above. It is not hard to see why coupling by mutual inductance which transfers negligible voltages at 50Hz into the victim circuit, may cause some trouble at higher frequencies — typically an increase of 20dB in transmission between 50Hz and 500Hz, or an increase of 30dB between 50Hz and 1600 Hz.
- (4) By the transmission of energy as an electromagnetic wave between the source and the victim. If this problem could be evaluated, this would be a much more satisfactory means for "quantising" the problem at audio frequencies. The readily available techniques for calculating the amount of attenuation when an EM wave passes through a metallic structure (i.e. shielding) are limited to calculations for the passage of a plane wave through an infinitely extensive thin metal sheet, and to approximate calculations for such penetration through an idealised shield in a coaxial cable. In some audio frequency cases with "practical" shielded cables the measured attenuation may be only a few dB.

It can be seen therefore that the technical situation as regards EMC does actually present many unresolved difficulties. I note in your remarks that you describe these problems as having been relegated to the "too hard" basket, and I rather agree with you that this has undoubtedly happened and will continue to happen all too frequently. I would be interested to learn more about the complaints of audio tone interference. Although I regret I could not undertake the large task of individually commenting on each complaint. I would try from time to time to comment on groups of complaints having common features.

R.M. HUEY

Associate Professor of Electrical Engineering,
The University of New South Wales.

Still, I'm one of those hard-to-convince people, particularly where money might be involved!

BUZZPHRASES: Having just pointed the finger at a paragraph which, to say the least, contains a curious collection of terms, one must admit that whoever wrote it is a mere beginner when it comes to compiling technical sounding jargon. You will know what I mean when you read a quote from "Electronics Weekly," in a section entitled "Talkback" ascribed to one who uses the pseudonym "Janus."

"Many of my readers will be familiar with the Honeywell Buzzword Generator, an ingenious card which enables anyone to construct highly technical - sounding phrases without having any idea what they are talking about.

"Now the company have come with a second - generation model — the Honeywell Computers Buzzphrase Generator.

"Master this, and you can construct whole sentences and paragraphs. In fact, with a certain amount of patience you could probably write a complete thesis, and perhaps even get a Ph.D for it.

"It works on much the same principle as the Buzzword Generator, but with four columns of phrases rather than words. These can be put together in a great number of permutations to create statements of seemingly high intelligence.

"Using the kit, say Honeywell, anyone who can count to 10 can write up to 40,000 discrete, well-balanced grammatically correct sentences packed with state of the art terminology.

"For example, the top line of the four columns makes the sentence: 'In particular, a large portion of the interface co-ordination communication must utilise and be functionally interwoven with the sophistication hardware.' Try it backwards, as well.

"With 40,000 combinations to choose from, I will resist the temptation to give more examples. But I leave you with this thought:

"Any discrete configuration made presents extremely interesting challenges to the independent functional principle in respect to specific goals."

HERTZ: I had thought that the skirmishing about Hertz and cycles per second had finished but one valiant soul is still keen to join battle:

"Sir,
"While listening to a Voice of America moon-shot broadcast, I was pleased to hear them announce their various transmission frequencies IN KILOCYCLES PER SECOND. This

CIRCUIT THEORY COLLOQUIUM

A Circuit Theory Colloquium on Filter and Integrated Circuit Design will be held at the School of Electrical Engineering, the University of N.S.W. on Thursday, September 25, 1969.

Sponsored jointly by the University, the Institution of Engineers, Australia, and the Institution of Radio and Electronics Engineers, Australia, the colloquium is intended to provide a means whereby contact between universities and Industry can be strengthened, education can be supplemented and whereby non-specialists can gain an appreciation of the broad problems encountered in the area under discussion.

It is anticipated that 10-12 papers will be presented by invited authors.

Further information may be obtained from Mr K. G. Knight, General Secretary I.R.E.E. Aust., Box 3120 G.P.O., Sydney, 2001.

demonstrates conclusively that the trade has not accepted the foolish and unnecessary change to KHz. I suggest that 'Electronics Australia' might well abandon its futile effort to promote this unwanted change and revert to the well established cps. Without doubt, radio men still THINK in cps for, no matter what abbreviation is used, this is the unit they are interested in, and the time and mental effort necessary to convert every KHz to the wanted unit is both frustrating and distracting.

"The intrusion of the unwanted KHz has destroyed much of the pleasure of reading technical articles, and I frequently find myself so distracted as to abandon an article out of sheer disgust. Whatever excuses may be made for introducing the change it has certainly done a disservice to the industry, is illogical, out of line with the concept, and rightly rejected by those on whom it is being inflicted.

"If for no other reason, Electronics Australia' might well lead the world in a change back to cps and receive the unstinted approbation of its readers."
(L.S., Auckland, N.Z.)

Rather than argue at a superficial level, I can do no better than refer L.S. to the excellent article written by his compatriot L. S. Spackman, and reproduced on page 84 of our December 1968 issue.

It would be funny, you know, if the NASA boys were technically wrong!

ALWAYS RELY ON R.D.S.

SPECIALS

R
D
S

Matched prs., AC127/
128 trans., \$1.20 nett.

200V pl diodes at
500MA, 25c each nett

EMG 1065 conds. 1000
mfd at 50V, 80c each
nett.

PVD 103. 100MA V.D.
transformers. \$10.00
each nett.

PF1229 trans. 340/340 1500MA
\$5.00 each nett.

Pkts. mixed resistors and pots.
Great value. \$1.00 nett.

Compax transcription turntable,
\$39.50 nett.

The Independent Wholesaler

RADIO DESPATCH SERVICE

Radio and Electrical Distributors

**869 GEORGE STREET,
SYDNEY.**

Corner George and Harris Streets
Telephone 211-0816, 211-0191

Open Saturday mornings

SERVICE

BILL TURNBULL offers you service on Hi Fidelity equipment tape Recorders, Communication Receivers and Electronic Test Equipment.

25 years experience
All work guaranteed

BILL TURNBULL

11 ELLALONG ROAD,
CREMORNE, N.S.W. 90 4825

SO YOU WANT TO . . .

ORGAN-ise some lights?
Install a HUE-fi system?
Set up a PSYCHO-delicatessen?
Greet Christmas with jingle-BULBS?

BUT SERIOUSLY . . .

The new **ELECTRONICS** Australia "Musicolour" unit should meet the many requests for devices which have so often been mis-called colour organs. It splits an audio signal into three frequency bands and uses the signals to control up to 1,000 watts of coloured lighting per band. It can be added as a gimmick to a hi-fi system or organ, developed as a stage feature by pop groups, or used to create the most novel Christmas decorations in your district.

FULL DESCRIPTION IN NEXT MONTH'S ISSUE.



**PRINTED CIRCUITS
DESIGN &
PRODUCTION**

WE MANUFACTURE P.C. TO MEET THE HIGHEST STANDARDS OF QUALITY. SPECIALISE IN LAYOUT, ARTWORK, ALL TYPES OF PRINTED CIRCUITS, COILING AND SPECIAL FINISHES.

PHOTRONIC Tel. 937664

315 FITZWATER ROAD, P.O. BOX 199, BROOKVALE, N.S.W. 2100