



When I Think Back...

by Neville Williams

'Shadders on the wall' — 2: the country picture show goes 'talkie'

If last month's story about an old-time country picture show emphasised the primitive side of such an enterprise, this month's sequel is similar. The difference is that it was enacted about 10 years later, when the same show had to be re-equipped for the 'talkies'.

As I indicated last month, my grandfather A.P. ('Alf') Hicks 'pulled the plug' on the original show around 1930, when interest in silent features and their ready availability diminished sharply with the introduction of sound films. Besides that, the novelty of running his own picture show had long since waned, and the prospect of spending Saturday evenings by the family fireside was more inviting than the hassle and expense of installing the new projection equipment that would be needed.

How practical it would have been at the time, also had to be considered. The projectors would have to be driven at a higher and constant speed, free from 'wow' — which ruled out the existing 80V DC drive motors and slipping belts. In the continued absence of AC mains, that could have meant installing a custom-built DC/AC rotary converter and running it from a well regulated supply, unaffected by the projection arcs.

The amplifier system would also need a 240V AC supply, or else be custom built to operate from 80V DC.

By comparison, a crackling log fire in the living room grate looked just too inviting and he accordingly threw an oil-stained dust cover over the existing projectors, locked the projection room door and settled back to ponder his pending retirement.

About that time, the proprietor of the theatre in nearby Picton invited him to drive down one evening and have a look at the sound equipment he had installed some time previously. Much to my delight, I was invited to go with him and, as well, see my first-ever talkie — featuring, as I remember, Janet Gaynor.

Still attending high school, my knowledge of electronics at the time was limited to the superficialities of a crystal

set and what I had picked up from my father's strictly hobby interest in 1920s-style battery sets. I knew enough, however, to feel cheated when I realised that the sound system in the Picton theatre was sound-on-disc rather than the 'real thing': sound on film.

Sound on disc

These days, I have only the vaguest recollection of seeing two otherwise conventional projectors with a bulky structure bolted to their blind side supporting an enormous (16", or 40cm in diameter) turntable and pickup. The operator explained how he had to load the film with a particular frame in the gate and place the pickup at a given spot in a particular track. Sharing a common drive, both would start together and would remain synchronised — provided no break occurred in the film and no-one bumped the turntable.

Much more recently, I had a most enlightening conversation with a friend, who was related to the former operator of a similar sound on disc show in a small town in the NSW Blue Mountains. As his unofficial assistant, he saw some of its problems at first hand.

Sound films did break on occasions, he said, for precisely the same reasons as did silent films. Everyone just had to be that much more careful with them to keep out of quite horrible trouble.

If the film broke after the first sprocket the operator could switch off the drive without losing sync. Then, without touching the pickup, he could carefully nudge the whole thing forward sufficient to re-thread the loose end of the film and start again. If, on the other hand, the break occurred ahead of the first sprocket, the operator could only 'guesstimate' how much film to pull through to match

the position of the pickup on the disc. If he got it wrong, he had to make a decision whether to put up with the error or try nudging the pickup this way or that, a groove at a time.

Said my informant: "Some operators were more adept at this than others. The remainder were just lucky or unlucky on the night!"

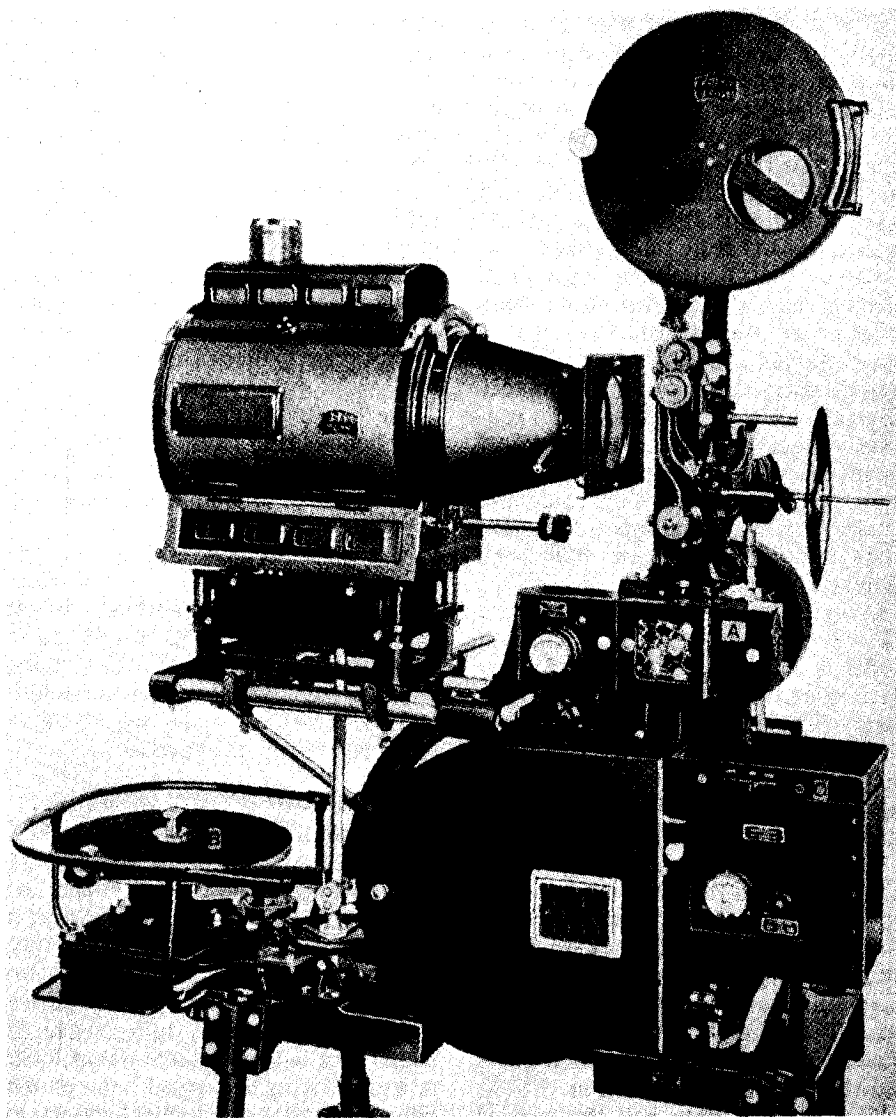
In repairing a damaged film, it was important not just to snip out the affected frames and join the remaining ends, because that could shorten the film enough to prejudice synchronisation after the splice. The appropriate procedure in the field was to replace any damaged frames with an equivalent length of opaque film.

But the problems didn't end there. According to my friend, the hall in the Blue Mountains town, where his relative acted as operator, was on the same subterranean rock shelf as a segment of the main western railway line which passed close by. When a huge 57 type goods loco chugged past, the whole hall would vibrate. So also did the pickup arm — which, on occasions, would jump a track, again posing the operator the question whether to accept the situation or 'have a go' at correcting it.

Back at Bargo

One other aspect mentioned by my friend was new to me. In those days, he said, shows equipped only with sound-on-disc were sometimes supplied with versions of new films along with discs dubbed from optical soundtrack prints. I quote: "Adding the limitations of a dubbed disc to those of an early optical print, the end result was often pretty lousy."

For what it is worth, my lasting impression of the sound from that ancient Janet Gaynor film was that it was any-



A Western Electric sound projector of the early 1930's, fitted with both an optical sound head for sound-on-film (beneath the picture head) and a synchronous turntable for sound-on-disc (beneath the lamphouse, at lower left).

thing but crisp. And that to a lad from the bush, whose hearing was still unblunted by loud noise or the passage of time. Mind you, the problem could well have been due to the acoustics of the theatre itself.

I am reminded of a report by the late Don B. Knock, in *Wireless Weekly* for February 8, 1929. Commenting on optical sound films being shown at the once proud Sydney Regent theatre, he complained of a difficulty in following the words being spoken. He was uncertain whether to blame the acoustics of the theatre, muffling of the louspeakers by the screen or the actors' "very American intonation".

Fortunately, in hindsight, my grandfather's initial reluctance to get involved in talkies saved him from any involvement with the ill-fated disc system. In the meantime, my immediate

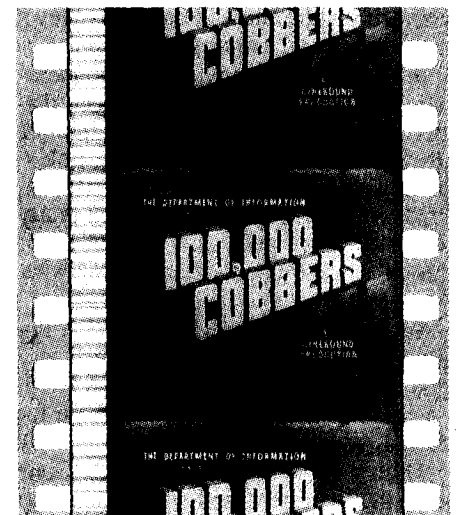
family had moved to Sydney and I had taken a job in the electronics industry — building, testing and servicing radio sets. In the new situation, my boyhood experiences in Bargo were rapidly becoming but a memory.

It so happened, however, that one of the operators from the 'silent' era at Bargo had heard about a rundown suburban theatre that was being remodelled and re-equipped. In the process, its original projectors, which had been converted for sound, were being replaced and would probably 'go for a song'.

The operator's own situation had changed and, if Alf Hicks would buy the surplus gear, he was sure that it could be married to what Alf owned already, to provide acceptable results. No less to the point, reticulated AC was now available in Bargo and that would make the changeover much easier.



Samples showing the two main types of optical sound-on-film track. Above is a 'variable area' track, while below is a 'variable density' track.



The course of events in the next few weeks I can only guess at, because I was 100km away and the people directly involved are no longer with us, to speak for themselves.

All I learned, by letter, was that they had bought and installed the surplus equipment and advertised a show for 'last Saturday'. Unfortunately, it had to be cancelled at the last minute because they couldn't get the sound system to work. They had postponed the show for a week so: could I possibly come up next weekend in time to fix whatever was wrong?

'Youth rushes in...'

Such is the optimism — and impetuosity — of youth that I duly turned up at my grandfather's place on the Friday evening. Complete with tools, meter and an assortment of wiring parts,

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I was all set to 'fix' the amplifier next morning, ready for the advertised show in the evening.

Yes, I was told, they had picked the best out of their old equipment, and the 'new', and got it all working fine as far as the picture was concerned. It was just that they didn't know how to connect up the amplifier. To someone who built and tested radios all day, it should just be a matter of checking things over, connecting this to that and away it should go. After all, they reasoned, it had been working right up to the time it was dismantled.

Apprehension on my part may have been allayed by the fact that, some time previously, a senior member of the staff at Reliance Radio, where I worked, had been involved in setting up another do-it-yourself picture show in one of Sydney's northern coastal suburbs.

In reply to his many questions, members of the technical staff had been discussing things like projection lamps, transarcs, photoelectric cells, preamplifiers, power amplifiers, loudspeakers and so on. It was all pretty straightforward and even without a circuit, it shouldn't be too hard to spot what was wrong.

So, next morning, without undue apprehension, I accompanied my grandfather up into the projection booth — the first time I had been in there for several years.

Things had certainly changed. Gone was the wooden bridge between the projectors and the sliding lamphouse. Each projector now had its own arc — still operating from 80V DC, I was told, because it was available and easier to cope with at short notice than having to worry about AC arcs or lamp optics.

The DC drive motors bracketed to the front wall had also gone, to be replaced by AC motors attached to the projectors. Bolt-on sound heads and extended drive trains were in position and, I guess, different film gates to match the slightly smaller images on sound film.

How much else had been interchanged was lost on me because, after all, the projectors had been checked out and pronounced optically okay. My by-now urgent task was to check-out and 'fix' the amplifier.

Ah yes, the amplifier!

The amplifier was standing forlornly in one rear corner of the projection box — about the only place it could go in the

restricted space. But even back in the 1930s, it looked like a relic of the electronic stone age!

It occupied two shelves in an angle-iron frame, about twice the size of a large filing cabinet and faced on all sides with steel wire mesh. The whole lot had been sprayed with so-called gold paint, long since faded and coated with grime.

On the top shelf, mounted on some sort of a plate and with exposed wiring, stood a couple of what looked like type 50 power triodes. They had input and output transformers, and were presumably driven by a 27 type triode and a 24 pentode voltage amplifier. On the lower shelf was the power supply — the whole thing with interconnecting leads and sundry other wires that appeared to have been cut when the gear had been removed.

Lying on top of the cabinet were two 12" (30cm) loudspeakers, the like of which I had never seen before. They were assembled on a pressed metal back plate, with holes that suggested that they were intended to hang on the wall like a picture. In the front was a heavy paper cone, with apex pointing outward, and also sprayed with gold paint.

At first glance they looked like ruggedly built old-time moving armature cone speakers, but closer inspection showed them to be back-to-front dynamics with the magnet and voice coil assembly accommodated inside the cone. Their age, their impedance, sound quality, sensitivity and condition could only be a matter for speculation.

But that was only half the story. I couldn't imagine a cabinet that size fitting between the two projectors in an average projection booth. In most cases, it could only stand where it was at the moment: right at the back. That meant that the shielded leads from the PE (photo-electric) cells would have been several metres long, with a prohibitively large shunt capacitance for the high natural circuit impedance.

What's more — and here was the killer — there was no sign of input connectors or controls of any kind on the amplifier. It was painfully obvious that the preamplifiers and controls must have been in one or two control boxes fixed to the front wall, or overhead, in the original projection booth. Where they were now was anybody's guess — but they were certainly not in Bargo!

A quick peep into one of the soundhead assemblies revealed a grimy looking interior and a PE cell about the size of an ordinary valve, fitted with a standard 4-pin UX base: almost certainly an RCA 868 or one of its many

equivalents. The exciter lamps were also in place, apparently with their own supply transformers and wired to come on simultaneously with the associated drive motor. That was fine, but where was the missing link?

Having summed up the situation, I could only shake my head sadly and suggest that tonight's show would have to be cancelled also. It would have been job enough to get the basic amplifier working, without having also to contrive a control preamplifier from literally nothing.

The inevitable questions followed: If the original control system could not be located, could I build another one to suit? Was the old amplifier worth salvaging anyway?

In response to the last question, I explained that I would really need to check through the amplifier, extract the circuit and see whether it could be restored to working order. That would not be easy, with me employed full time in the city and the unwieldy old amplifier in a projection booth 100km away.

What about a new one?

Then would it be simpler to build a new amplifier? How much would it cost and how long would it take? This called for a bit of figuring on my part, but I reckoned that it would not be too costly a project if I used receiver type components, which were available over the counter and relatively inexpensive. It would take me about three weeks, built in a wooden rack to stand between the projectors and with a turntable on top to play records as part of the show.

Looking back now, I must have been crazy to stick my neck out that far. Yes, I had built, tested and serviced numerous receivers in a small factory situation — but I had never devised and built a private project of any kind, let alone a complete talkie sound system!

Back at home, I worked out the dimensions for a wooden rack that would be sufficiently deep and wide to accommodate a compact record player on top, and tall enough to bring the controls to a convenient height for the operator. My plan was to assemble the rack progressively over the period, allowing time for glue to harden and paint to dry.

The chassis and panels for the amplifier and power supply were bent up from 16-gauge aluminium — separate to minimise any risk of hum injection into the sound head preamplifier stage. They were then punched, drilled, lacquered and lettered in the way we did things in those days. This done, it was a matter of fitting the major components and getting

on with the wiring, working out the details on a stage by stage basis.

Unfortunately, I have no photographs of the finished amplifier, being blithely unaware that, for me, it would one day become an item of personal history. I didn't even draw layout and circuit diagrams, on the assumption that I would be the only person likely to service the gear in the foreseeable future and, having built it in the first place, I wouldn't need them.

But that is a long time ago and, if I'd had to rely purely on memory, 50-plus years on, I'd have been hard put to do more than recall a few salient points about the design.

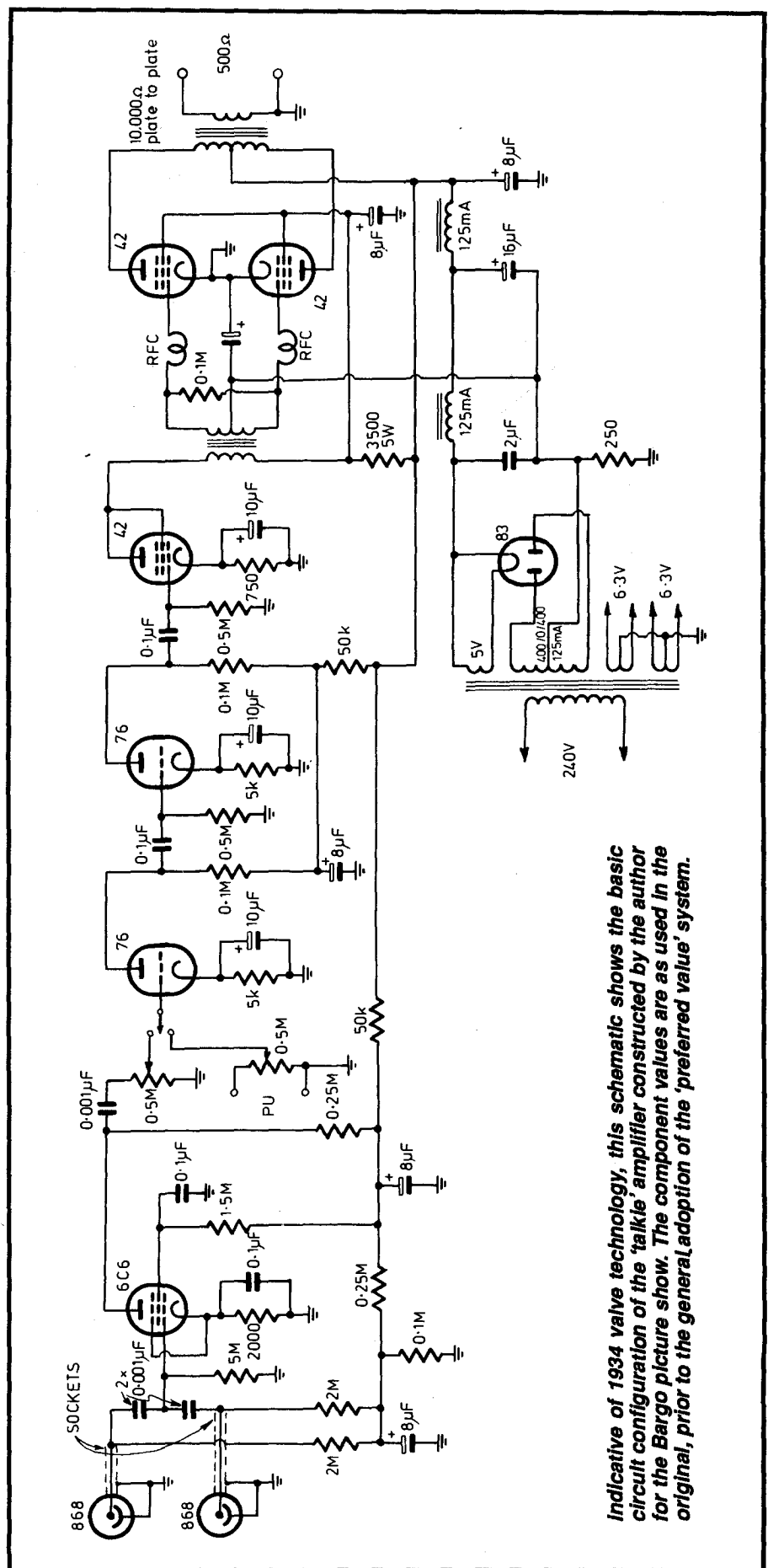
Circuit configuration

By sheer good fortune, however, when looking through an old lab notebook from my subsequent stint at the Amalgamated Wireless Valve Co, I came across an entry dated June 26, 1941. At the time, we must have been trying to cross-check the signal level to be expected from a PE cell in typical 35mm sound film projectors.

One entry, endorsed 'From FLS', records information that must have been obtained by Fritz Langford-Smith, possibly direct from Ray Allsop. Itself a fragment of history, it indicates that the valve line-up in one of Ray Allsop's current 'Raycophone' talkie amplifiers comprised a 1603 pentode preamplifier, 1603 triode connected amplifier, followed by another 1603 triode driving push-pull 2A3s through a 1:2.5 step-up transformer. (If memory serves me correctly, the 1603 was a low-noise equivalent of the 6C6, 6J7, etc). Calculations suggested an input sensitivity of 3mV RMS at full gain for full output, indicating an anticipated cell output comfortably above that figure.

More to the point in the present context is that, pasted into the notebook was a rough pencilled circuit endorsed 'Original amplifier for APH built about 1934/5'. As a further example of a functional amplifier, it was sketched only about six years after the event and would have been substantially accurate.

Built in 1934/5, the amplifier (see diagram) was obviously based on an RCA configuration which specified a triode-connected type 42 (6F6-G) driving two 42 pentodes in class AB2, through a step-down (class-B type) transformer; there was no provision for negative feedback. Maximum power output (5% distortion) into a 10,000 ohm P-P load was given as 19 watts — nominally higher than for either push-pull 2A3s or 50s.



Indicative of 1934 valve technology, this schematic shows the basic circuit configuration of the 'talkie' amplifier constructed by the author for the Bargo picture show. The component values are as used in the original, prior to the general adoption of the 'preferred value' system.

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Ahead of this I had added two type 76 triodes which, with hindsight, could probably have been replaced by a single 6C6 (6J7-G) pentode, fed from the volume control and film/pickup switch. In those far-off 78rpm days, the pickup could either have been an old-style magnetic or — preferably — a then-new crystal type.

Ahead of this again was a 6C6 pentode preamplifier, boosting the signal from the PE cell to an appropriate level for volume control and switching. The resistive network supplying the cell is intended to provide an HT voltage at the lower end of the 2- meg cell load resistor of marginally less than 90V. If it were to exceed 90V, the gas in the PE cell could ionise, preventing normal operation.

A rough calculation suggests that, for typical half-power output (10W) and the C-taper volume control at half physical rotation, the PE cell would need to be delivering about 8mV RMS.

Because the purpose of the lab exercise was to derive just such a 'ballpark' figure, my pencilled circuit did not show the exact configuration of the original input system; whether it provided separate preamplifiers for the respective PE cells, with changeover switching or mixing for the individual projectors.

To the best of my recollection it did not, with the amplifier panel carrying only a two-way film/pickup selector switch and separate volume controls for records and films. This was with a PE cell input socket in the lower corners with short, shielded leads to the projectors on either side.

'Optical' switching

Based on this recollection, the PE cells would most likely have been wired as shown. Both would remain connected to the amplifier at all times, their cathodes being activated optically by switching on the exciter light along with the drive motor of the respective projector.

According to my lab notebook, exciter lamps at the time were commonly rated at 10V/7.5A, the high-current filament being meant to minimise temperature variations at the half-cycle rate, when driven with AC. The purpose of the deliberately small coupling capacitors to and from the 6C6 preamplifier, and the small cathode bypass capacitor would have been to attenuate residual 100Hz hum from the lamp filament and, as well, to assist speech clarity by attenuating possible bass boom in the auditorium.

As already indicated, it was essential to use short, low capacitance connecting leads to the PE cells to minimise loss of treble response — especially speech sibilants. Because some loss was inevitable, a top-cut tone control was considered neither necessary nor desirable.

Back in 1934/5, with the projectors 100km away, I had no way of checking out the preamplifier circuit, apart from verifying that it had enough gain to get well down into the hiss level, without any evidence of hum or power supply feedback. It also seemed to work normally when fed from a low output home-made ribbon microphone.

To make the best use of the available audio power, I remember shopping around for two reliable permanent-magnet 12" (30cm) loudspeakers, which was not an easy quest at a time when manufacturers were still concentrating on electrodynamics, with a field coil that needed to be energised. They also had to be fitted with 'line' transformers, instead of the usual 5000-10,000 ohm variety to match a valve output stage.

Setting it up

All too soon the fateful day arrived and I loaded the new system into the car, conscious that, on Saturday evening, the patrons would be assembling to watch — and hear — the first local talkies. To have had to cancel for a third time would have been unthinkable!

On the Saturday morning, we set about to instal the system — beginning with the loudspeaker cable which had to be run by the most direct route from the

projection box, through the ceiling rafters to the wall behind the screen.

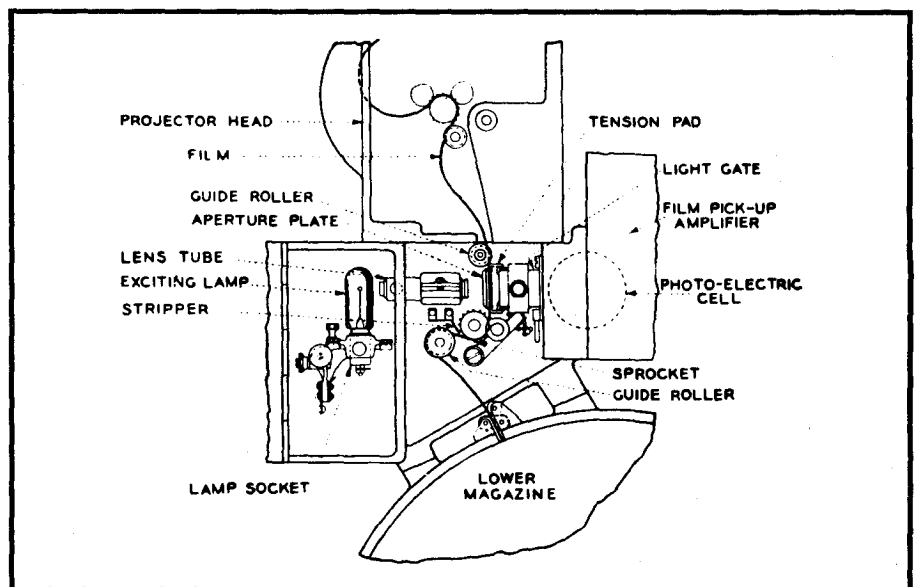
I left that job to someone else, while I mounted the loudspeakers on a baffle board. This was bridging a hole which had been cut in the wall backing the screen and separating the 'supper room' from the hall proper. I had specified that the rear had to be enclosed with a large padded box, both to confine the noise and to prevent the cones from being blown out of their housing by a blast of westerly wind through the open back door!

That done, I set about checking and connecting the leads to the loudspeakers and to a terminal strip and cable plugging into the rear of the amplifier. A monitor loudspeaker also had to be set up in the projection box, with its own preset level control.

The amplifier was duly 'fired up' and the building re-echoed to the promising sound of Reginald Dixon at the Blackpool organ playing *Blaze Away* — a Regal-Zonophone record that seemed appropriate for the occasion. In those days of 78rpm discs, the music sounded clean, with volume to spare. If the films sounded like that, we'd all be happy!

The next job was to attach new cables to the soundheads for connection to the amplifier — and here progress slowed to a crawl. The existing cables were 'goeey' with oil, as also was the inside of the PE cell enclosure and the anti-vibration foam rubber pad supporting the socket. Over the years, oil had obviously seeped into the soundhead from the optical projection mechanism above.

The thick layer of oil and grime may



A diagram of an early Western Electric 'pull through' sound head, similar to the kind of head fitted to the Bargo projectors. In some units the sound 'aperture plate' took the form of a curved guide, making a pressure shoe unnecessary.

well have affected the optical path, as well as making it difficult to attach the new leads. No less to the point, in a high impedance device like a PE cell, with an anode load of 2 megohms and an anode current of a few microamps, a leakage path of grease and grime could have a devastating effect on the output signal.

There was nothing for it but to dismantle and degrease the entire PE cell assembly, and substitute a length of new, low capacitance microphone output cable to conserve as much as possible of the top-end frequency response. I was also uncomfortably aware that cables carrying low-level DC polarised signals can be microphonic.

By the time I had cleaned, re-assembled and connected up both soundheads, the sun was dipping rather low on the western horizon and there was some urgency about the final step of loading up a spool of film, starting the engine out the back to provide an adequate DC supply for the arcs and checking to see whether the whole system would run.

No time to spare

Fortunately it did. But by the time we had checked both projectors, decided on typical settings for the volume control and set everything up ready for the night's entertainment, there was time only for a quick scrub-up and meal before it was on with the show.

Instead of a solo pianist of the silent era, this one opened with *Blaze Away* on Wurlitzer organ, followed by *Parade of the Tin Soldiers* — or was it *Teddy Bears' Picnic*? Then the lights suddenly went out and on the screen flashed a real talking picture.

A few minutes later, I left the operators to it and sank on to (not into) a wooden seat in the auditorium. For one day, I'd had just about enough. Suddenly an express loco appeared on the screen roaring straight towards us. Roaring? Yes, *roaring* — and with a deafening blare from the steam horn atop the boiler.

It was the sweetest sound I'd ever heard. Perhaps because of it, I didn't hear the sigh of relief from my grandfather in his favourite spot, just inside the doorway leading to the ticket office. After two cancelled shows, one could scarcely begrudge him a sense of relief.

The amplifier continued to work without a hitch for months — with one amazingly fortuitous exception. On a particular weekend, I visited my grandparents on a purely social call and volunteered to have a quick look at the amplifier while on the spot. Imagine my surprise to find that it was completely

dead, even though it had been operating normally right up to switch-off the previous Saturday. Fortunately, it proved to be a minor fault, easy to correct — but the experience came as a shock to Alf Hicks. He commissioned me on the spot to build a standby amplifier, which was duly fitted into spare space in the amplifier rack. It was essentially an electrical duplicate of the original and was run interchangeably with it, to ensure that both amps remained operative.

Problem with trains

In the mid 1930s, without the competition of television, the sheer novelty of local talkies ensured their success. But gradually, the patrons became more critical regarding the presentation.

The main southern rail line to Melbourne ran right past the front door, complete with two goods sidings, a steep grade, water towers for the steam locos and an ash pit where the crew cleared the gratings. Passing trains were problem enough, but when shunting and water stops coincided with tender moments in the film, the effect was distracting to say the least.

So also was a thunderstorm and/or pelting rain on the galvanised iron roof overhead. Even at the best of times the sloping roof posed an acoustic problem, with echoes picked up from the loudspeakers and reflected back to the audience with just enough delay to compromise the diction.

I suggested to Alf Hicks that some form of ceiling would ease all these problems, but the idea was much easier for me to suggest than for him to execute.

These days, I would have recommended a line source loudspeaker system — a four-driver vertical array — to beam the sound out over the audience but, if line source systems had been conceived at the time, I didn't know about them.

Some time later, for an entirely different reason, Alf Hicks built a decorative proscenium over the front of the stage, about four metres (10-12') in front of the screen. I suggested that the loudspeakers could logically be accommodated in the top face of this, where they would be that much closer and inclined downwards towards the audience. The echo effect from the rear-rangement did help quite significantly.

One other problem led to a rather startling result. As described in the last article, the silent pictures had always been shown against the background of a regular 'bom-bom-bom' of the single

cylinder engine driving the generator. With talkies, it was just one more sonic distraction, especially when Alf Hicks elected to use the larger diesel. Minor modifications to the exhaust system made little difference.

Dramatic solution

Irritated by the complaints, Alf Hicks decided to fix the problem once and for all. He dug a large hole just outside the engine shed and buried in it a 40-gallon drum, as used for bulk storage of fuels or other liquids. Into it he led the exhaust pipe from the diesel engine, along with a separate pressure relief pipe into the open air. The hole was then filled and tamped down.

On the following Saturday, the engine was started as usual and cycled from petrol to kerosene and then to diesel. It certainly was much quieter.

One can only assume that, part way through the evening, the engine picked up speed — causing the governor to interrupt normal operation. Presumably, the engine pumped a number of unburnt charges of fuel-air mixture into the drum, which were then triggered by the next active exhaust discharge.

Sufficient to say that the night was suddenly rent by the most enormous explosion, followed by an open exhaust. The 40-gallon drum had been blown apart and its overburden of earth scattered to the winds. Thereafter the smaller engine did most of the work on Saturday nights!

Final intermission

Hicks' Bargo talkies have long since closed down, but what happened to the equipment, I don't really know.

My grandfather really did retire, long after the calendar said he should. He ceased to be active in the picture show, sold his home and hall and spent his closing years in suburban Sydney. The projection equipment, I was told, was bought by one of his former operators, who had ideas of either setting it up elsewhere or taking it on the road as an itinerant show. Either way, it would long since have fallen silent.

My direct involvement with 35mm movies began and ended with that show, but it left me with a hands-on feeling for the technology which I could never have obtained from books alone. It has also left me with an appreciation for the refinements that have found their way into the art — ranging from widescreen, stereo sound films in your local cinema to the enveloping sight and sound of the specialised hi-tech theatres dotted around the world. ■