1. Summary

Ferrograph 2A/N amplifier chassis. Chassis 3954. From 1955.

Ferrograph 2A/N amplifier chassis only (ie. no tape deck or power supply). High gain (0.5mV) SK3 input from Playback head through matching isolation transformer with EF86 pentode V1 gain stage and frequency equalisation circuit (with external setting for different tape speed). Subsequent EF86 pentode V2 gain stage for Input 1 (10mV). Subsequent EF86 pentode V3 gain stage for Input 2 (400mV) with Gain pot, and includes global feedback from 15 Ω winding and some hf feedback from EL84 anode. 6BQ5/EL84 SE output stage with 2.3 Ω and 15 Ω secondary windings for nominal 3W output. Peak responding meter stage using EL84 plate signal and 12AT7/ECC81 as detector diode and meter signal buffer. EL84 plate output signal for record.

Output transformer	Partridge T1428, 6k SE; 2.3Ω, 15Ω. Pri: 17.5H 200mV 1kHz; 587Ω DCR.		
Input transformer	913 ; playback head matching step-up; 0.5mV input.		
Pots	Welwyn A7253 trimpots datecode LA		
	Morganite 35 ANAR50410		
	Dubilier DCC FD		
Resistors			
Caps	TCC - datecodes KM (year K=1954, month M=Dec), LC (1955), KJ, KK.		
-	Dubilier caps - datecode OF LA		
	Mutards – datecode 074H		
Valves	6BQ5 Radiotron N3 4G		
	EF86 Mullard 8Y5 L6B3 shock mount and cover		
	EF86 Miniwatt Britain 21 9r2 B2E4 shock mount and cover		
	EF86 Miniwatt Britain 203 B4K3		
	12AT7 Miniwatt Britain 21 Tk3 B2E1		
T 111 (* 1 ($\mathbf{T} = \mathbf{T} \mathbf{T} \mathbf{T} \mathbf{T} \mathbf{T} \mathbf{T} \mathbf{T} \mathbf{T}$		

Treble boost inductor Type 727, DCR=100, Wright & Weaire, 55mH (see WW 1953 May) Meter – Peak Signal Level – SIFAM Type M 202, No. G3505; Moving Coil 1mA FSD; DCR 60Ω. Bulb – Osram 8V 1.6W (0.2A).

Manual: <u>https://elektrotanya.com/ferrograph_2a-n_tape_recorder_sm.pdf/download.html</u> References:

https://worldradiohistory.com/Archive-All-Audio/Archive-Audio/50s/Audio-1959-Jun.pdf https://www.gracesguide.co.uk/Wright_and_Weaire

Same amplifier chassis appears in Ferrograph series 4.

Issues:

TCC 50nF 500V, 100nF 250V; Dubilier 0.5uF 150V; leaky. Factory mods – 470k from R16 wiper to C15/R32 node. Some resistors in green spaghetti so resistance values are closest measurement. R5 appears to be 2k but measures 8k. R13 value suspect. Chassis slightly bent at rear under transformer. Equalisation trimpots fixed with glue/thread-locker. Pot track noise

Design:

J.M.Carter WW 1953 articles (March, April, May).

Meter has zero set for external B+ provided during 'Record' to pin 6, with trimpot providing cathode bias for 1mA (meter FSD) cathode current with grid grounded. During playback, the output stage anode signal is capacitor coupled and diode rectified (V5) and attenuated to provide

Ferrograph 2A/N Amplifier

pin 7 grid signal. Unsure where P5/pin 4 B+ comes from – appears to be P4/pin 6 and then through Record switch position to P1/ pin7, which connects to +270V feed.

V4 cathode follower drives 0 to 1mA through cathode and meter, which sits at a 'set zero' trimpot voltage between 270x1.5/475=0.85V and 3x0.85=2.55V, which is the idle cathode bias for zero signal. Peak rectified negative signal voltage for meter FSD is the 12AT7 pushed into cutoff. The V3 anode signal is CR filtered (>16Hz) and attenuated to 75% for the rectifier cathode, and the rectified signal is then attenuated to 18% for the buffer grid input, making a total attenuation to 13% (ie. a V3 Vpk of 200V causes a -26Vpk buffer grid input to V5, and represents a 200/20=10Vpk on a 15 Ω speaker output, or 3.3W, given the 20:1 turns ratio of T1428 for 15 Ω). On test, 33k was increased to 220k to allow 6Vrms across 16 Ω load to give meter FSD.

Output stage +260V feed appears to come via Hold-in solenoid L1/Sw4/Sw5 from +270V P/S rail.

The T1428 is used in single ended mode with an EL84 operating with a 220R cathode bias (9V or circa 35mA anode), and 260V B+ (and screen) for a rated 2.5W, so this amp is using textbook setup. The 6BQ5/EL84 datasheet SE pentode rating is 7k impedance for 4W output. Someone has stated the 1428 has a 6k primary impedance, which is confirmed.



6K primary loadline for 300Vak 35mA idle. Va ~21V lower than VS1; Vk ~ +9V, so VS1 = 330V for Vak=300V.

V4 anode can operate with VS1 up to 330V due to ~24V drop across OPT primary, and 9V cathode bias, although screen voltage is still limited to 300V.

Meter V5 12AT7 exceeds rating above 300V, so V5 is fed from the lower rail for V3, although signal then modulates VS2 rail.

Ferrograph 2A/N Amplifier

Heater requirement: 3x0.2+0.3+0.76+0.2 = 1.86A (12W)

B+ requirement (idle): 0.9+1.17+1.53+41 = 45mA at 270V (12W)

Bleeds: 475k (set zero cct); 150k VS1 sense divider.

Measurements:

C18 Dubilier 0.5uF 500V can 35Meg 500V, 0.5uF. L2: 59mH and 105 Ω DCR with no resonance below 90kHz. L3: 17mH 200mV 1kHz; DCR 93 Ω .

V1 B+ current ~ (178-142)/47k = 0.76mA V2 B+ current ~ (227-178)/22k -0.8 = 2.2-0.8 = 1.4mA V3 B+ current ~ (282-227)/15k -1.4 = 3.7-1.4 = 2.3mA

V4 cathode current ~ 8.4/220=38mA V1-4 total ~42mA at 282V Cathode current = 1.1/1k5=0.73mACathode current = 1.8/1k5=1.2mACathode current = 2.6/(1k5//13k)=1.9mA

Voltage rails for Plugpack model PC-125P

Rails	Idle, with meter @ 0	
12V plugpack	11.90V, 11.64V*	
VS1	301V	
VS2	231V	
VS3	188V	
VS4	149V	
V1	70V, 1.18V	
V2	82V, 1.58V	
V3	78V, 2.66V	
V4	277V, 8.9V	
Heaters	5.79V, 5.71V	

* Voltage drop due to fuse, switch, $22m\Omega$ current sense.

One diode drop inserted before inverter to give 300V nominal output. Feedback level ~ 10.5dB.

Gain of V1 stage ~ 118/34 = 3.4x. Treble max, bass min.

Gain of V2 stage ~ 2190/118= 18.6x

Voltage at input of V4 from Gain pot with pot at '8' to give 6Vrms across 16Ω load is 2.76Vrms 12Vdc supply current for total amp with 2W output is 55/22=2.5A, with power consumption constant due to class A output stage.

Hum pickup very low if AC mains cable and plugpack kept away from signal input stage.

With no equalisation connections to 4-pin socket, the amp frequency response was flat for Bass at min and Treble at max settings, with -3dB at 15Hz and 20kHz.

Modifications:

- E-cap and coupling caps replaced. Out of spec resistors replaced.
- Triode mode for V1 and V2 with 100Ω stoppers
- JK1 connected to V1 input (disconnect TR1) with 10k stopper.
- Remove extension plug P5; chassis socket SK1; filter network R33/C23-L3/C22; R31.
- 12V 5A plugpack powering dc/dc for 270V B+ and 12Vdc direct for EL84 heater // bulb (0.96A) in series with 3xEF86 // ECC81 (0.9A) plus 1N5341B (6V2 5W) parallel protection.

Ferrograph 2A/N Amplifier

- ON switch used to connect 12Vdc. In-line fuse added. 12Vdc connector socket added.
- 150W inverter smps long board with up to 220V squarewave output
 - o 12Vin needs doubler as full bridge output too low (~220Vdc)
 - Lowest doubler is 2x172 = 340Vdc, so use V0 to V3 taps.
 - All e-caps and couplings are at least 400Vdc
 - Given 300V max design centre for 6BQ5, then use 1-2 diode drops to lower Vin to circa 10.5V to lower output to circa 300V.
 - Use BYG20J (600V 1.5A smt 75ns diodes)
 - Doubler caps- 10nF 500V smt and Wima MKS4 100N 250V
- Modified SK7 Aux Socket to suit 8-meter adaptor, but with 2.3 ohm to pin 8. Added new bleed divider for VS1/100 to pin 7.
- Pots cleaned.
- Peak Signal Level meter circuit modified for 6Vrms = FSD.











Response is not all the story

HE FERROGRAPH was the first portable Tape Recorder to be designed and wholly manufactured in Britain. To-day the bewildered buyer may well hesitate when confronted with a choice of so many makes offered. But if he is serious — and not lightly choosing something for his casual enjoyment — he would do well to ponder the following fact.

Frequency response is often popularly quoted in advertisements as 50-12,000 c.p.s. This, of itself, means nothing in evaluating the excellence or otherwise of a recorder. Two other interdependent factors must be regarded, viz.—signal/noise ratio and distortion, if the true worth of the instrument is to be gauged.

Furthermore, the limits in which the response is held must be given or the statement is again valueless. The Ferrograph frequency response is guaranteed to be within ± 3 db up to 10,000 c.p.s. at $7\frac{1}{2}$ i.p.s., although the response does, of course, extend much beyond this.

No exaggerated claims are made for the Ferrograph since its established reputation makes such claims unnecessary. Simple conservatism has always been a feature of Ferrograph publications and advertisements, and experience has shown the discerning user prefers it that way.

> MODEL 2A/N 3³/₄ and 7¹/₂ i.p.s. 76 gns.

MODEL 2A/NH 71 and 15 i.p.s. 86 gns.



BRIEF SPECIFICATION

Twin Track (to International standards) Playing British and America pre-recorded tapes

Playing Time with 1,750 ft. Reel 45 minutes per track a (1,1, p.s. (otherspeedsprorata)

Quick Rewind in less than 60 seconds

Signal Level Meter giving positive reading

E3 db 50/10,000 c.p.s. at 7¹/₂ i.p.s.

"Wow" and Flutter Less than 0.2% at 71 i.p.s.

Signal to Noise Ratio Better than 50 db, 200/12,000 c.p.s. Unweighted, including hum, 45 db.

Longterm Speed Stability Less than .5% variation

> Output Power 24 watts into 15 ohms

Dealerships in several of the principal towns are still open and applications are invited.

WRIGHT & WEAIRE LTD

131 SLOANE STREET . LONDON . SWI Tel: SLOane 2214/5 & 1510