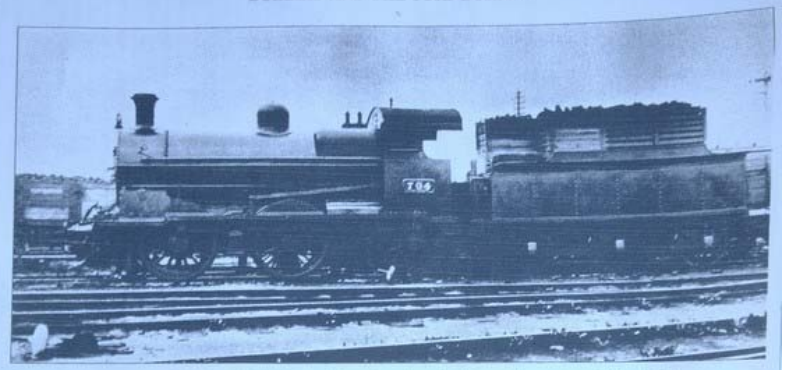
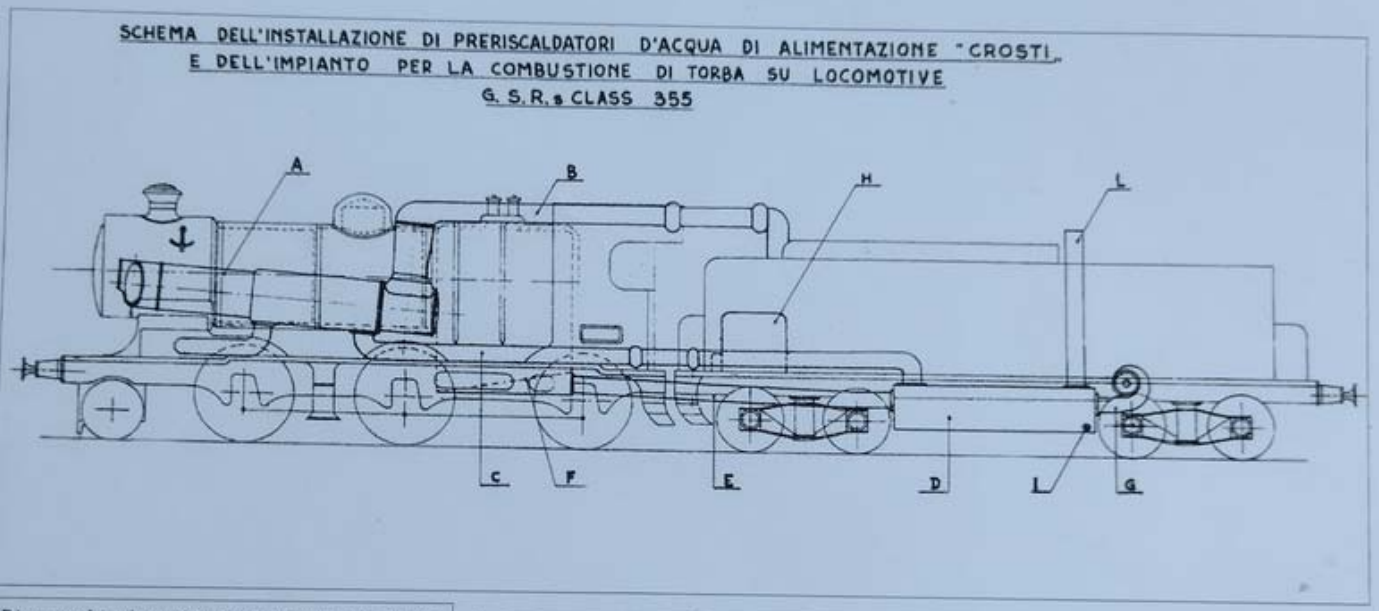
BULLEID AND THE TURF BURNER



Great Southern Railways 700 class 0-6-0 No 704 with the tender enlarged with a creal to carry turf during the Emergency.
(CI

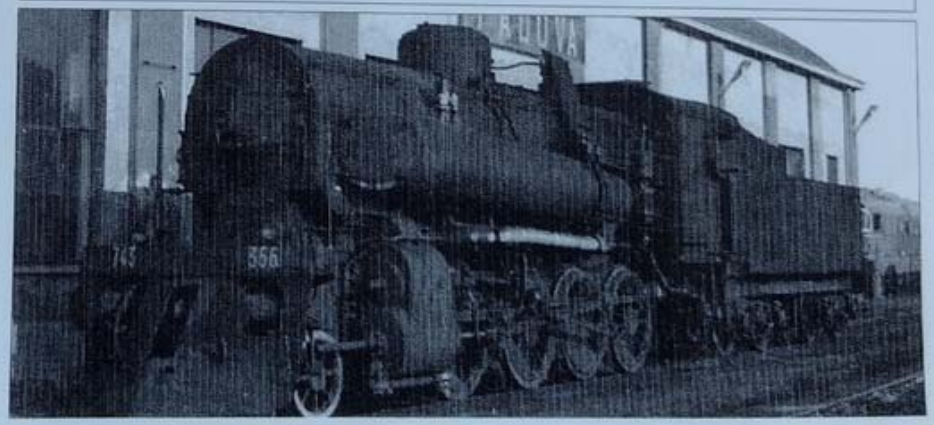
GNR(I) S class 4-4-0 No 173 "Galteemore". A very similar locomotive, S2 class No 190 "Lugnaquilla" (named after a mou in Co. Wicklow) underwent trials burning turf in July 1941.
(H. Fayle, IRRS colle



Discovered in the archives at Inchicore, this drawing was clearly produced by the Italian firm of Locomotive a Vapore Franco regarding the possible use of a Crosti boiler on No 356 - the proposed bogie tender will be noted. Perhaps typically, Bulleid was to modify the design - his assertion being that to use peat and not coal negated the patent. This did not, though, prevent the Societa Franco-Crosti of Milan, approaching the CIE General Manager, F. Lemass, through the Italian Minister in relation to patent rights in 1954, a figure of £900 being suggested. The letter was passed to the CIE Solicitor, Brendan A. McGrath whose report appears to attempt to distance CIE from Bulleid somewhat, on the basis that the designer appeared to have met the Italians on a personal rather than formal basis. Accordingly, McGrath's advice was a carefully worded reply, "We were interested in the device and did carry out some experiments, which proved unsuccessful...". After this matters appear to have rested, although whether the decision to later physically modify the shape of the pre-heaters was affected by the patent position is not clear. The letters on the drawing refer to a key which has not been located.

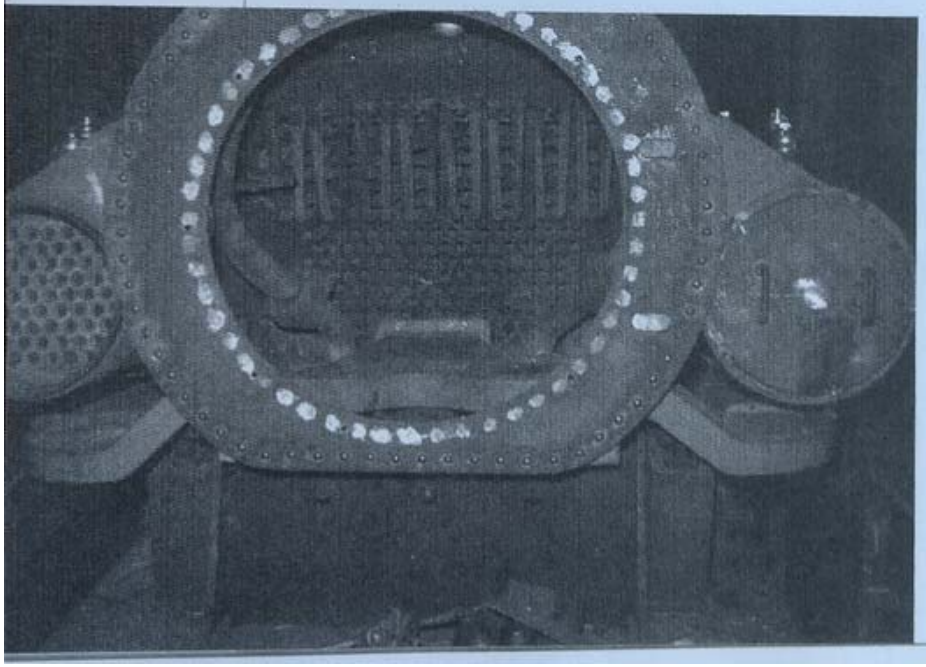
(CIE IRPS collection)

The Franco-Crosti system understandably had the greatest use on the Italian Railways, an example of this being with the GR 743 type of 2-8-0, 94 of which were built from 1940. A number also had streamlining. Without the streamlined casing, however, the similarity to No 356 is apparent, with pre-heaters either side and no chimney on the smokebox. One example is preserved.

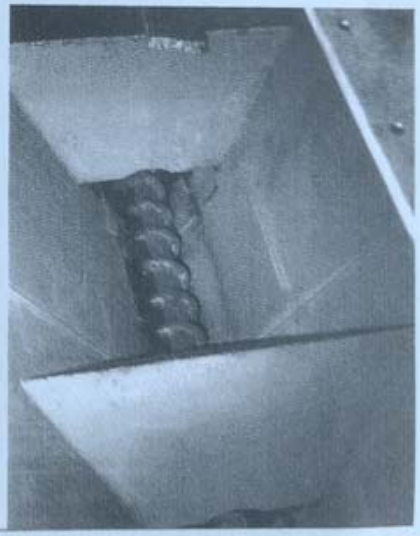


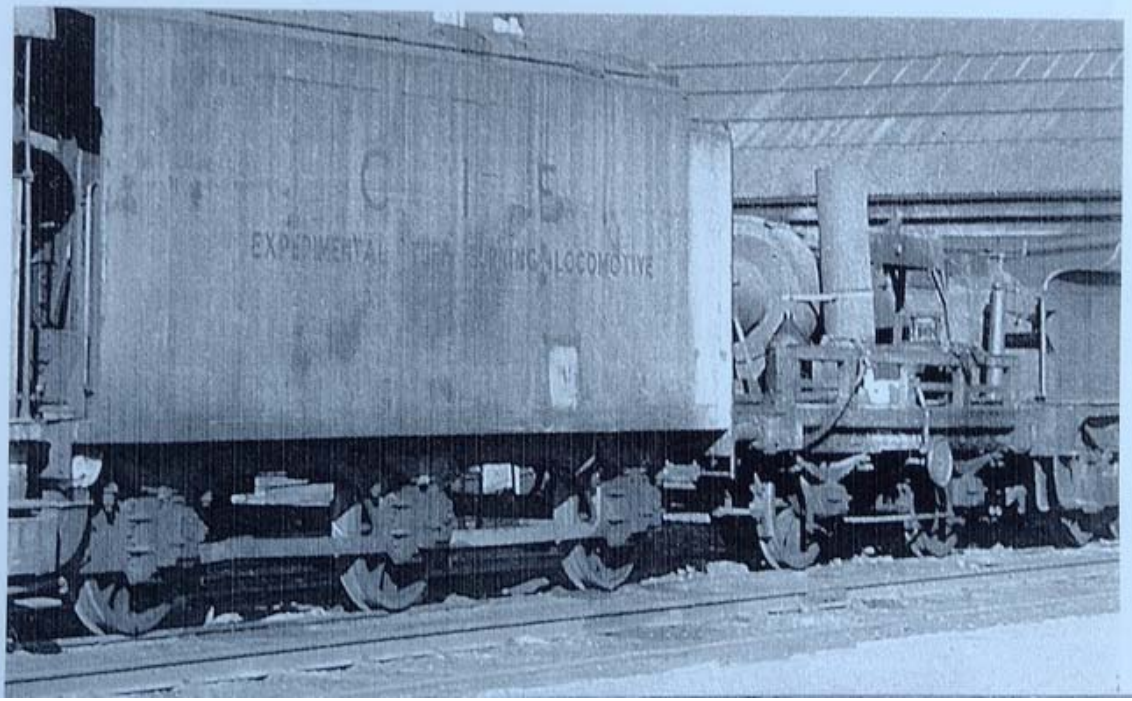
engine blower to provide the draught necessary to force enough combustion air through the *tuyéres* into the firebox. *F.A. Wycherley*

Looking into the smokebox of 356, one can see the three-row superheater and the lack of a conventional blastpipe. On the left the exhaust gas tubes within one of the two preheater drums are visible. *Anthony O'Toole, courtesy E. Shepherd*



The fuel was milled peat, as used in some Irish power stations. The turf was milled fine enough to be fed from the tender bunker to the firebox via a series of screws. *Anthony O'Toole, courtesy E. Shepherd*

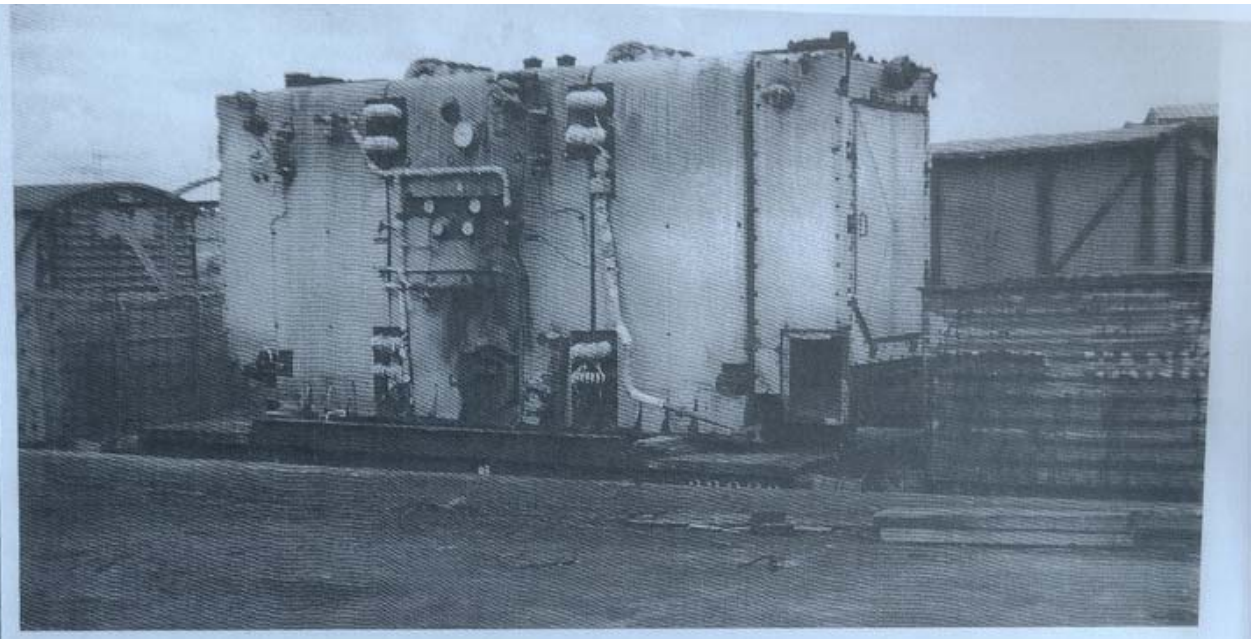




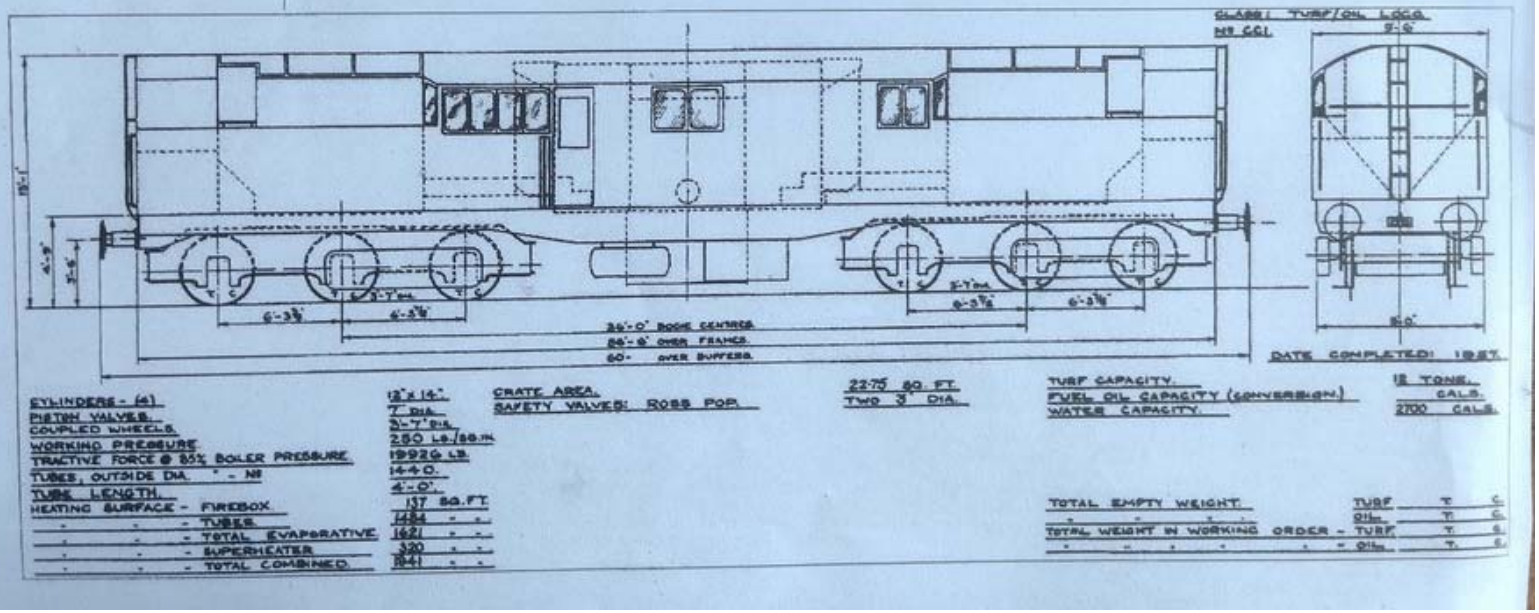
No 356 was later modified further with much larger casings for the pre-heaters which gave it a somewhat neater appearance. This change may have helped to convince Crosti's that the firm's patented system was not being used on 356! *IRRS*

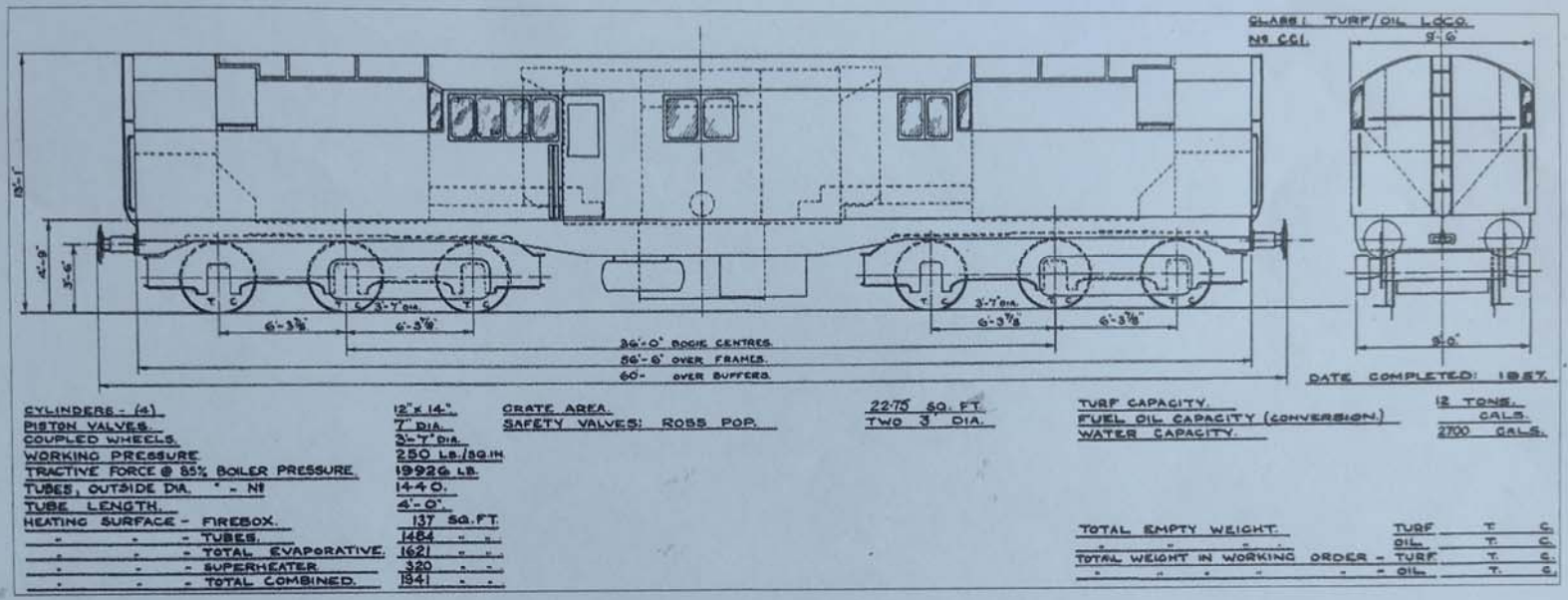
For most of its trials, behind the tender of 356 was coupled this wagon carrying a Leyland bus diesel engine that drove a blower for enhancing the flow of combustion air. *IRRS*

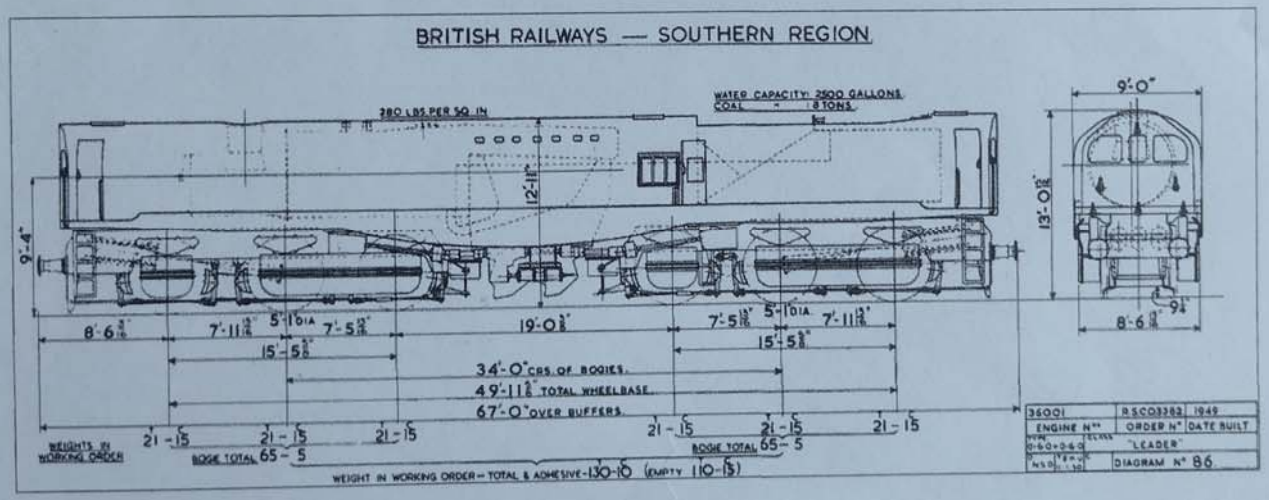
truncated smokeboxes. Its rectangular section was reminiscent of power station practice but drew some gasps of disbelief from visiting UK railway engineers! It was stabled on a wagon at Inchicore in 1966, some time after removal from CC 1.
Kevin A. Murray/Irish Railway Record Society



This is an early official CIÉ weight diagram for CC 1, except that weights had not been entered when this version was published. Interestingly, the machine is shown as a 'turf/oil loco'. *CIÉ*

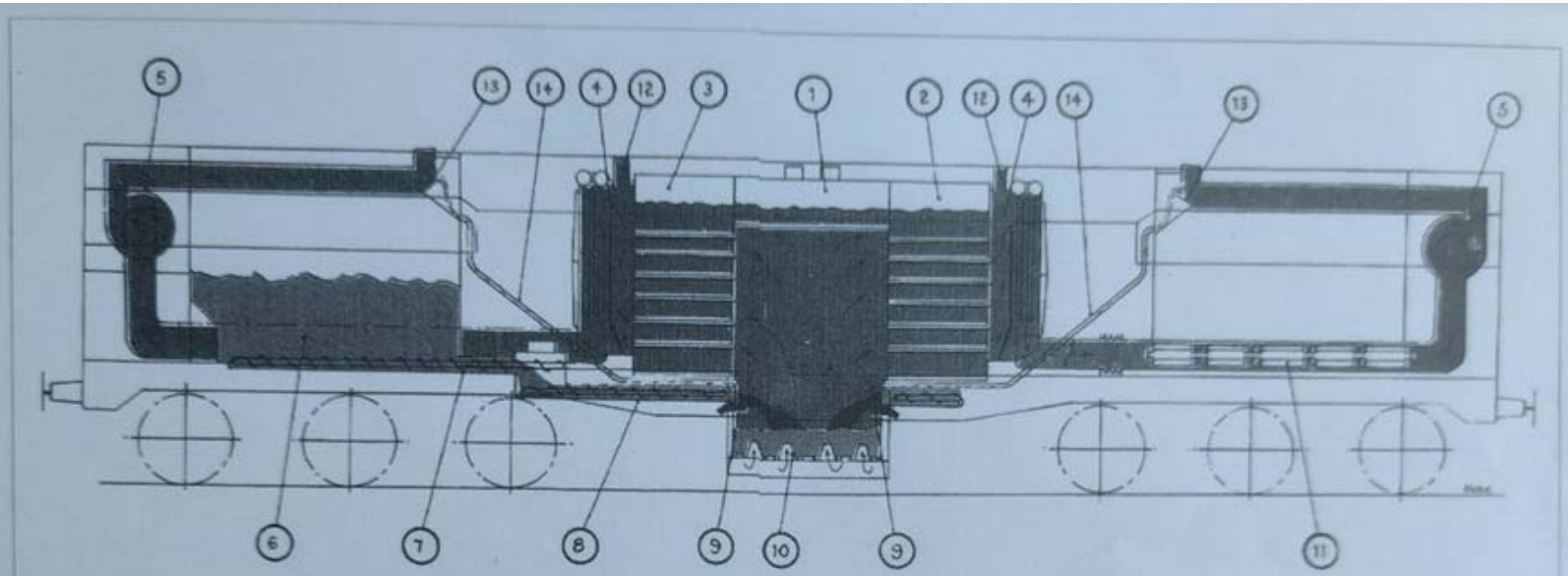






Above: Weight diagram for the Turf Burner in its final form.

Left: Drawing of the precursor to Turf Burner - the SR "Leader". Apart from the obvious external similarities, the basic mechanical concept incorporated many similar ideas. In practice the final weight of "Leader" was far greater than that stated.



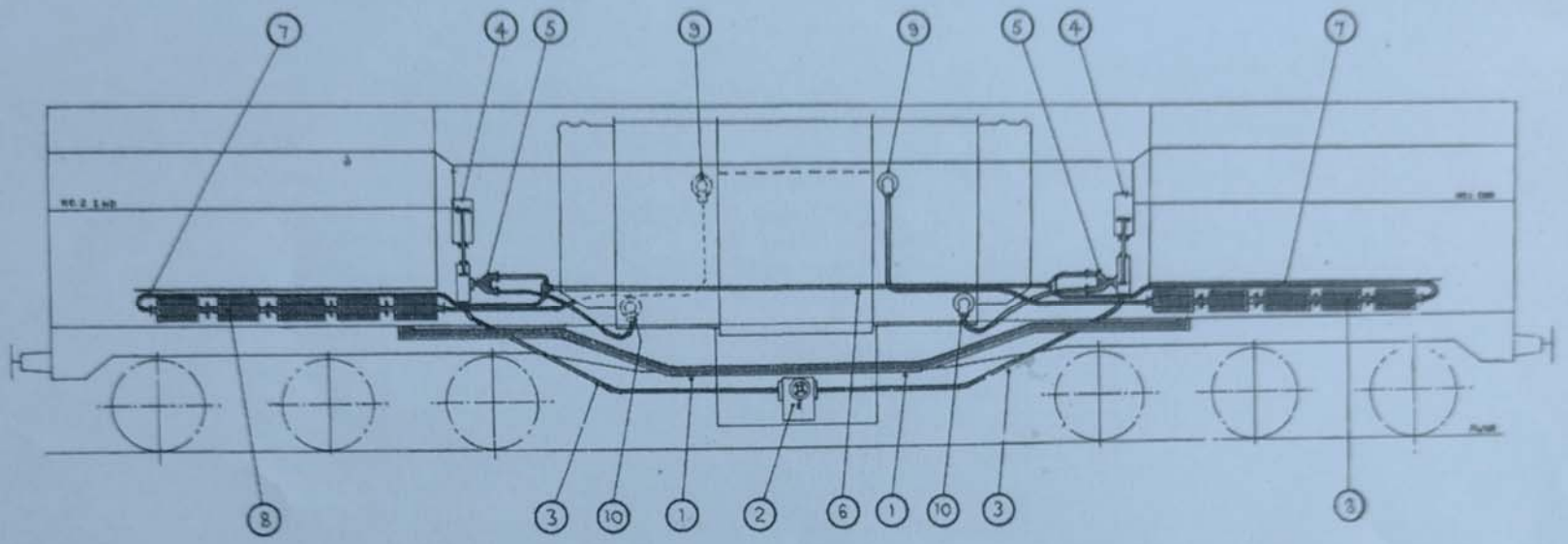
GAS CIRCUIT

1. Firebox section of boiler
2. Barrel section of boiler
3. Barrel section of boiler
4. Smokeboxes
5. Induction fan (turbine driven)
6. Turf supply
7. Hopper feed screw
8. Firebox feed screw
9. Jet plate
10. Firebars
11. Water feed heaters
12. Lighting-up chimney
13. Spark arrester
14. Spark return tube

The Gas Circuit

The mechanical stoker engine drives, through gearing, two turf feed screws (7) and (8) which convey turf from the hoppers (6) to the two entry points. Steam jets from the jet plates (9) distribute turf over the grate (10). The fire may be viewed through the firehole which is on one side of the firebox section of the boiler (1). Gases pass through tubes in the barrel sections of the boiler (2&3) and enter the smokeboxes (4). They are directed upwards by removable baffle plates and then down past the superheater elements. The gases leave the smokebox by right angled ducts at the corner of the smokeboxes (below the cab floor on the fireman's side) and passing through expansion bellows enter the heater duct in which are placed the aluminium feed water heaters (11). Leaving the heater ducts the gases pass upwards into the induction fan casings (5). Ducts from the fans lead to the outlets which are combined with spark arrestors (13). Particles caught by the spark arrestors are conveyed, via the flexible tubes (14) back to the firebox.

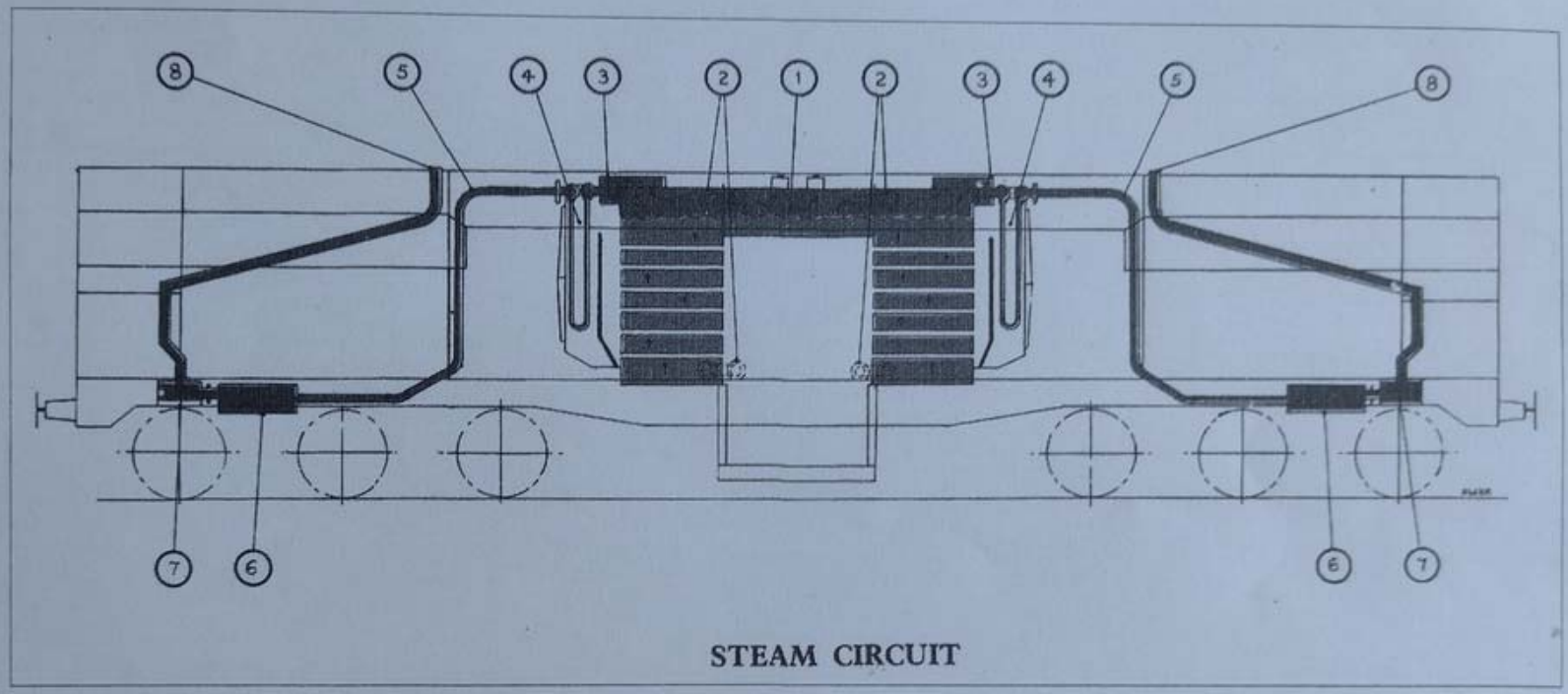
Note that although in the diagram only one pair of feed screws and one bank of heaters is shown for clarity, they were in fact fitted at both ends of the locomotive.



FEED WATER PIPING

1. Balance pipe between water tanks
2. Water feed valve and strainer
3. Suction pipes to Weir pumps
4. Weir feed pumps
5. Heater isolating emergency cocks
6. Connection between pumps
7. Delivery pipe from pump to heaters
8. Water feed heaters
9. Clackboxes
10. Clackboxes (when heaters isolated)

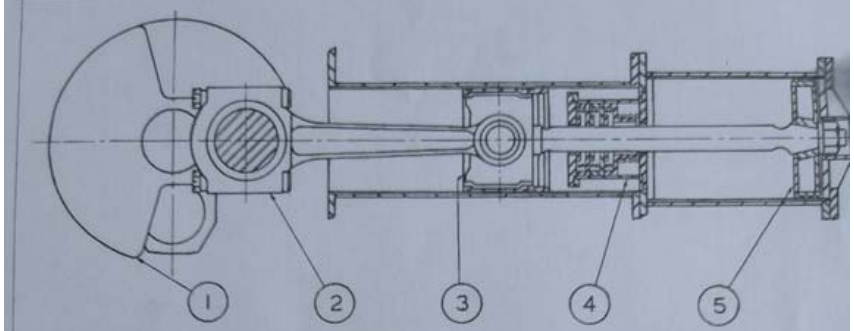
Feed water from the water tanks at each end of the locomotive flows via the 4in diameter bore pipe (1) to the combined water feed valve and strainer (2). From here, suction pipes (3) carry the water to the Weir feed pumps (4). Leaving the pumps, under pressure, the water passes through two-way cocks, normally positioned to pass the water via the pipes (7) to the feed water heaters (8). In the event of emergency caused by leaking of the heaters, reversing the two-way cock causes water to flow into the boiler barrels via the emergency clacks (10). Normally water enters the boiler by the clackboxes (9). A balance pipe (6) connects the pumps so that either pump feeds both banks of heaters.



STEAM CIRCUIT

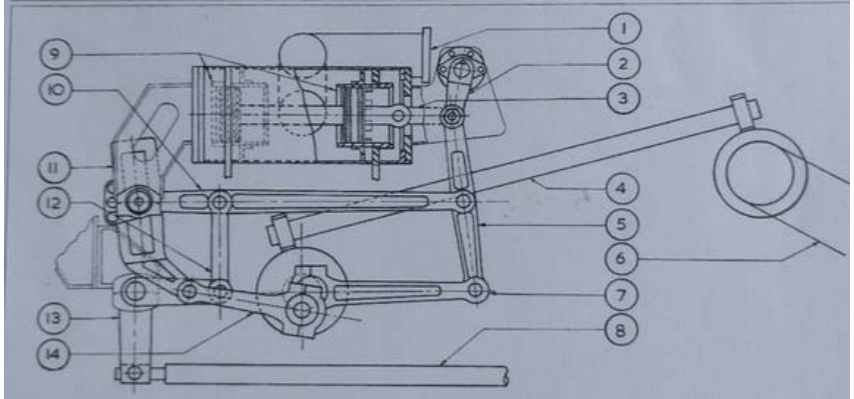
1. Firebox section of boiler
2. Equalising pipes between boiler sections
3. Regulator valves
4. Superheaters
5. Main steampipes
6. Engine
7. Exhaust chambers in bogie segments
8. Exhaust steampipes

Steam generated in the firebox section of the boiler (1) flows into the steam space in the barrel section via the equalising pipes (2). Steam leaves the barrel and passes into a collector *en route* to the regulator valve (3). The steam then passes through the coils of the superheater (4) and into the flexible main steam pipe (5) which conveys it to the engine (6). The exhaust steam from the cylinder enters the bogie frame stretcher (7) which makes a faced joint with the main frame. Communicating slots in the stretchers allow the steam to pass away to atmosphere up the exhaust pipes (8).



CONNECTING ROD, CROSSHEAD AND PISTON

1. Crankshaft balance weight
2. Connecting rod big end
3. Crosshead
4. Piston valve stuffing box
5. Piston



VALVE GEAR

1. Steam Inlet
2. Rocking arm
3. Valve rod
4. Valve gear driving shaft
5. Combining lever
6. Valve gear driving chain
7. Combining lever motion shaft
8. Reversing rod
9. Piston valve and valve liners
10. Radius rod
11. Slotted link
12. Lifting link
13. Weighbar shaft
14. Eccentric rod

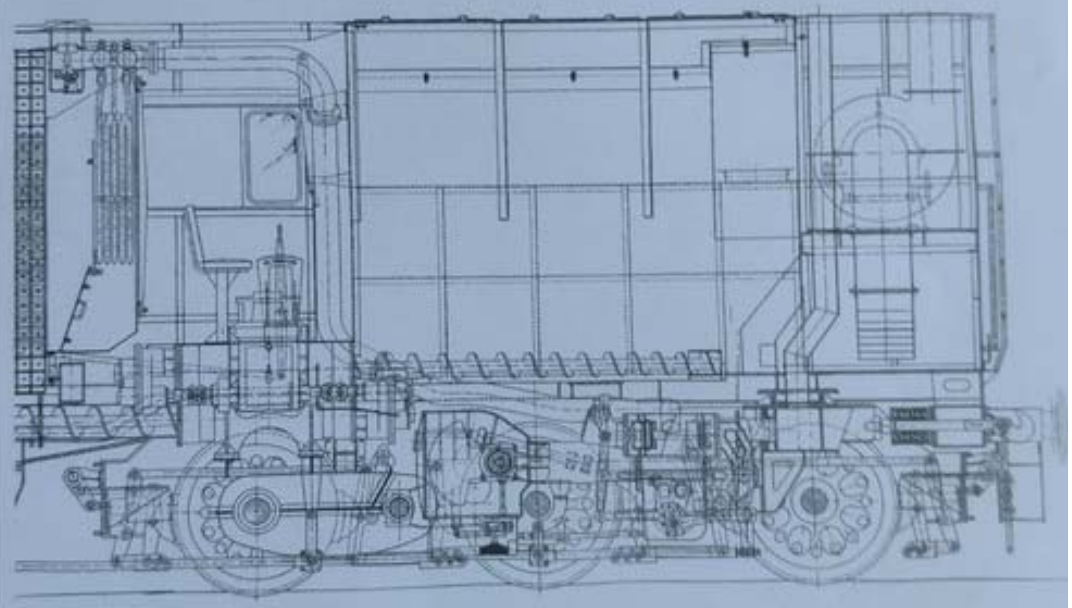
previous steam locomotives.

The body and equipment were carried on a strong girder underframe. The crew cabs were centrally placed, either side of the boiler with driving positions just ahead of the boiler compartment. This ensured that communication within the crew was good though, as the firehole door was on only one side of the firebox, in one direction the driver and fireman were necessarily separated. The more central cabs were at the expense of a more restricted forward view, but the drivers of large steam locomotives were already used to that. At the outer ends of the locomotive were the turf hoppers, front and rear, and the water tanks.

rectangular section, of welded steel construction, with two short rectangular barrels flanking a deep central firebox. It is likely to have been based on power station practice, something of which the Irish had unique experience; at that time about a third of electric energy in the republic was generated in power stations fuelled by turf. Pre-heated feed water was supplied through Weir pumps. On CC 1, turf was fed mechanically by screws from the turf hoppers, and distributed into the firebox by high pressure steam jets. This gave a measure of control by the fireman in the cab. The principle followed was of independent control of firing and

pressure pulls greater or lesser quantities of air through the fire grate as required to match the rate of working). The gases were drawn through the firebox and water heating circuits by a steam turbine at each end of the locomotive, and exhausted through the locomotive roof via spark arrestors. The steam generated in the boiler passed through rudimentary superheaters in the smokeboxes before reaching the engines and then exhausting to atmosphere, again through a chimney pipe in the roof.

Thankfully, it was political pressure to get the prototype running that led to a change of heart in OVB about the form the engines in the bogies should take



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be seen at the outer ends of the locomotive. These are the larger deflectors which were fitted after trials with a smaller version. *C.L. Fry*

Trial running began in September 1957. An early difficulty was exhaust steam blocking the driver's view. This was resolved by fitting smoke deflectors, one on each front corner of the bunkers. Once the size of the deflectors had been optimised the system worked – shades of experience with the SR Bulleid Pacifics here. During movements in Inchicore Works yard, an accident occurred when CC 1 collided with diesel Bo-Bo 1100. The reports from the people driving the locomotives claimed that both locomotives were stationary at the time of impact, causing OVB considerable amusement.

The subsequent road trials of CC 1 were deemed to be satisfactory in that a steaming rate of 14,000lbs per hour could be reliably attained by an experienced crew, and speeds up to 60mph were achieved in main line running. Turf consumption on loaded runs was between 84 and 99lbs per train mile including turf used in lighting up from 100lb/sq in and stabling. A major issue against continuing with the turf-burner design was its weight. At 118 tons on six axles, CC 1 averaged just under 20 tons axleload. That restricted it to main lines only. For it to have been of general-purpose use across the

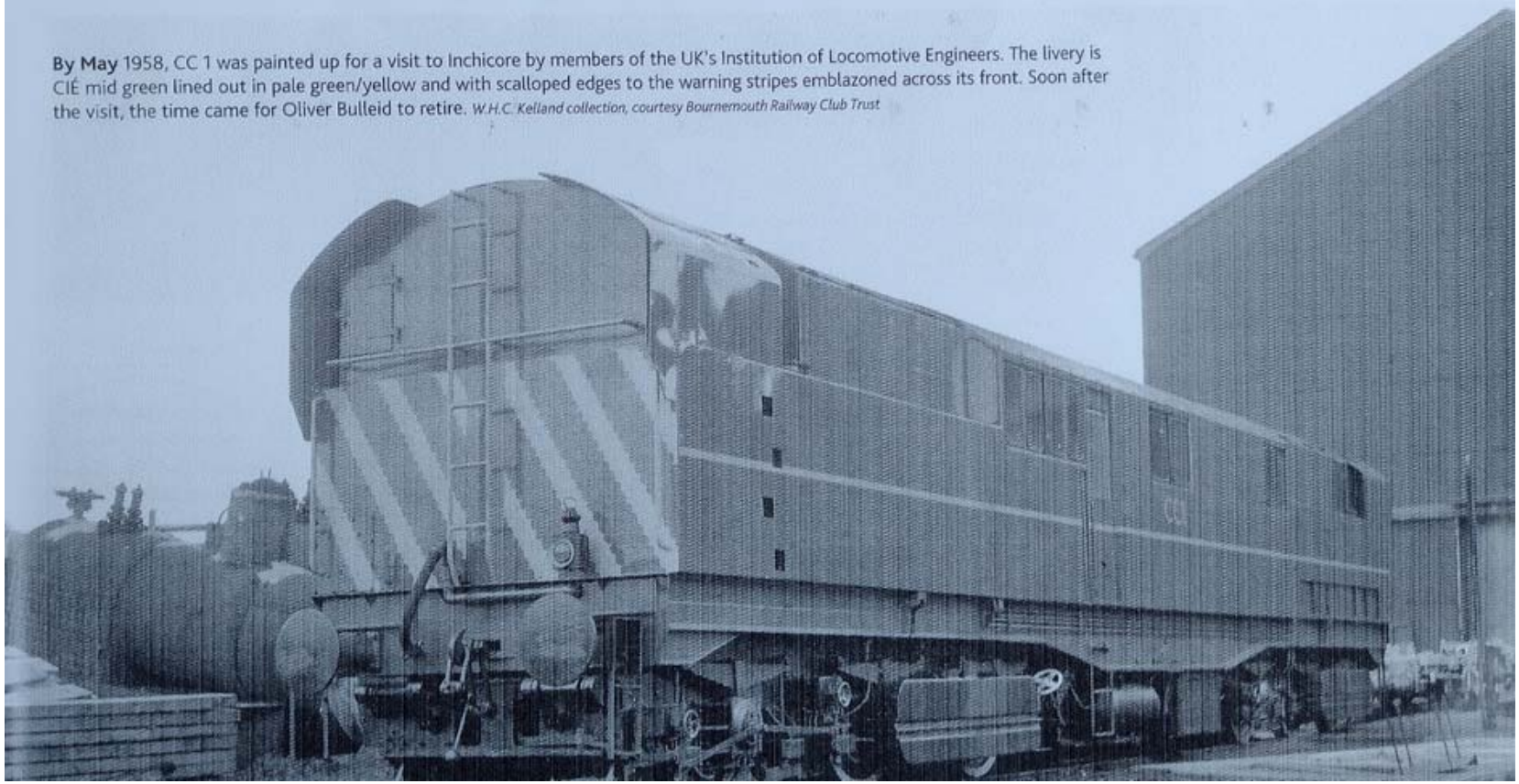
have needed an axleload of less than 15 tons to be within reach of achieving real usefulness.

In early 1958, a formal visit by the UK's Institution of Locomotive Engineers took place to Inchicore Works, and OVB acted as host there. No CC 1 was painted up for the occasion and gave footplate rides to the senior visitors, some of whom were impressed and others who were frankly bemused. Oliver Bulleid retired later that

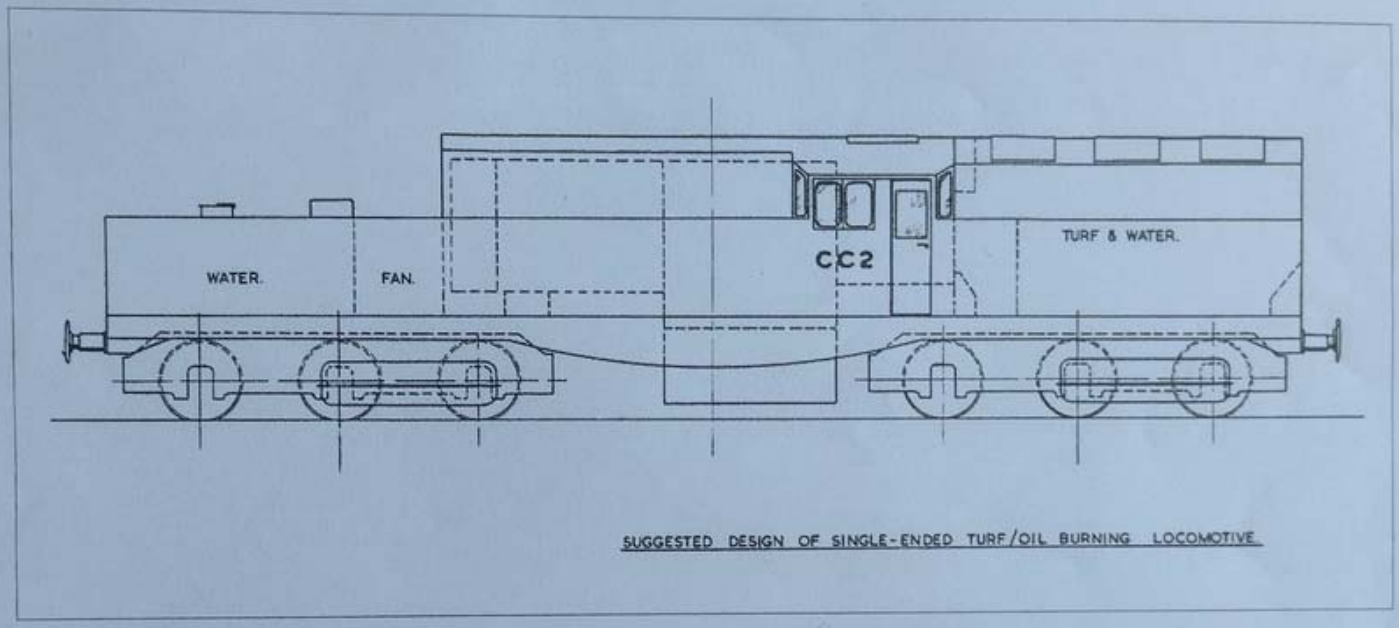
reached a number of successful milestones in his technical career. By then it was already clear that total dieselisation was intended by the CIÉ Board to be the way forward. With oil supplies reasonably assured, there was no need for a standby fleet of steam locomotives. CC 1 was quietly put to one side, to remain outside the back of Inchicore Works until its final scrapping which took place late in 1963.

Engineer	O.V.S. Bulleid
Number in class	1
Introduced	1957*
Cylinders (4)	12in x 14in
Coupled wheels	3ft 7in
Boiler pressure	250lbf/sq in
Grate area	22.75sq ft
Tractive effort	20,000lbf
Weight in w.o.	118tons 0cwt
Number series	CC1

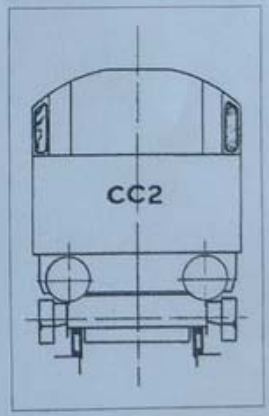
* This locomotive was experimental and was not taken into operating stock.



By May 1958, CC 1 was painted up for a visit to Inchicore by members of the UK's Institution of Locomotive Engineers. The livery is CIÉ mid green lined out in pale green/yellow and with scalloped edges to the warning stripes emblazoned across its front. Soon after the visit, the time came for Oliver Bulleid to retire. *W.H.C. Kelland collection, courtesy Bournemouth Railway Club Trust*

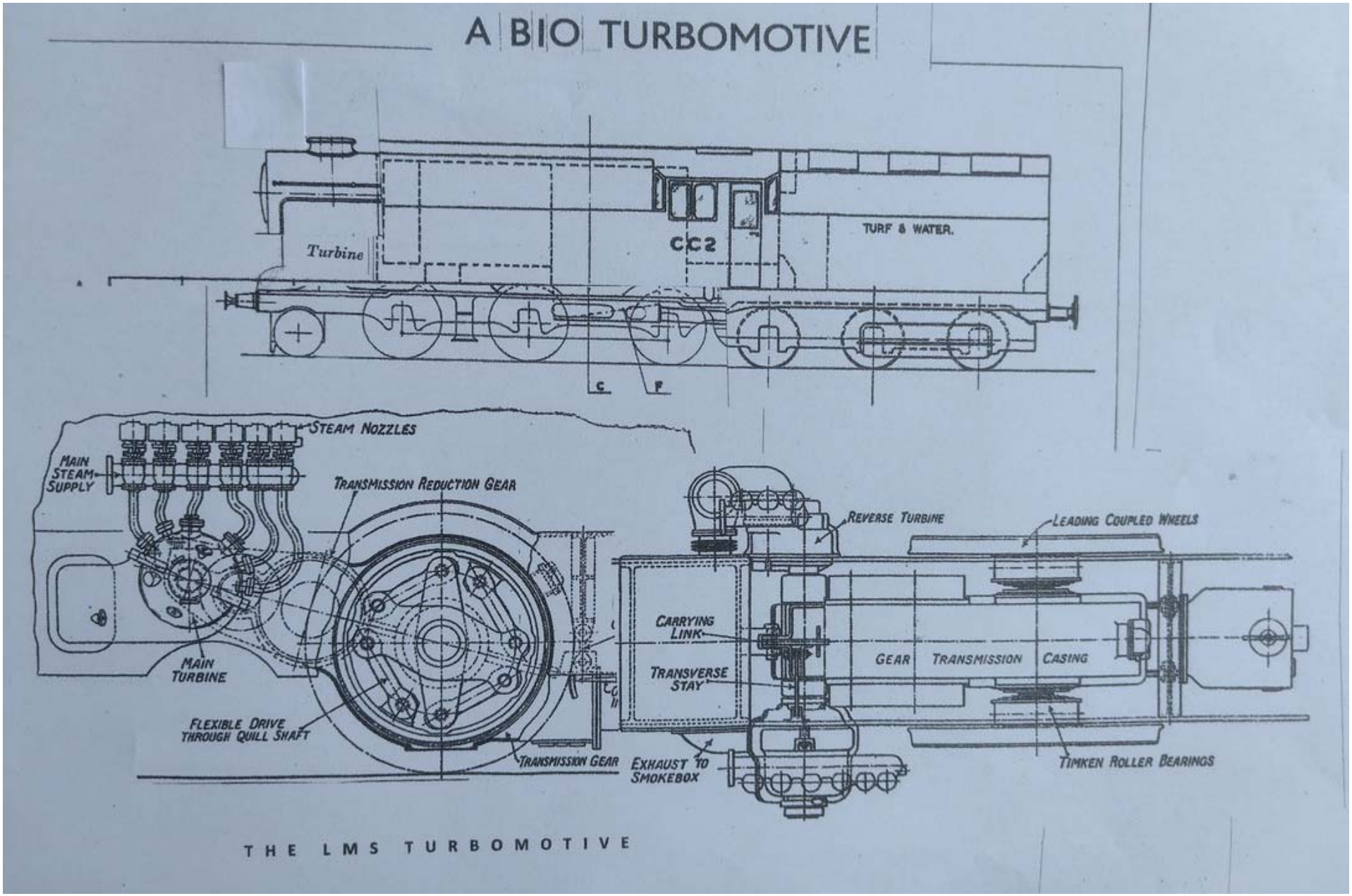


SUGGESTED DESIGN OF SINGLE-ENDED TURF/OIL BURNING LOCOMOTIVE



Plan of proposed single ended Turf Burner. The plan is both undated and unsigned although may well be the work of Click. A sketched drawing of a similar proposal is located within the NRM archives.

A BIO TURBOMOTIVE



THE LMS TURBOMOTIVE