DOCUMENT No. L.136/4

DEPARTMENT OF INDUSTRY AND COMMERCE, IRISH FREE STATE.

REPORT ON ACCIDENT TO DRUMM BATTERY TRAIN.

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YOUR REFERENCE .....

OUR REFERENCE FL/IAP.

24th July 1935.

THE SECRETARY,
DEPARTMENT OF INDUSTRY AND COMMERCE,
Irish Free State,
Upper Merrion Street,
DUBLIN.

Sir,

In accordance with your instructions, our representative proceeded to Dublin on the 7th July to enquire into the incidence of the accident which occurred on the 25th June, when the Drumm Battery "A" train, one of the two in trial service on the Great Southern Railways, collided with masonry and earth debris on the track between Dun Laoghaire and Sandy Cove and was, subsequently, further damaged by fire.

Our representative spent four days in Dublin, during which he visited the site of the

accident, examined the damaged train in detail at the Railway Works at Inchicore, and enquired into all the circumstances of the accident and the conditions appertaining to this. He was assisted in this by your officers, the officers and staff of the Railway Company, the Drumm Battery Company, and others concerned, and obtained all the information he required.

We now beg to present our report, which is divided into two parts: I, the cause of the fire, and II, our recommendations as to the precautions to be taken to guard against similar mishaps in future. The report is illustrated by a diagram of the train and by nine photographs showing different views of the damaged parts.

I. THE CAUSE OF THE FIRE.

Circumstances of the accident.

A very severe storm was experienced between 9.30 and 10.30 p.m. on the evening of

the 25th June, 1935, accompanied by heavy rain. About 250 yards south of Dun Laoghaire station the track runs through a cutting faced with a vertical stone wall, 19 feet 6 inches high; a storm sewer located 8 feet 6 inches from the top and 5 feet inside the "up" track wall burst at about 10.5 p.m., causing the retaining wall to collapse for 30 feet in length. The fallen stone and earth blocked the "up" track to a height of about 4 feet and the "down" track to a height of about 1 foot.

The 2-coach Drumm battery "A" train, the general outline of which is shewn on the accompanying diagram, left Sandycove at 10.8 p.m. travelling towards Amiens Street, Dublin, on the "up" track.

On the previous "down" trip the driver and guard noticed water in the cutting sufficient to cover the rails, and in view of this the driver slowed down on approaching the cutting, especially

as the "up" track at this point is on the inside of a sharp curve and the sighting distance is short. The driver estimates his approaching speed at 10 miles per hour, and when about 20 yards from the point of derailment he noticed the blockage on the line. The track was then flooded with storm water to a depth of 2 feet. He was unable to apply his brakes in sufficient time to stop the train before meeting the debris, and ran into the obstruction at an estimated speed of 6 miles per hour.

The front bogie truck mounted the debris and was brought to rest before the remainder of the train, and forced about 3 feet 6 inches back under the leading coach, raising the front end 3 feet before the train came to a standstill. The train travelled through the debris for some 20 feet, and the impact with the debris bent and distorted the channel iron members at the lower outside edge of both battery chambers in the leading coach (Photo.3).

Description of the Fire.

Immediately following the derailment a fire broke out in two places in the battery chambers, as described in the reports of the train staff, the Drumm Company's representative on the train at the time, the chief officer of the Fire Brigade who attended, and others concerned. These reports were reviewed and substantially confirmed in subsequent conversations with the witnesses.

Allowing for some variation in the evidence as to the magnitude and duration of the fire, it is clear that a great deal of heat was generated, sufficient to distort the thin sheet steel sides of the battery chambers at two points and to char portions of the coach body, although there was little flame due to combustion. There was also a good deal of arcing and flashing which produced the effect of flames. The consequent alarm was accentuated by a number of small explosions due to the ignition of inflammable gases

from the battery, although these explosions were at no time dangerous nor productive of any ill effects.

The immediate cause of the fire.

The battery consists of 272 cells built into stainless steel containers each 10 inches long, 13½ inches deep and 14½ inches high. The positive pole of each cell is connected to its container and, therefore, any metallic connection between two or more steel containers or between the battery circuit and any one of the containers establishes a short circuit path for a current between the points of connection.

The cells are assembled in groups in crates which are housed in battery chambers suspended from the coach underframe. These crates, which provide for the insulation of the cell containers from each other and all of them from the coach steelwork, are constructed with hard wood barriers treated with an insulating paint between

each container, and the same material is used for the ends of the crate. The crate sides are of sheet steel, and a small clearance space is maintained between the containers and the sides.

As the result of the derailment the channel iron sections at the bottom edges of the battery chambers were bent, and in the case of the offside chamber of the leading coach were pressed against the steel sides of the crate and forced the steel sides into contact with the containers of the adjacent cells. This point, which is marked "X" on the diagram, is about 24 feet from the leading end of the offside chamber. (Photo. 4).

The general distortion of the battery chamber similarly forced parts of the metal structure into contact with steel containers at other points in the leading coach, causing local short circuits between these containers via the coach frame, but these local short circuits may be regarded as of secondary importance in the present

considerations. (Photo.9).

At point "X" severe arcing and burning had taken place and a very heavy current had evidently passed to the coach underframe.

A second point of contact between the battery and the underframe was found in a faulty cable connection at the point marked "Y" on the diagram. This cable passes through a bushed hole in one of the steel members of the underframe, but both bushing and cable insulation were found to be faulty. The cable is one of two which, in parallel, connect the main positive terminal of the complete 460 volt battery to the positive isolating switch. It is impossible to state definitely whether this fault occurred as the result of the derailment, or had developed before the accident.

The connection of these two points "X" and "Y" to the underframe immediately set up a

very heavy current from the battery through the short circuit, estimated at 3000 to 4000 amperes, continuing for 3 or 4 minutes, which generated sufficient heat to burn the insulation on the cables, and char the adjacent woodwork of the floor and sides of the coaches and the wood barriers in the crates.

II. RECOMMENDATIONS AS TO PRECAUTIONS TO GUARD AGAINST SIMILAR MISHAPS.

(1) In our opinion the first essential precaution is to eliminate the possibility of accidental connection between the cell containers and the coach underframe by constructing the sides of the crates of hard wood or other suitable insulating material. (This has already been done in train "B", and is provided for in the specification for new trains.)

(2) The general design of the battery chambers and their suspension from the underframe should

be carefully considered with a view to ensuring that in the event of a collision or derailment the possibility of an electrical connection being set up between the cell containers and the underframe is reduced to a minimum.

(3) Special care should be taken by the maintenance staff that the whole of the electrical circuit is kept insulated from the metal of the coach. All cable connections should be efficiently protected in order to eliminate as far as possible a breakdown of cable insulation, such as occurred at point "Y". Possibly an "earth indicator" might be devised, and connected to the main circuit, which would indicate immediately the breakdown of insulation at any point, but such an indicator should not be relied on to the exclusion of regular, and frequent, routine insulation tests.

(4) A further precaution should be taken by supplementing the battery section isolating switches by fuses inserted in the connections between the

four sections of the battery, which would automatically interrupt any current in excess of the maximum operating current. The positions of these fuses should be so arranged that the possibility of igniting gases is reduced to a minimum, while keeping them as close to their battery groups as this provision permits.

(5) We are satisfied that if the foregoing precautions are taken, the probability of an electric fire resulting from a derailment or collision is remote.

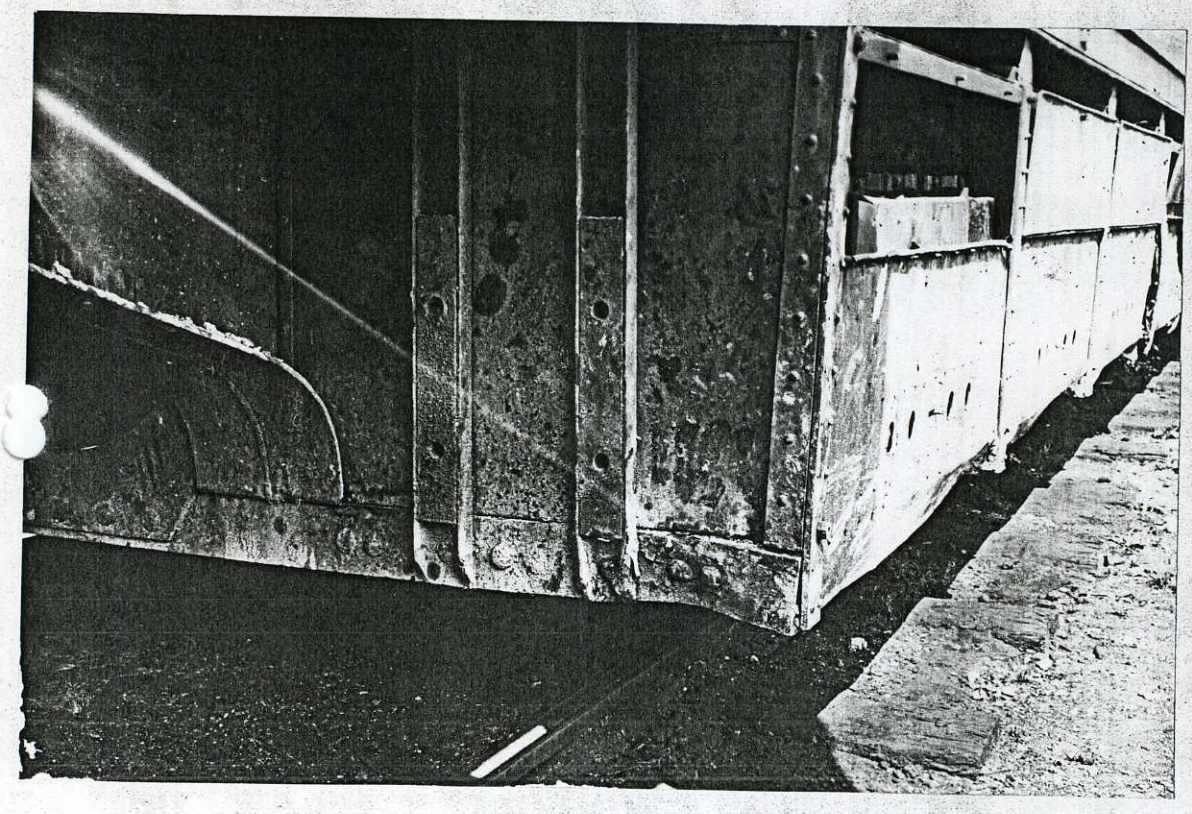
We are, Sir,

Your obedient Servants,

M & M.

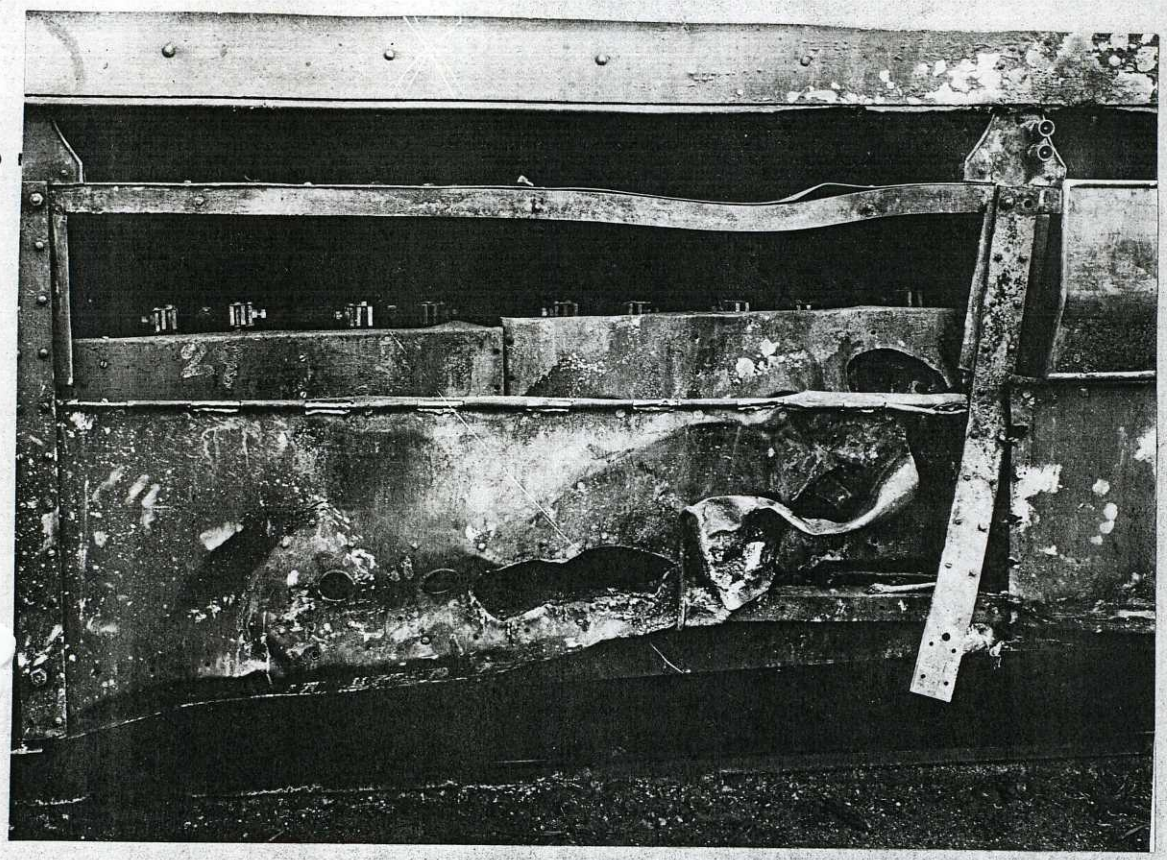
AND

(1) Offside leading corner of leading coach.

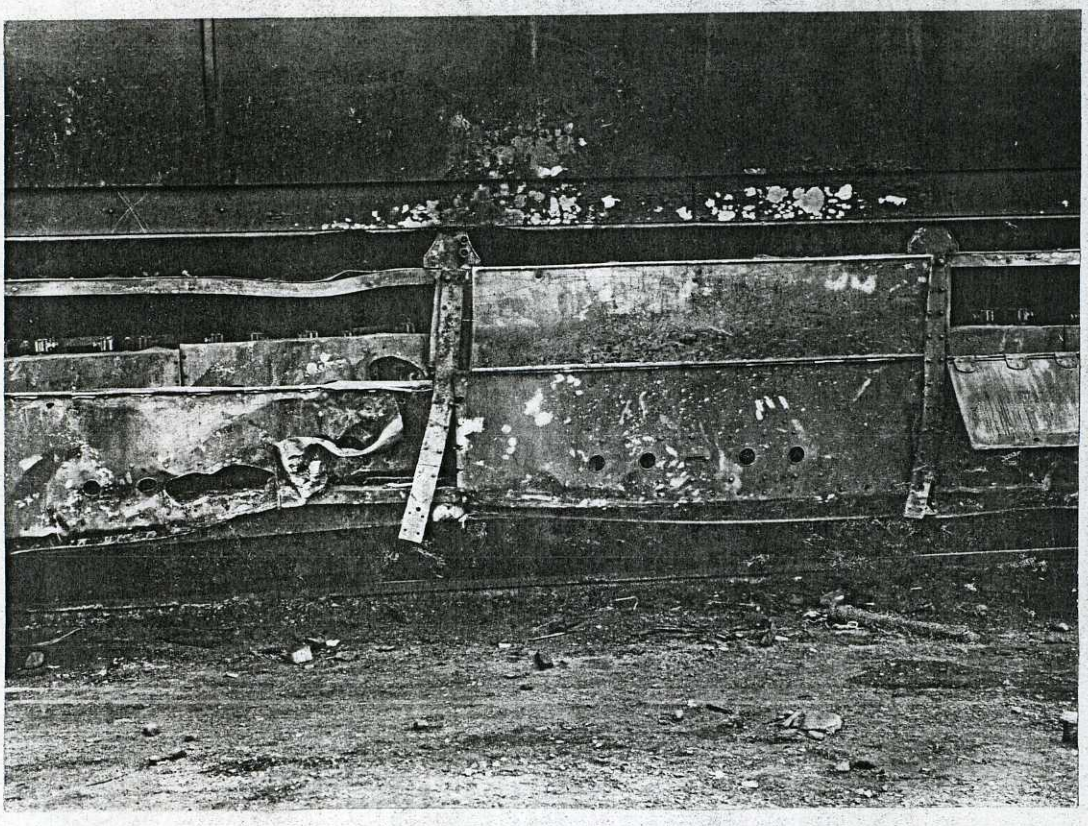


(2) Near side leading corner of leading coach.

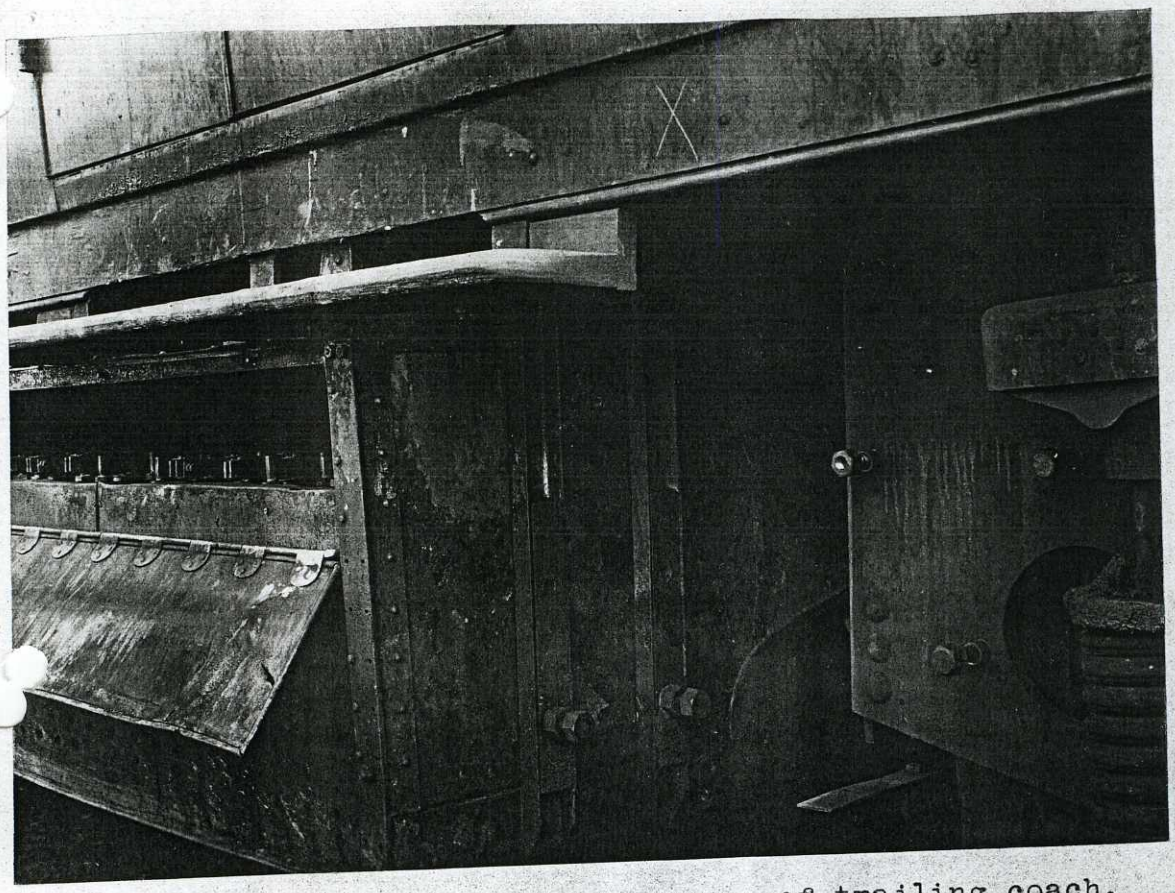
(3). Cells 1 to 24. Bay 4.



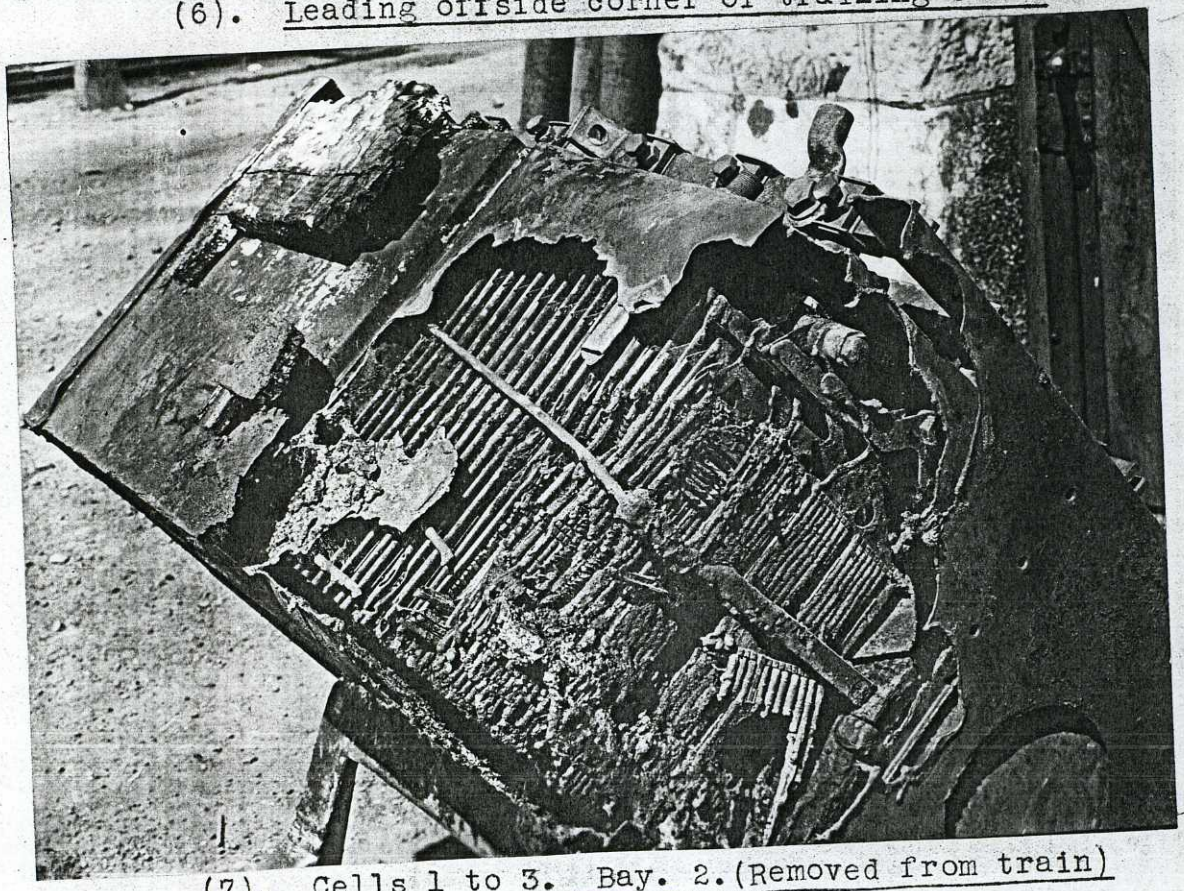
(4). Cells 28 to 25. (Left to Right) Bay.3.



(5) Cells 26 to 21 (Left to Right). Bay 3.



(6). Leading offside corner of trailing coach.



(7). Cells 1 to 3. Bay. 2.(Removed from train)

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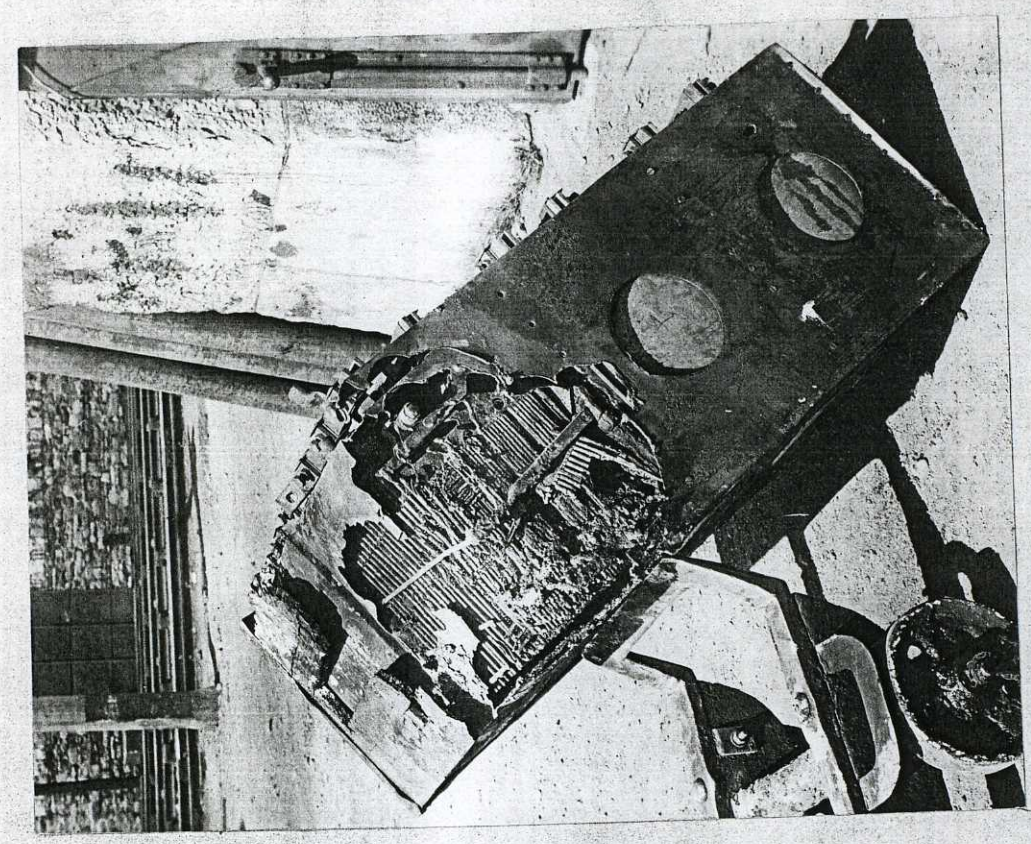
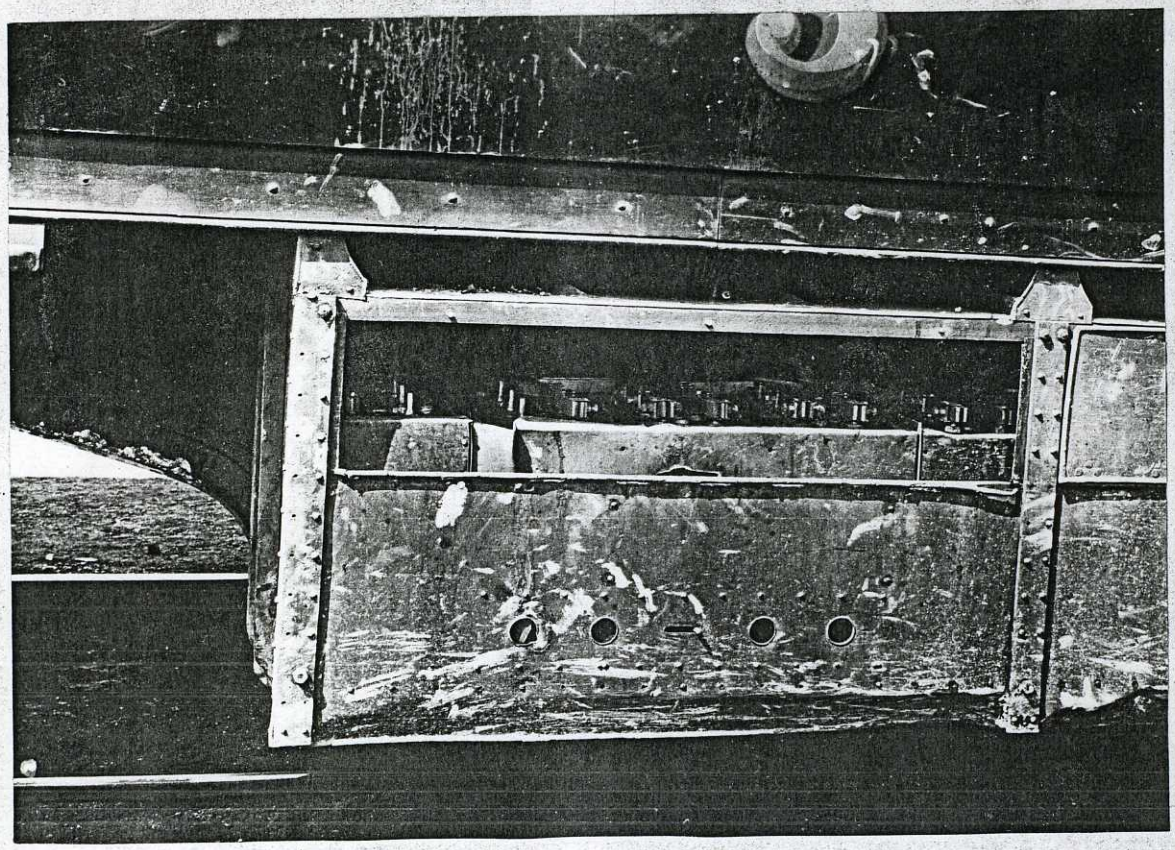


(8). Cells 1 to 3. Bay 2. (Removed from train).



(9). Cells 1 to 5. Bay 4.