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(54) Automatic railway platform barrier

(57) A barrier (5) has a moulded rubber wall of tapered cross-section, widest at its base and narrowest at its top when it is in the upright position and is hinged along its lower edge to a railway platform. The barrier separates waiting passengers on the platform from the potential dangers of the permanent way (railway track well). The barrier extends for the full length of the platform and is depressed along its length by the action of an approaching train. The forward motion of the train transfers a turning force to the barrier via bearing assemblies (3) fitted to the train and depresses the barrier into the permanent way. When the train departs the barrier is automatically restored. The barrier is flexible and provides a barrier regardless of the length of the train. Where it has been depressed it is invisible to waiting passengers and obstructs them in no way.

FIG 4. TRAIN ARRIVING AT PLATFORM

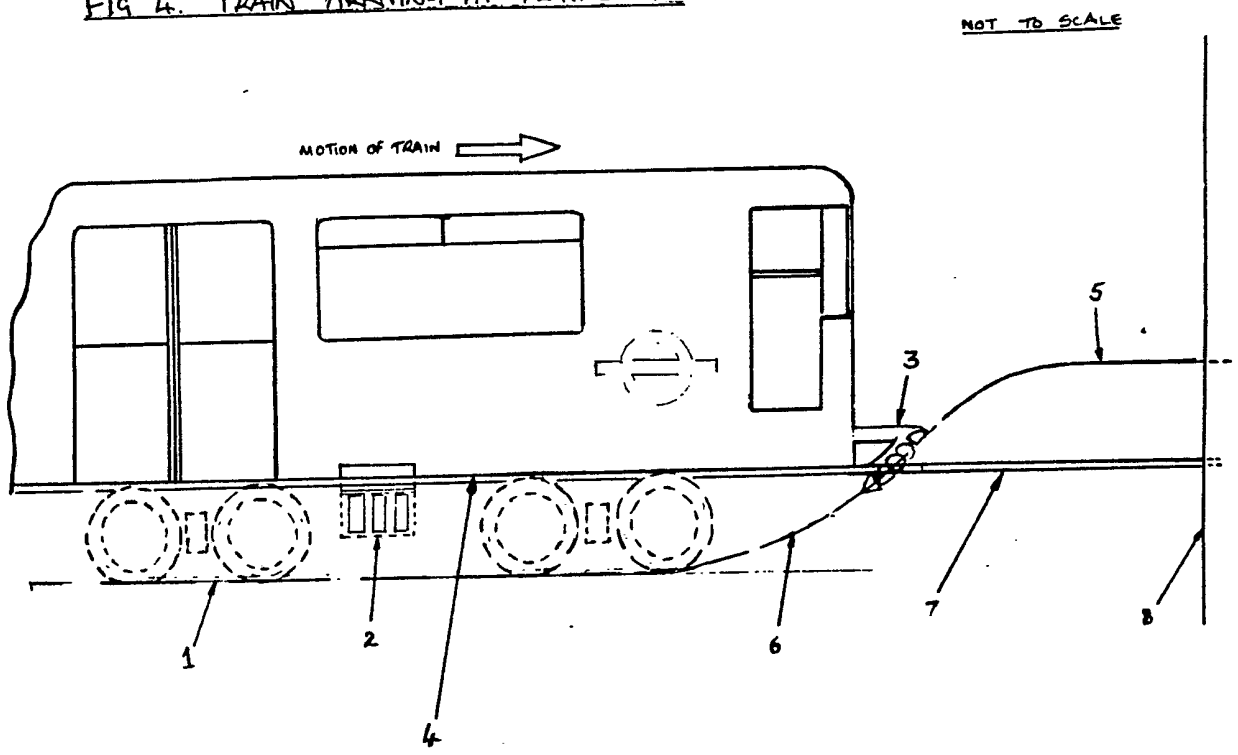

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FIG 1. THE BARRIER

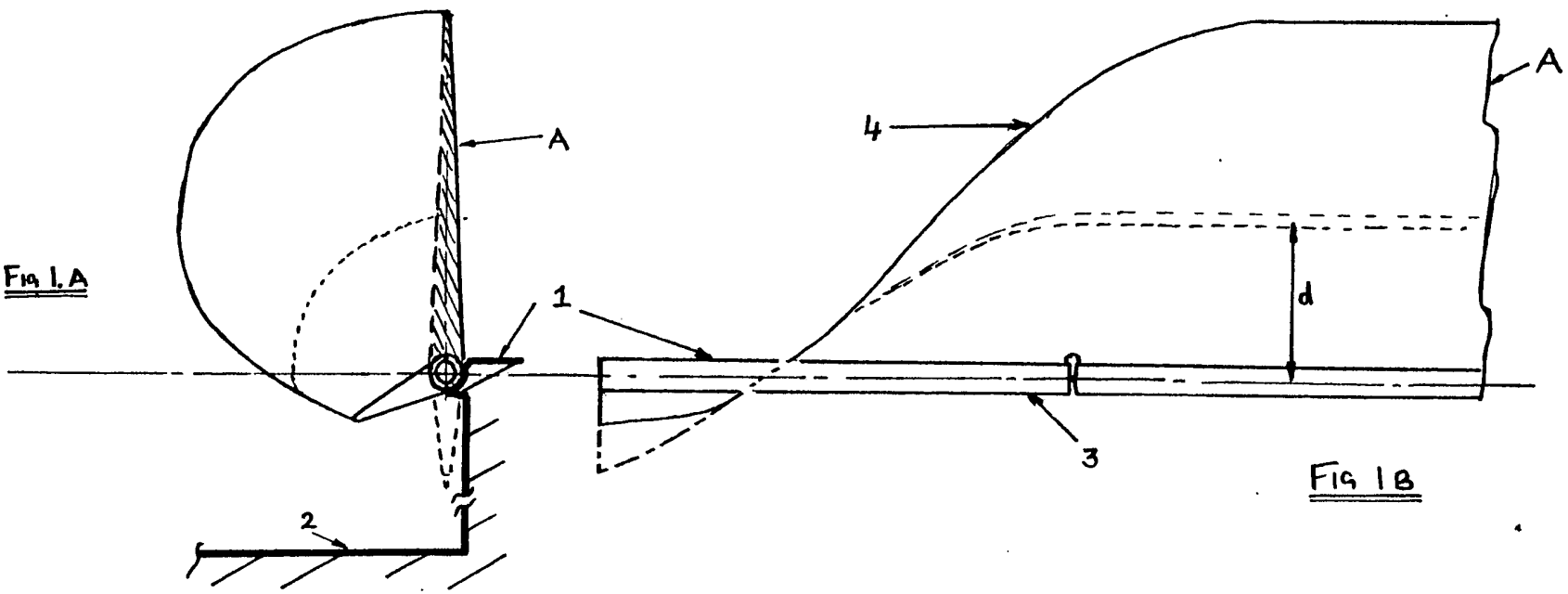


FIG 1.A

FIG 1B

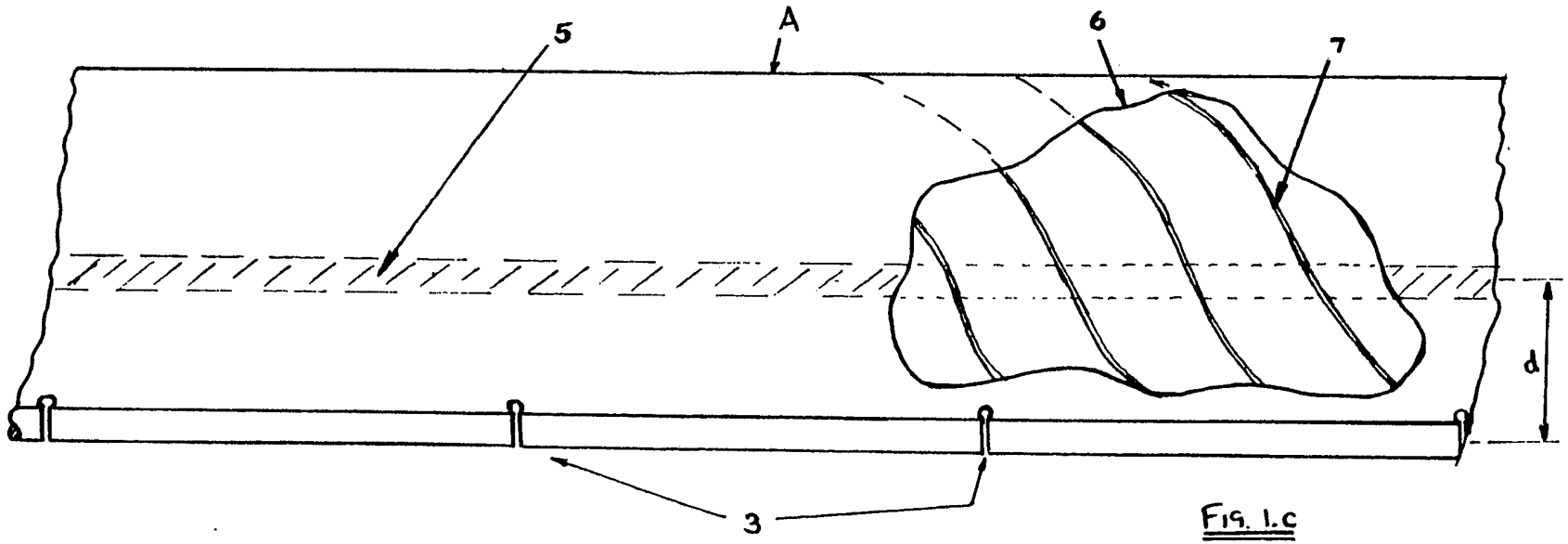


FIG. 1.C

Fig 2 THE ATTACK BEARING ASSEMBLY

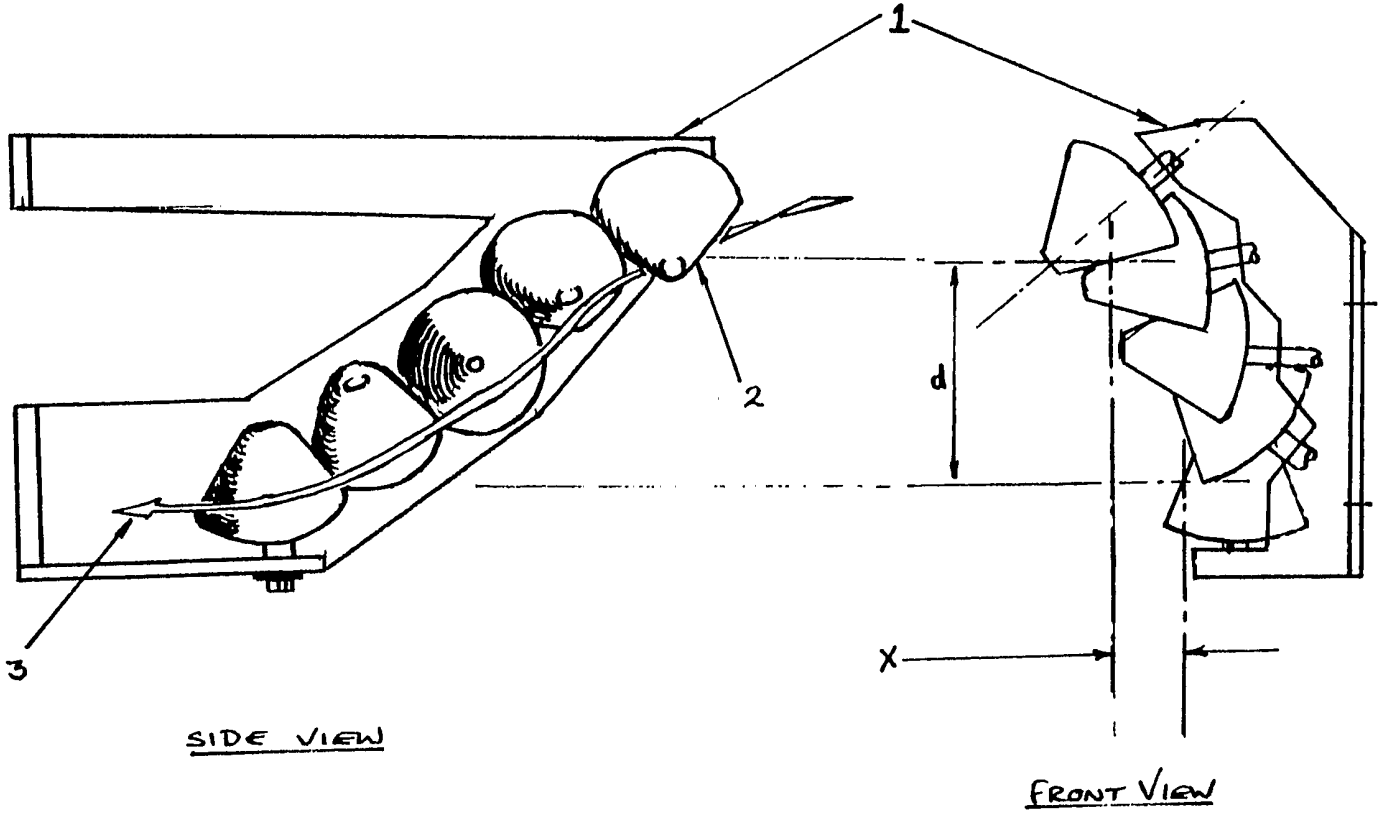


FIG 3. THE FOLLOW BEARING ASSEMBLY

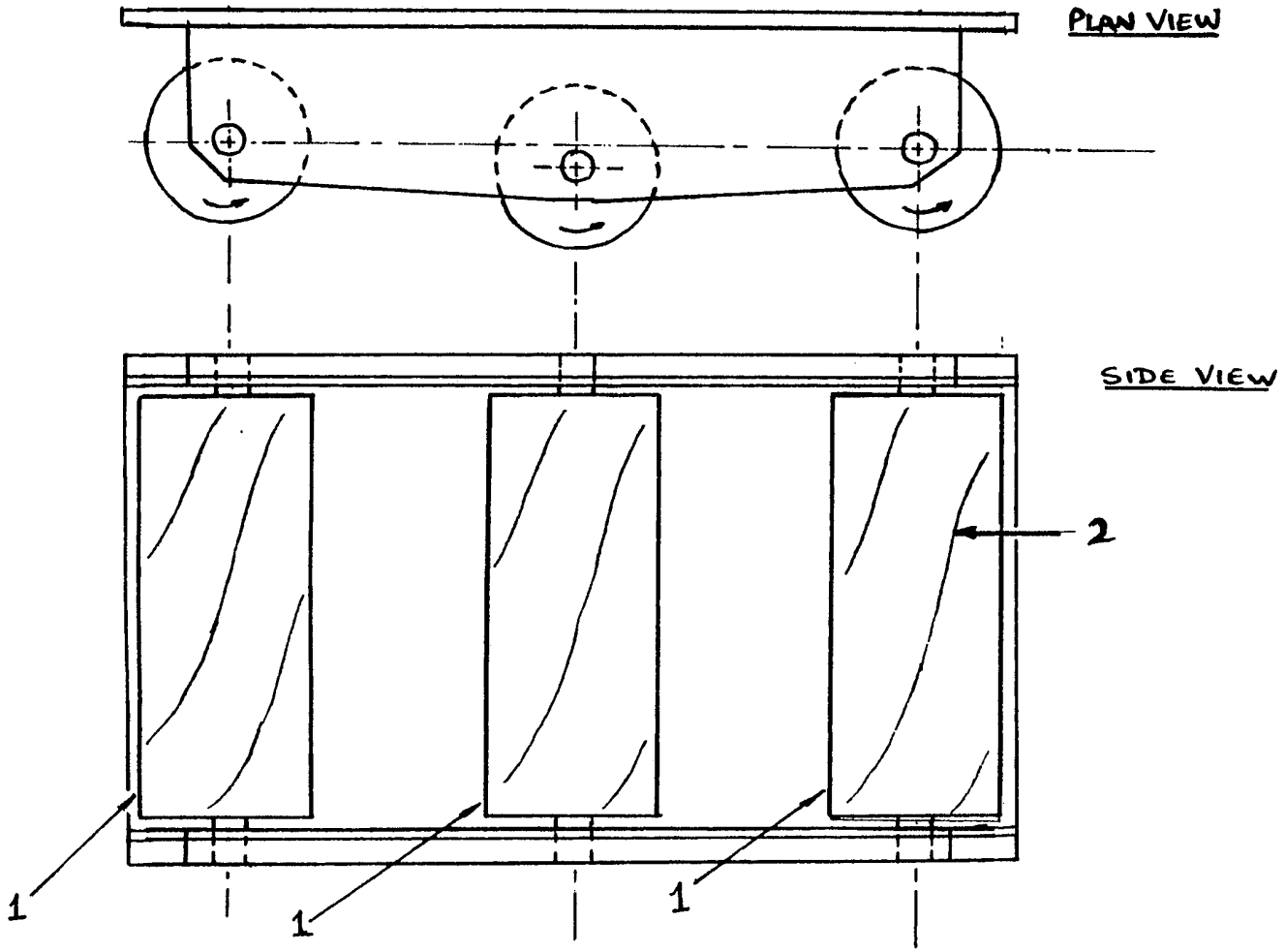
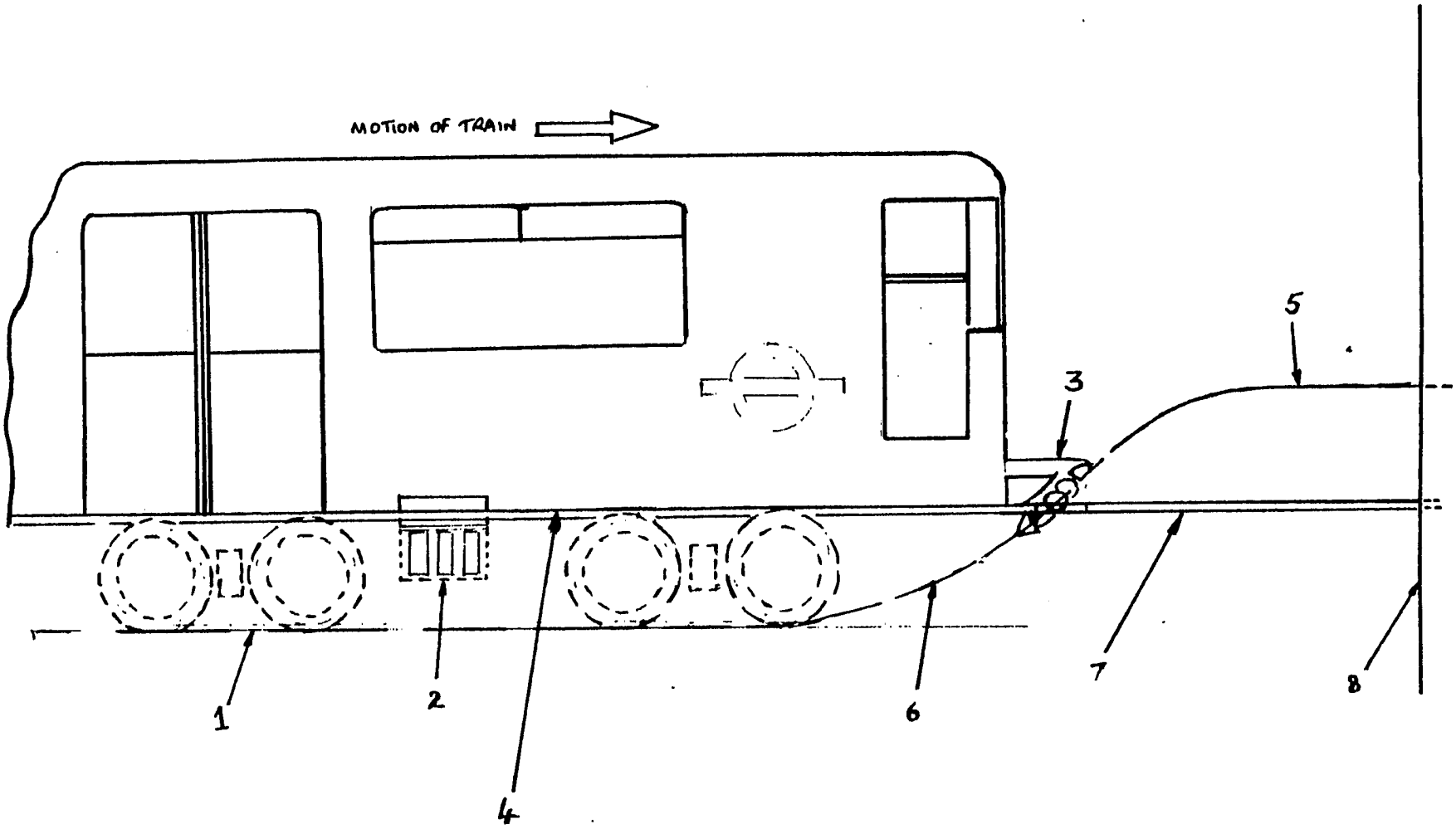


FIG 4. TRAIN ARRIVING AT PLATFORM

NOT TO SCALE



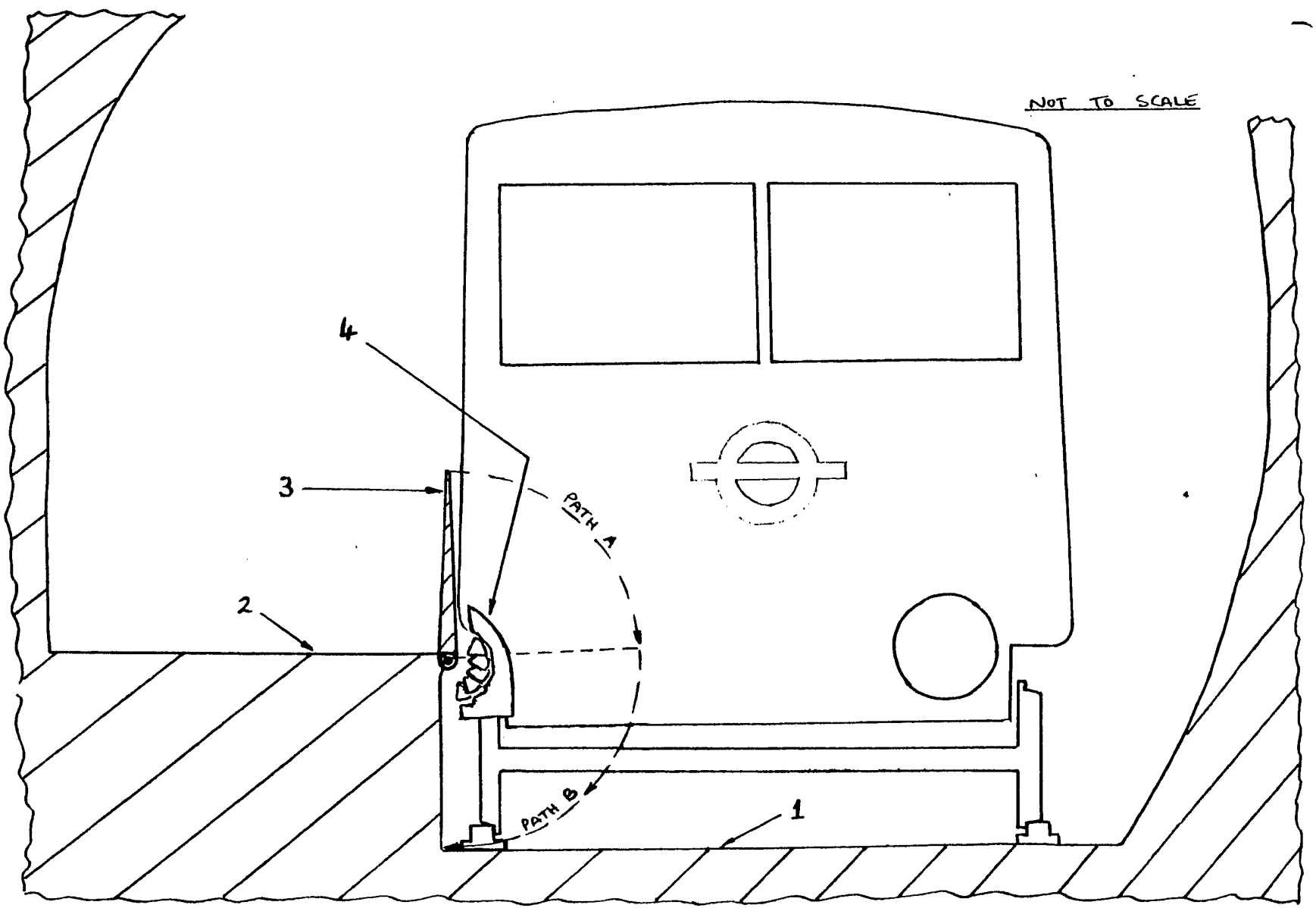
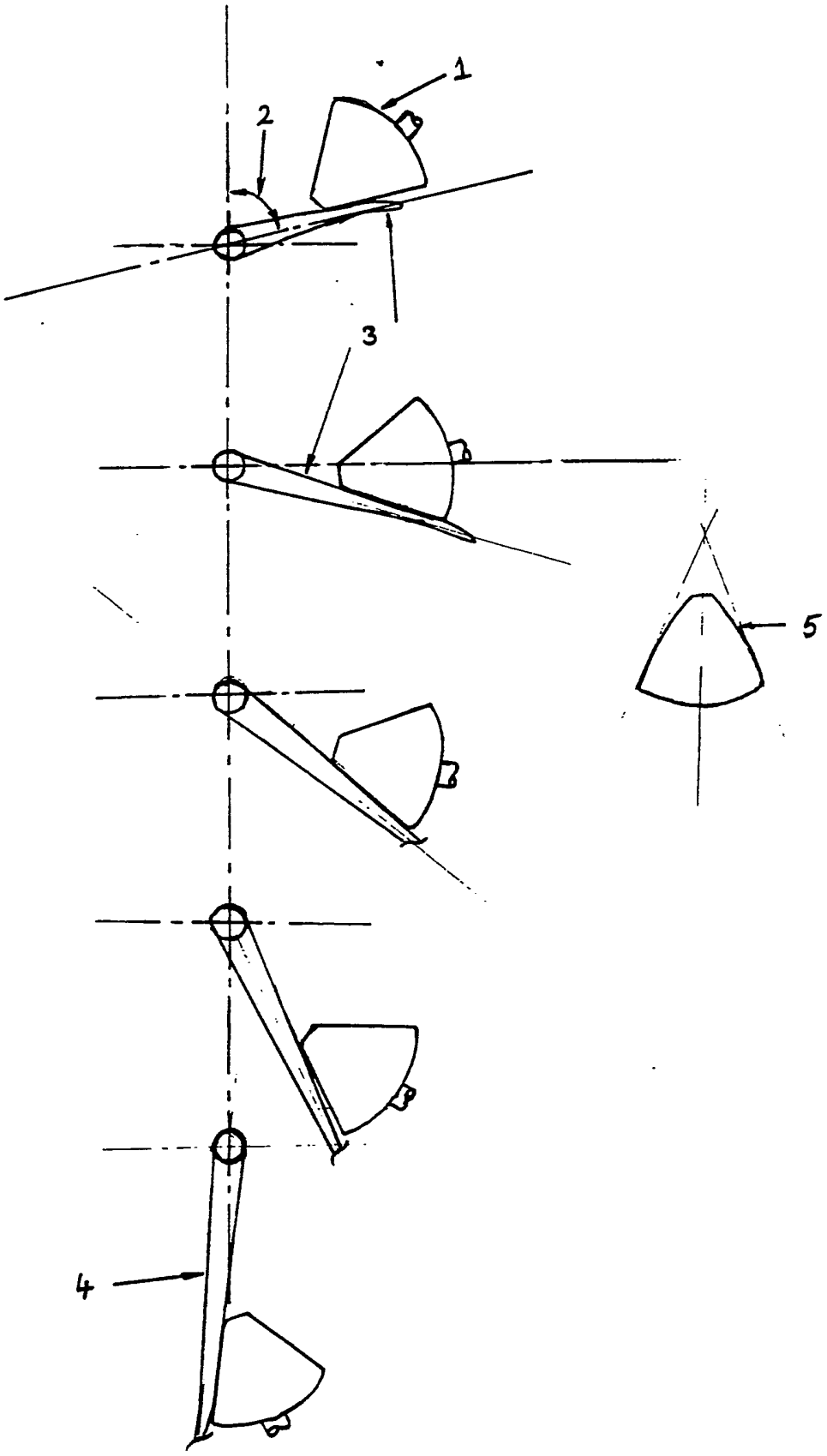


FIG 5. TRAIN ARRIVING AT PLATFORM (OF AN UNDERGROUND STATION).

FIG 6. ATTACK BEARING ASSEMBLY ACTION



RAILWAY AUTOMATIC PLATFORM BARRIER

1. PURPOSE

This document describes a retracting barrier which will seperate passengers at a railway station platform from the railway track well (permanent way) and which is particularly suited for use on underground networks.

2. BACKGROUND

2.1 Anyone using the London Underground (or any railway platform for that matter) will be aware of the frighteningly total absence of any barrier between the waiting and jostling passengers and the permanent way.

2.2 Certainly when one considers the turnover of trains and the passenger throughput on the London Underground for example, it is remarkable that there are not more accidents.

2.3 On the London Underground and during rush hours most people will spend most of their time waiting on platforms rather than on the train itself. Platforms are often overfilled with waiting passengers and yet more passengers are still forcing their way on in anticipation that they might not get their train. It is a forbidding prospect that so many passengers are within 2-3cms of onrushing trains.

2.4 Any transport organisation operating a railway has an obligation to ensure the safety of the public and it's staff on it's premises. In assessing the value of a Railway Automatic Platform Barrier (RAPB) it is well to consider the terrible overcrowding on the platforms of the London Underground. Considerable costs are incurred and inconveniences caused (delays particularly) as a consequence of foreign objects or people on the tracks (eg suicides - of which there are a few each year), suggest a requirement for a effective barrier.

3. DESCRIPTION (OF INVENTION)

3.1 The barrier is a continuous moulded rubber wall of tapered cross-section, wide at its base and narrowest at its top in the upright position. See Fig 1A/A. Its exact height is limited by the depth of the permanent way into which it is stowed during the presence of a train. This height may therefore vary but in most cases my studies have shown that this will be between thigh and waist height for Underground services (approx 1m), and in excess of that for Main Line services. Its length will be a few metres in excess of the length of the platform to which it is to be fitted.

3.2 The body of the barrier comprises sprung steel ribs or high tensile plastic ribs which are flexible and allow the barrier to flex and twist along its length. See Fig 1C/7. They are set into the barriers moulded body and give it vertical rigidity and strength when free of any twisting force. They also assist in the transmission along the barrier of the turning moment applied at the end.

3.3 The height of the barrier is less at the end from which the train approaches (or at both ends if trains approach from either directions). The reduced height will assist the initial contact between train and barrier. Once the Bearing Assemblies have turned the barrier to its fully depressed position (180 degrees from vertical), the torque in the barrier will effectively cease as no further angular force is applied by the train.

3.4 The lead end of the barrier will also be pre-moulded inwards from the vertical so as to ease first contact between the barrier and the train. The tip of this end of the barrier will be 80 to 90 degrees from the vertical. Since the reduced height of the barrier at the end(s) (see Fig 1A & 1B) would lessen its effectiveness to the public the lead ends of the barrier will begin prior to platform limits ie within the tunnels in the case of underground networks.

3.5 Within its base, the widest section, and along its full length is a sprung tubular pivot or hinge, sectioned for ease of construction or repair, see Fig 1A, 1B/3 & 1C/3. This hinge permits 180 degrees rotation about its axis for normal operation. The hinge is robust and quick acting, able to cope with a twisting moment imparted to it by an approaching train.

The hinge may be unlocked from its 180 degree restricted movement to permit rotation enabling it to be laid upon the platform. This might be necessary to permit passage of a fast non-stopping train.

This hinge is considered a component not requiring any new technology.

3.6 In its upright vertical position the barrier is rested against a stop (integral to the hinge) so establishing an effective barrier between those on the platform and the track well itself. This stop may be unlocked to permit greater movement for other reasons. When the barrier is forced to the down vertical position by the motion of an advancing train it moves against a spring in its base which returns the barrier when the train departs.

3.7 The region of the barrier along its length which makes contact with the Bearing Assemblies , see Fig 1C/5, is specially constructed to withstand the forces and resulting frictions applied to it. It will be of a denser mix of the rubber solution used in the moulding process or would be a removeable strip fitting of a harder wearing material. This second method would facilitate easier maintenance of the barrier eliminating any need to replace the entire barrier in the course of routine maintenance.

3.8 BEARING ASSEMBLIES

3.9 Bearing assemblies are fitted to the front nearside quarter and along the length of the nearside of the train. See Fig 4/3 & 5/4, and Fig 4/2 respectively. These assemblies serve to place the barrier in its depressed position by utilising the forward motion of the train and also reduce friction between the barrier and the train as it is held down in its depressed position.

The Bearing Assemblies do not comprise any new technology and are not the subject of the patent. They are however essential to the operation of the barrier.

3.10 Attack Bearing Assembly (Fig 2)

Fig 2/1 - Assembly Chassis
Fig 2/2 - Roller Bearing
Fig 2/3 - Path offerred to barrier contact area.

3.11 A series of radially arranged roller bearings ,the Attack Bearing Assembly is fitted to the front nearside quarter only. It is the first point of contact between the moving train and the barrier. This contact occurs before the train reaches the limit of the platform.

3.12 The assembly is fitted to the train so that the first bearing is at approximately platform height. Distance 'd' on Fig 2 is the span of the bering assembly and also corresponds to the distance between the bearing contact area on the barrier and the hinge in its base, see distance d Fig 1.
This is because at the point of first contact, the pre-formed barrier is in a near horizontal plane across the path of the train and points inward to the permanent way. (That is the lead portion of the barrier is already at 80-90 degrees from the vertical due to its pre-formed construction).

3.13 The contact surfaces of successive bearings, radially arranged on the assembly present a angular path to the barriers contact surface, Fig 2/3. The barrier is free to rotate (and twist) so it follows the helical path offerred to it.

Note: the displacement X shown on the front view Fig 2 is exagerrated for reasons of clarity.

The pre-forming of the lead of the barrier biases it in favour of inward rotation. The turning moment is easily transmitted along the length of the barrier. After initial contact has been made the barrier rotation moves as a wave down the length of the barrier.

3.14 The result is a smooth and continuous depression of the barrier in advance of the train, see Fig 4/6. As a result of the elasticity of the moulded barrier, areas in front and behind the train will be unprotected as the barriers height varies from platform level to its full height. It is anticipated that this need not be in excess of 3 metres and will probably be outside of the limits of the platform area.

3.15 Follow Bearing Assemblies (Fig 3)

3.16 The Follow Bearing Assemblies serve merely to hold the already depressed barrier fully depressed and clear of the train along the trains full length whilst it is within the limits of the barrier.

3.17 The assembly consists simply of three parallel rollers (Fig 3/1) fitted to the nearside of the train at a height commensurate with the contact bearing surface of the barrier when it is in its fully depressed position, distance 'd' on Fig 1. A number of these assemblies will be fitted to a train and its carriages. The number fitted will be dependent on the length of the train and the elasticity of the barrier.

3.18 The surface of the bearings can incorporate a raised helix (Fig 3/2) which will impart a slight downward motion to the barrier and will assist continued depression of the barrier. The assembly is otherwise of conventional design.

4. ACTION (Fig 4, 5 & 6)

4.1 With no train at the platform the barrier is upright providing a minimum 1m high divider between the permanent way and the platform along the platforms full length.

4.2 As the train approaches the platform and whilst it is still in the tunnel, the Attack Bearing Assembly fitted to the front nearside of the train makes contact with the lead portion of the barrier. Note that because of the pre-moulded twist of the lead portion of the barrier, the barrier at point of first contact is already at approx. 90 degrees inward from the vertical, Fig 6/2. This will lessen the torque needed to move the barrier through to its fully depressed position.

4.3 The forward motion of the train against the barrier, which is fed in a downward spiral action by the arrangement of the bearings, causes a turning moment to be transmitted along the length of the barrier. In this way the entire barrier is turned inward in advance of the position of the train.

4.4 Fig 6 shows the action of successive bearings of the Attack Bearing Assembly. the first bearing making contact with the lead of the barrier which is pre-set at approximately 80/90 degrees from the vertical. The successive bearings progress the rotation of the barrier, the last one virtually fully depressing it into the side of the permanent way.

It is essentially the same action as that of a snow plough as it clears snow from the road (though the angular rotations are in opposite directions).

4.5 The 80-90 degree advance setting of the lead of the barrier is important since it lessens the torque present in the system. Since at the moment of first contact the barrier is near 90 degrees from the vertical, the bearing assembly only has to apply adequete force to rotate the barrier through 90 degrees (for full depression), see Fig 5 Path B. The greater portion of the barrier has to turn through 180 degrees, Fig 5 Path A plus Path B. For that portion of the barrier, the movement from the vertical to mid-point is achieved by the transmission of the torque longitudinally through the body of the barrier. As most platforms are in the order of 40m or more in length the flexible structure of the barrier can use this force productively.

4.6 Along its full length the barrier will be depressed into an accomodating space which already exists in the permanent way beside the platform foundation (between the trains undercarriage and the platform foundations). See Fig 4/6.

4.7 At intervals along the trains length 'Follow Bearing Assemblies' will maintain a clearance between the train itself and the barrier. These intervals will be determined by the longitudinal elasticity of the barriers top-most edge.

4.8 Because the barrier is only depressed along the length of the train itself, unoccupied areas of the permanent way will continue to be isolated by the barrier regardless of the trains length. This self-adjusting feature is a prime attribute of the barrier.

Note that the barrier copes with differing lengths of train without alteration or attention.

4.9 Furthermore since the barrier has been completely depressed along the trains length there are no constraints on the train to attempt any sort of allignment that might otherwise be necessary to allow passengers to alight to or from the train.

4.10 As the train departs the barrier is driven back to its vertical position by the pressure of the spring hinge in its base which was tensioned by the torque depressing the barrier earlier.

4.11 To prevent damage or injury as a result of any whiplash the barriers return travel will be damped either by fitted dampers or by a damping mechanism integral to the hinge.

Future variations of the barrier could include assisting or remotely controlling the depression of the barrier.

4.12 Safety Features

4.13 It is intended that the barrier should only be fitted where overcrowding is a real problem and where trains will always stop, eg Underground services. If a train needs to pass through the station at high speed, platform staff should first use levers or spanners (not shown in any figures) to lower the barrier onto the platform or to manually depress it. As stated in Section 3, the hinge may be unlocked from its normally restricted 180 degree operation.

4.14 The adhesion of the hinge to the barrier base should provide for a sheer force (to be decided) that if achieved strips the barrier from the hinge. Because of the relative flimsiness of the barrier no damage or injury to the train and its passengers should result. This is of course a worst case failure.

6. BENEFITS

The obvious benefits are summarised below:

6.1 Benefits to Passengers

a) Confidence in knowing that a physical barrier exists between themselves and the permanent way. This applies particularly to parents with children.

b) A reduction of delays caused by persons or foreign objects on the tracks.

c) Dust blown onto the platform by winds in the tunnels of underground systems will be reduced.

d) A barrier exists at unoccupied track even when a train is at the station.

e) No restrictions are imposed as to where on the platform passengers may alight the train, as is the case with other designs of barriers.

6.2 Benefits to the Transport Organisation

a) As a consequence of reduced incidents caused by unauthorised persons or foreign objects on the track there will be fewer occasions to re-arrange or cancel services. Overheads for these will be reduced.

b) Increased customer satisfaction will result from the safer and cleaner environment.

c) The barrier continues to provide protection even when a train is at the station. IE Areas not occupied by a train will be protected by vertical or near vertical barrier. This is a self-adjusting feature that provides barrier protection regardless of the length of train.

d) It is likely that the visible surface of the barrier can be utilised for advertising and will therefore be a source of revenue.

e) Maintenance costs will be low due to the barriers simple design.

KEY TO FIGURES

Figure 1 - THE BARRIER

/A - Barrier
/1 - Platform Level
/2 - Permanent Way
/3 - Sectioned Hinge
/4 - Pre-formed Lead
/5 - Bearing Contact Area
/6 - Cutaway for illustration only
/7 - Strengthener Rib

Figure 2 - THE ATTACK BEARING ASSEMBLY

/1 - Assembly Chassis
/2 - Roller (1 of 5)
/3 - Path taken by barrier
/d - Vertical span of bearing contact surfaces
/x - Displacement exagerrated for clarity

Figure 3 - THE FOLLOW BEARING ASSEMBLY

/1 - Roller
/2 - Raised helix

Figure 4 - TRAIN ARRIVING AT PLATFORM (SIDE VIEW)

/1 - Permanent Way
/2 - Follow Bearing Assembly
/3 - Attack Bearing Assembly
/4 - Platform Level
/5 - Fully raised barrier
/6 - Depressed barrier
/7 - Hinge
/8 - End of platform

Figure 5 - TRAIN ARRIVING AT PLATFORM (FRONT VIEW)

/1 - Permanent Way
/2 - Platform level
/3 - Upright barrier
/4 - Attack Bearing Assembly

Figure 6 - ATTACK BEARING ASSEMBLY ACTION

/1 - First bearing (1 of 5)
/2 - 80/90 degrees from vertical
/3 - The lead end of the barrier has reduced height
/4 - Fully depressed barrier
/5 - Convex sides of bearing

5. CLAIMS

a) The barrier is a moulded barrier of rubber and is of tapered cross-section, (widest at the bottom, narrowest at the top), with a longitudinal hinge in the base extending the full length of the barrier.

b) The barrier as claimed in a) provides an effective barrier which will seperate the public from the open permanent way.

c) The barrier is automatically depressed by the action of an approaching train.

d) The barrier as claimed has only one major moving feature.

e) The barrier as claimed can be fitted to existing platforms whether straight, curved or double-curved.

f) Its operation does not require ancilliary control systems, it is operated by the train itself.

g) The barrier as claimed maintains a safety barrier where needed regardless of train length.

h) The barrier as claimed causes no obstruction to passengers getting on or off trains.

i) There is no need for the train to allign doors with specific points of the platform.

AMENDMENTS TO THE CLAIMS HAVE BEEEN FILED AS FOLLOWS.

a) A barrier, hinged along the length of its base and reducing in height at the end towards oncoming trains (both ends if barrier is to cope with trains from either direction). Where the barrier height reduces the barrier is preformed from the vertical plane so that the endmost point is at least 90 degrees from the upright face. The preforming is in the direction away from the platform to which it is fitted. (Appl 9010737.6 para 3.1, 3.3, 3.4, 3.5, 3.13.)

b) The barrier as claimed is FIRST depressed by an angular force resolved from a linear force, parallel to the barrier axis and which is applied by the train itself. (Appl 9010737.6 para 4.2, 4.3, original claim c.)

c) A barrier as claimed which is FULLY rotated from its upright position (guard on) to a depressed position (guard off) by an angular force which by virtue of the construction of the barrier is transmitted as a wave down the length of the barrier and in advance of the train.(Appl 9010737.6 para 4.4).

d) A barrier as claimed which when operated is TOTALLY REMOVED from the path of alighting or disembarking passengers at a railway platform. (Appl 9010737.6 para 4.9, original claim b.).

e) A barrier as claimed which is first operated by the motion of the train itself and is maintained in a depressed state by the presence of the train. (Friction is reduced using bearing assemblies, the barrier returns to the upright under the action of a spring). (Appl 9010737.6 para 3.16).

f) The barrier as claimed has only one major moving feature. (Appl 9010737.6 original claim d.).

g) The barrier as claimed can be fitted to existing platforms (straight, curved or double-curved) with only minor changes to the existing platform. (Appl 9010737.6 original claim e.).

h) The system does not require ancilliary control systems. (Appl 9010737.6 original claim f.).

i) The system maintains protection where needed even when the train is stationary at the station. IE Unoccupied track remains guarded since the extent of depressed barrier is determined by the trains length itself. (Appl 9010737.6 para 4.8).

j) The protection system renders no requirement for the train to align itself with any point on the platform or protection system. (Appl 9010737.6 para 4.9).

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