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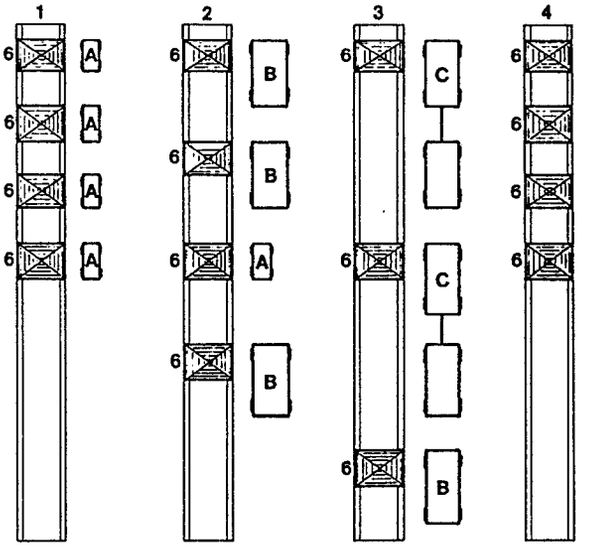
(54) **Mobile kiosk for toll collection at superhighway toll stations.**

(57) A description is given of a mobile kiosk either fitted with wheels or fixable on a trolley, and movable either with or without this latter along a rail track mounted on a base plinth or on a roadway, both these levels being provided with connectors for all necessary services.

The kiosk is to be installed in a superhighway toll station of any type, and in particular in a "multi-checkpoint" superhighway toll station and entrance of which is arranged for the distribution of tickets and the exit for toll collection, ie in a toll station in which each corridor comprises a series of consecutive kiosks positioned not in the direction of their width but in the direction of their depth, at variable distances apart.

FIG 1



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MOBILE KIOSK FOR TOLL COLLECTION AT SUPERHIGHWAY TOLL STATIONS

As is well known to millions of toll superhighway users, one of the most serious privations suffered in terms of obvious economical damage (individual and collective interests), ecological damage and safety is the increasingly more frequent formation of long entry and exit queues at superhighway toll stations, due to the continuous increase in superhighway traffic.

During certain periods of the year (holidays) and certain hours of the day (work commencement and termination) the automobile queues at toll stations reach a considerable size with entry and exit times for the superhighway user which are now considered intolerable.

Many studies have been dedicated to the problem of enlarging toll stations. The present applicant has in fact produced various alternative designs including the "three-level superimposed toll station" (underground, road level and overhead), the "longitudinal toll station", ie positioned parallel to the direction of travel with suitable access and exit lanes, the "comb-shaped toll station" consisting of spaced-apart banks of successive corridors arranged on the site and with successive access and exit lanes, and the "hypotenuse toll station" with the corridors arranged along a line oblique to the direction of travel of the user.

In addition there is the so-called "multi-checkpoint" with transit corridors provided with consecutive kiosks in the direction of their depth.

The suitability of these various types of toll station depends on whether the toll station is at the design stage and still to be build, or is an existing bottleneck toll station requiring restructuring, and for which severe rush-hour and thus regular traffic holdups occur at the transit passageways.

Of those solutions already proposed or theoretically discussed, the "multi-checkpoint" corridor toll station is of particular importance, this comprising two, three or four consecutive kiosks in each corridor in the direction of their depth.

This solution has, inter alia, been examined in depth during a study by the Centro Nazionale delle Ricerche on the design criteria for superhighway toll station sites published in the magazine Autostrade of February 1985, page 12 and onwards, in the name of R. D'Orsi and P. Giannatosio. The study was however limited to the assumption of only light vehicle (automobile) transit, ie the shortest vehicles, and by ignoring heavy vehicles with or without trailers, ie the longest vehicles, provided only questionable conclusions. The study also assumed a fixed non-adjustable distance between kiosks which was only the minimum, ie suitable only for transit of light vehicles (automobiles).

The kiosk according to the present invention overcomes the critical aspects of the conclusions of the aforesaid study because it confronts and solves the problems of mixed traffic, ie the transit through each toll station corridor of each type of vehicle from the shortest (automobile) to the longest (heavy vehicle with trailer).

Thus although the invention applies preferably to the "multi-checkpoint" corridor type with two, three or four kiosks installed in the toll station at a distance apart which is adjustable according to requirements, it is also applicable to the current type of single checkpoint barrier, to the depth version of this type of barrier, to the "comb-type toll station, to the "three-level toll station" and to the "hypotenuse toll station".

In the description given hereinafter the term "kiosk" signifies the typical construction currently fixed to the ground and normally of prefabricated elements, which is used at superhighway toll stations and is fitted with all the services required for its schedule use (cash desk, electricity, traffic control signals and warning systems, heating, telephone etc.).

Again in the description given hereinafter, the expressions "light vehicle", "heavy vehicle", "short vehicle", "long vehicle" relate to the following categories of normally taxable vehicles:

A) Automobiles up to 9 seats, and possibly with trailer or caravan

B) Lorries and vans to a total authorised weight of 3 tonnes

C) Trucks to a total authorised weight exceeding 3 tonnes, and isolated tractors

D) Trucks with trailer

E) Tractors with semitrailer

F) Motorbuses

G) Special vehicles and/or vehicles for exceptional transport

H) Agricultural vehicles

By applying the new mobile kiosk of the present invention to a multi-checkpoint toll station, two, three or four vehicles of different length are able to collect their ticket or pay their toll in one and the same corridor in the same time as it takes a single vehicle.

This results in a considerable reduction in queue lengths and waiting times, so solving the well known very serious economical, ecological and safety problems affecting tens of millions of users.

The considerable flexibility of the new multi-checkpoint toll station with mobile kiosks, for overcoming penalizing situations, can be summarised as follows:

a) it still allows the number of open corridors to be set at a lower level when required;

b) it enables the number of kiosks in operation at any given time to be reduced;

c) an essential new factor is that it allows the distance between the kiosks in each corridor to be adjusted up to the rare but theoretically possible limit of allowing simultaneous passage of for example four heavy vehicles with trailer, ie the longest vehicles. The new toll station is therefore well able to ensure easy transit of mixed traffic (all vehicle types), this being the statistically most probable case;

d) it obviates the negative effect of the slow vehicle in the single checkpoint system, which holds up all drivers following it. With the "multi-checkpoint mobile kiosk" system any slowness of one or more users is simultaneously absorbed; very importantly, the worst case, ie any slowness in the fourth vehicle drawn up at the kiosk and awaiting ticket collection or toll payment, corresponds precisely to the current permanent situation present in the "single checkpoint" system;

e) the current preferential treatment applying to certain corridors (reserved for heavy vehicles, viacards, subscriptions etc.) is no longer applicable, so further uprating the toll station; currently, although such a corridor accelerates the modestly advantageous transit of particular users, it remains unused for a considerable time even when long entry and exit queues are present at the station;

f) the considerable queue reduction overcomes the foreboding danger of serious ecological damage; in this respect an almost total solution is obtained to the poisoning risk to the user, who is currently compelled to breathe the poisonous gases emitted by petrol and diesel vehicles during forced stoppages which can sometimes last for some hours;

g) the considerable queue reduction also results in improved safety by removing excessive stress from the vehicle driver; with the current system, on finally passing the barrier and once again free to move, he is urged by this euphoric state to travel at such high speed as to attain the maximum risk threshold. Suitable warning information, including of luminous type (traffic control signals etc.) is provided while approaching the barrier, while passing through the corridor and while leaving the station to facilitate the entry and exit of vehicles of any type.

In the studies so far carried out, the problem of the need for all types of vehicle of any length to pass through the same corridor has not been confronted, and therefore the manner in which a multi-checkpoint toll station can be formed has not been examined.

After a lengthy and careful study of the possible solutions to the problem of constructing an effectively implementable toll station with a multi-checkpoint corridor which properly allows transit of the mixed traffic present on superhighways, the applicant has devised a mobile kiosk system representing an ideal and easily installed solution both for superhighways at the design stage and for those already in service.

According to a basic characteristic of the present invention, the multi-checkpoint system is formed by constructing kiosks which can move along the longitudinal profile of two adjacent corridors and can be fixed temporarily to the ground at distances apart judged suitable for any given situation, as determined by local circumstances and timing requirements (site length and the particular traffic type and quantity). The design basis followed has had to take account of the requirement for kiosk mobility along lengthy distances, layout flexibility, economy of adaptation to already operating toll stations, and general operational safety. These requirements are all satisfied even where certain local characteristics of already operating toll stations have to be respected, such as the length of the sites and the local presence of transit lane dividing plinths.

The kiosks of the present invention have the following essential characteristics:

a) they are mobile by being provided with wheels or by being mounted on a mobile wheeled trolley; in both cases they move along a rail track fixed to the ground or fixed onto a concrete base plinth;

b) they comprise a system for their direct fixing to the plinth or their fixing to the mobile trolley, which can then be fixed to the plinth or road;

c) they comprise insertion connectors for all required services, the sockets for which are provided directly on the ground or on the plinths;

d) they comprise all the automatic warning communication equipment, linked to the operation of photoelectric cells fitted at suitable points along the profile of each corridor.

While maintaining all the stated advantages of a multi-checkpoint station, the present invention offers the following further characteristics which solve certain serious difficulties.

Instead of being sized merely for the current traffic load, the rail track can extend along the entire site. As the intensity and type of traffic changes over the years, it will then be simple to install a further mobile kiosk or kiosks on the existing track, which will have been initially sized to allow this.

If traffic intensity falls or traffic composition changes (mixed traffic: light and heavy vehicles) the existing distance between the kiosks can be

increased without any intervention by the station personnel, so as to be able, in the extreme, to allow transit of the longest vehicles (heavy trucks with trailer).

This is attainable by the new concept which consists of closing one or more consecutive kiosks in the same corridor between two open operating kiosks. Such a circumstance may be advisable either because of a reduction in transiting traffic or because of a different mixed traffic vehicle ratio, or again, and frequently, because of the unscheduled absence of kiosk operating personnel. In these circumstances and in the case of kiosks in a corridor at the minimum distance apart (for only automobiles) or at the medium distance apart (for heavy vehicles without trailer) the new concept enables the toll station to compensate for the lost total capacity by an improved capacity for the longest type (transit of heavy vehicles with trailer). In this sense, any positive compensation of any kind represents an uprating of the toll station.

When the systems have been constructed and the mobile kiosks installed on the rack (two, three or four depending on the optimum number determined at any given time) and fixed at distances apart as judged suitable for current requirements, the vehicle transit capacity in terms of quality and type is set by simply closing those kiosks considered unnecessary. They can then be opened again whenever required.

The procedure will obviously be programmed for the heaviest days, weeks and possibly months, and taking into account the fact that toll collection personnel must be provided at the exits.

On the accompanying drawings:

Figure 1 is a diagrammatic representation of a series of track-carrying plinths with variously positioned mobile kiosks;

Figure 2 is a diagrammatic representation of a track-carrying plinth arranged for the installation of mobile kiosks and for the insertion of all services;

Figure 3 is a diagrammatic representation of a roadway carrying a track suitable for the installation of mobile kiosks;

Figure 4 is a diagrammatic representation of a mobile trolley with wheels;

Figure 5 is a diagrammatic representation of a kiosk which can be mounted on the mobile trolley slidable along the track, or if fitted with wheels can be mounted directly on the track installed either on the plinth or on the roadway.

With reference to the drawings, a description is given hereinafter of one embodiment of the concrete plinths (1, 2, 3, 4) with different positioning of the kiosks 6 along the plinths.

Specifically and by way of example only, the kiosks 6 are positioned spaced apart on the plinth 1 in such a manner as to allow transit only of automobiles A (short vehicles).

On the plinths 2 the kiosks 6 are spaced a greater distance apart to also allow transit of heavy vehicles B without trailer, on the plinth 3 the kiosks are spaced apart to also allow transit of heavy vehicles with trailer, ie the longest vehicles C, and finally on the plinth 4 the kiosks 6 are positioned close together to show their arrangement at rest before being spaced to their required arrangement, such as on the plinths 1, 2, 3.

It is obviously possible to position the mobile kiosks in very various arrangements at each entry and exit corridor of a superhighway toll station, to form a very flexible system which can be varied according to traffic and space requirements based on territorial and time factors which are hardly ever common to all toll stations.

In a preferred embodiment of the invention, the plinth 11 (Figure 2) on which the kiosks 6 rest is provided with a steel rail track 10 along which the wheels of the kiosk support trolley move, or the wheels of the kiosk itself if this is in the form of a self-supporting structure. Systems comprising quick insertion connectors 12 are provided along the plinth (Figure 2) for all the necessary kiosk services and points 13 are provided for locking the trolley or the trolley-supported kiosk to the plinth.

The same systems 12 and 13 are mounted on the roadway 15 if the track is installed not on the plinth but directly on the road surface (Figure 3).

The minimum distance (Figure 2) between the quick connector systems 12 and locking systems 13 corresponds to that necessary to enable at least one light vehicle to be positioned along the plinth.

The connection systems 12 and 22 (Figures 2, 3, 5) are of the sealed type and are opened only when the services are connected to the kiosk.

In the embodiment shown on the drawings (Figure 4) the trolley 7, on which the kiosk 8 is mounted, is provided with four wheels 20 and possibly with two hooks 10 to allow towing by an electric truck so that the kiosk can be moved along the track. The trolley comprises a locking system 14 to coincide with that on the kiosk and on the plinth or roadway.

In the embodiment shown on the drawings (Figure 5) the kiosk 8 is provided with four wheels 20 and possibly with a motor 21 which drives the wheels 20 to enable the kiosk 8 to move along the track 10. A mobile kiosk 8 without wheels or motor and fixed to the trolley comprises two towing hooks 9.

In addition, a mobile kiosk (Figure 5) with or without wheels 20 and with or without the motor 21 comprises on one of its walls or on the floor a quick insertion connection system 22 for all the services required for kiosk operation and corre-

sponding to the connection system on the plinth 11 or roadway 15, and also comprises a locking system 23 which cooperates with the locking points 13 provided in the plinth 11 or in the roadway 15. If the kiosk 8 is mounted on the carriage 7 the locking points 23, 13 cooperate via the locking point 14 in the base trolley.

When the quick connection system 22 (Figure 5) is connected to that on the plinth (Figure 3), the motor 21 can be arranged to automatically disconnect itself and to be unable to be further started until the services have been disconnected.

For further safety the services 12-22 (Figures 2, 3, 5) can be connected only after the locking system 23, 14, 13 (Figures 5,4, 3, 2) has been inserted.

The presence of the small motor 21 in the trolleyless kiosk is optional. If absent the kiosk can be moved by a suitable electric truck. Thus instead of being self-propelled (ie comprising wheels and a motor) the kiosk can rest on a wheeled trolley and be moved by an electric truck.

Claims

1. A superhighway kiosk mobile by means of wheels along a steel track mounted on a concrete plinth or on the roadway, comprising a locking system for the kiosk and a system for connecting the services installed in the kiosk to connectors provided on the plinth or on the roadway.

2. A mobile kiosk as claimed in claim 1, characterised by comprising four wheels its base.

3. A mobile kiosk as claimed in claim 2, characterised by comprising a motor for moving it.

4. A mobile kiosk as claimed in claim 1, characterised in that the kiosk base consists of a hook-fitted towable wheeled trolley on which the kiosk is fixed.

5. A mobile kiosk as claimed in claim 4, characterised in that if provided with a motor this latter can drive the wheels of the trolley on which the kiosk can rest.

6. A mobile kiosk as claimed in claim 4, characterised by being moved by an independent electric truck.

7. A mobile kiosk as claimed in claim 3, characterised in that said motor is automatically disconnected on connecting the kiosk service system.

8. A mobile kiosk as claimed in claim 1, characterised in that the kiosk service system can be connected to that possibly provided on the plinth or on the roadway only if the system for locking the kiosk to the plinth or roadway is inserted.

9. A mobile kiosk as claimed in claim 1, characterised in that the kiosk service system can possibly be connected to that provided on the plinth or on the roadway only if the system for locking the kiosk to the plinth or roadway is inserted.

10. A concrete plinth provided with a rail track along which the wheel-fitted kiosks or the wheeled trolleys on which the kiosks are mounted are moved.

11. A concrete plinth as claimed in claim 10, characterised in that the service systems are positioned in correspondence with the points at which the kiosk with or without trolley is locked to the plinth.

12. A concrete plinth as claimed in claim 10, for the movement of mobile kiosks when fitted with wheels or, if without wheels, when mounted on the wheeled base trolley, characterised by comprising on its surface, or on the surface of its perimetral depth, at regular intervals, quick connector sockets carrying the services required for operation of the kiosk and the locking system.

13. A concrete plinth as claimed in claim 10, characterised in that the minimum distance between said quick connector sockets carrying the services and the locking system corresponds to that required for positioning kiosks spaced apart along the plinth at least to the extent to allow transit of a light (short) vehicle.

14. A roadway provided with a rail track along which the wheel-fitted kiosks or the wheeled trolleys on which the kiosks are mounted are moved.

15. A roadway provided with a rail track as claimed in claim 14, characterised in that the service connection systems are provided in correspondence with the points at which the kiosk is locked to the road.

16. The roadway provided with a rail track as claimed in claim 14, characterised by comprising at regular intervals the quick connector sockets carrying the services required for operation of the kiosk and the locking system.

17. A roadway provided with a rail track as claimed in claim 14, characterised in that the minimum distance between said quick connector sockets carrying the services and the locking system corresponds to that required for positioning kiosks spaced apart along the plinth at least to the extent to allow transit of a light (short) vehicle.

18. A steel rail track mounted with maximum allowable length on the plinth or roadway to allow the wheel-fitted kiosk or kiosk mounted on the wheeled base trolley to be moved.

19. The quick connection systems on the plinth or roadway and on the kiosk as claimed in claims 9, 12 and 16, are of the sealed type and are opened only when the service connection is made.

FIG 1

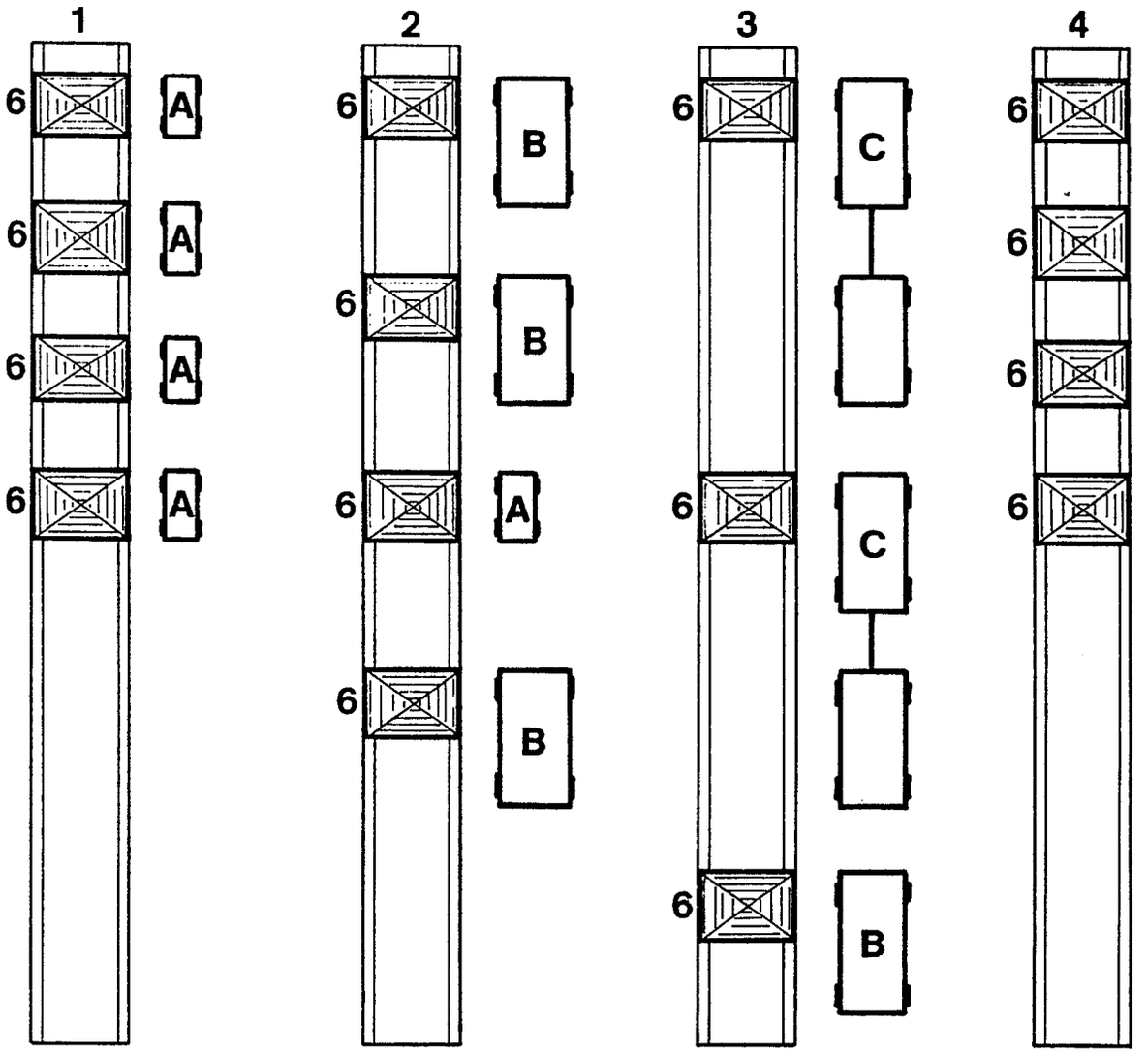

FIG 2

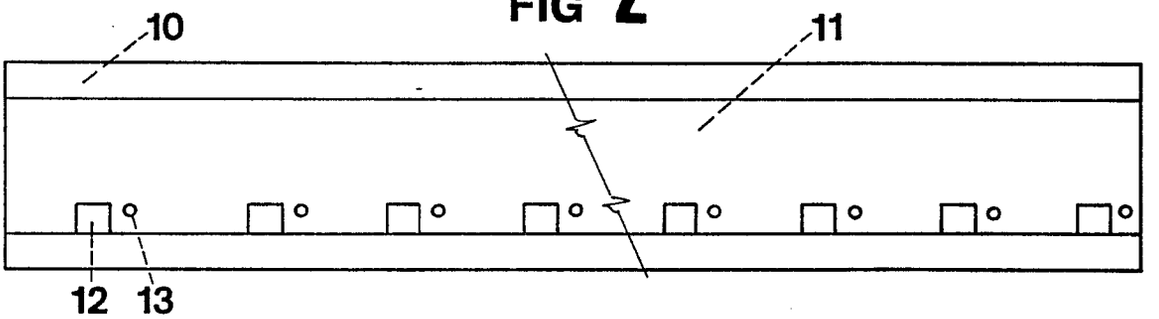

FIG 3

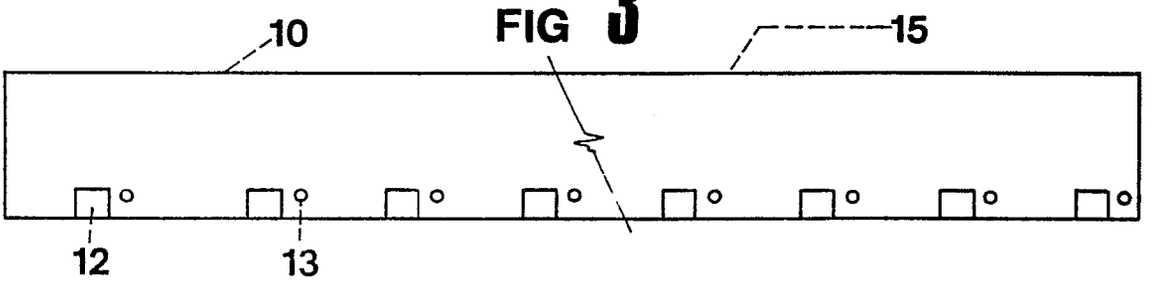

FIG 4

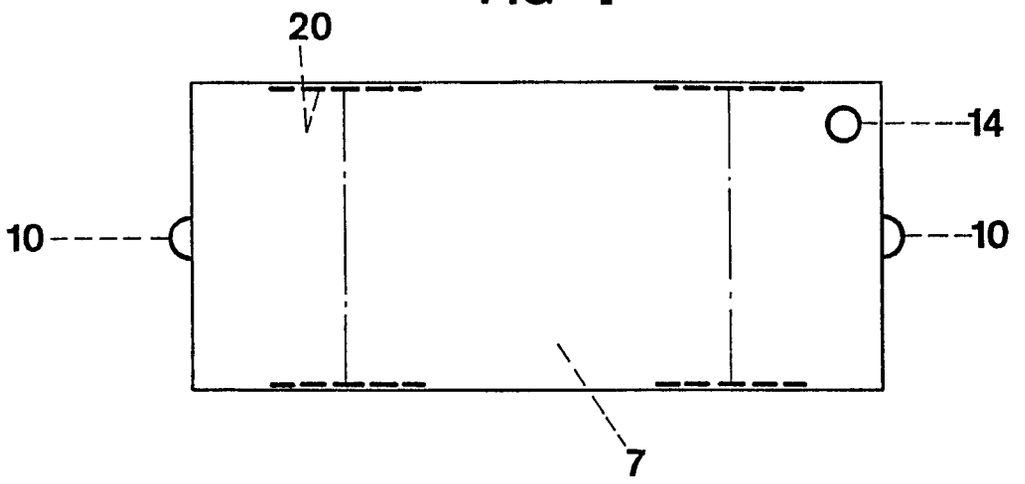

FIG 5