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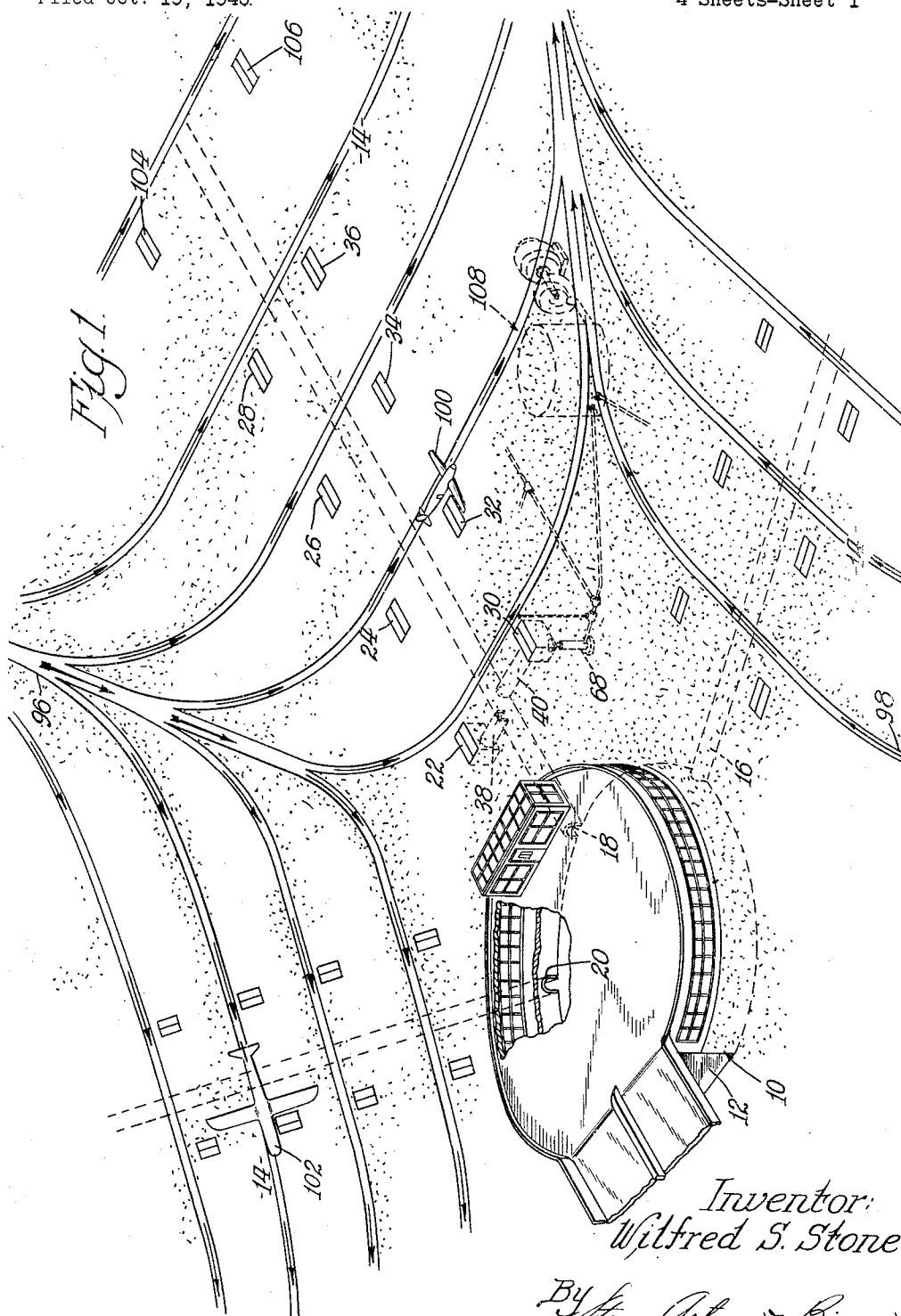
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2,487,613

AIRPORT AND AIRPORT GANGWAY

Filed Oct. 19, 1946.

4 Sheets-Sheet 1



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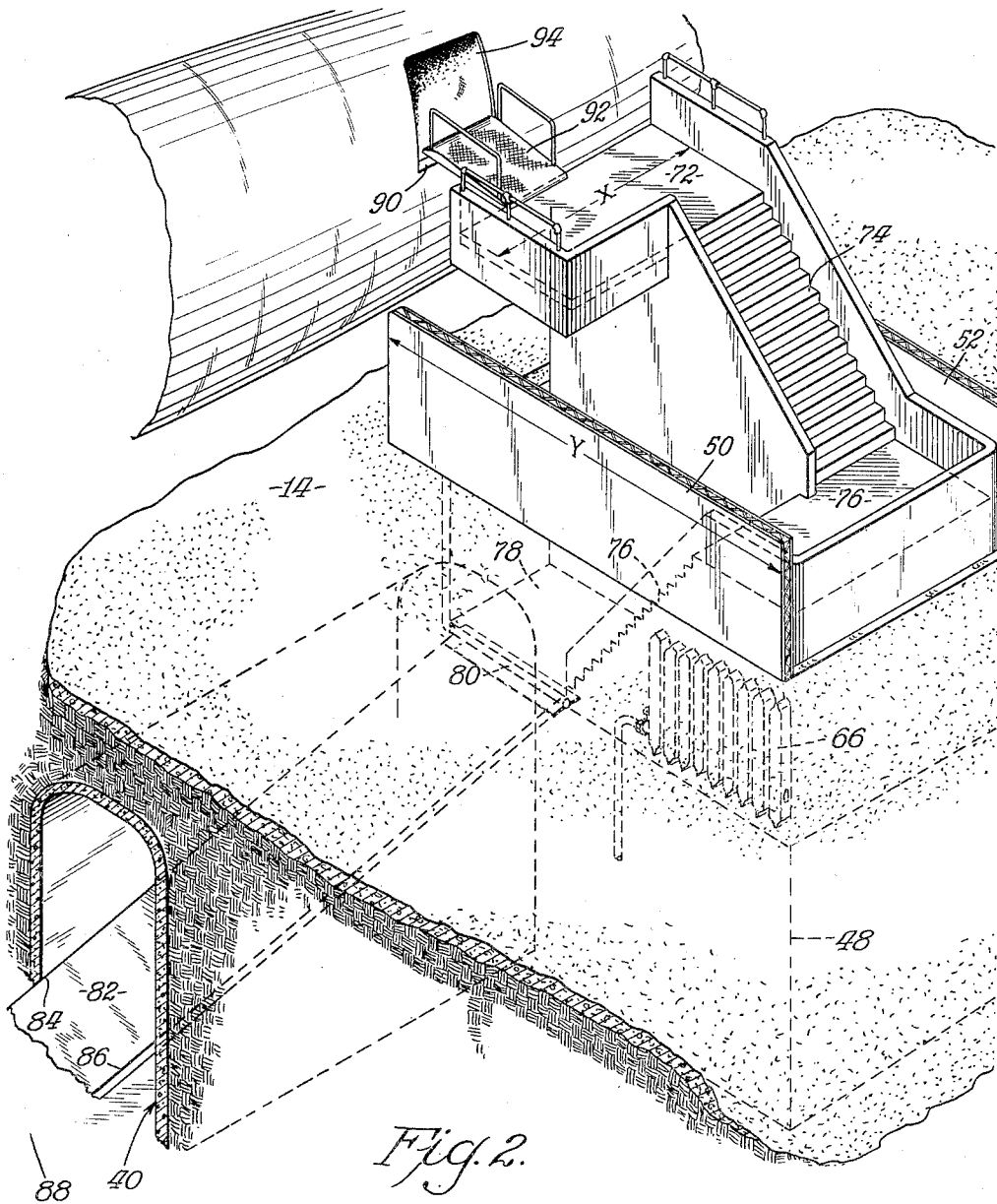
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AIRPORT AND AIRPORT GANGWAY

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AIRPORT AND AIRPORT GANGWAY

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4 Sheets-Sheet 3

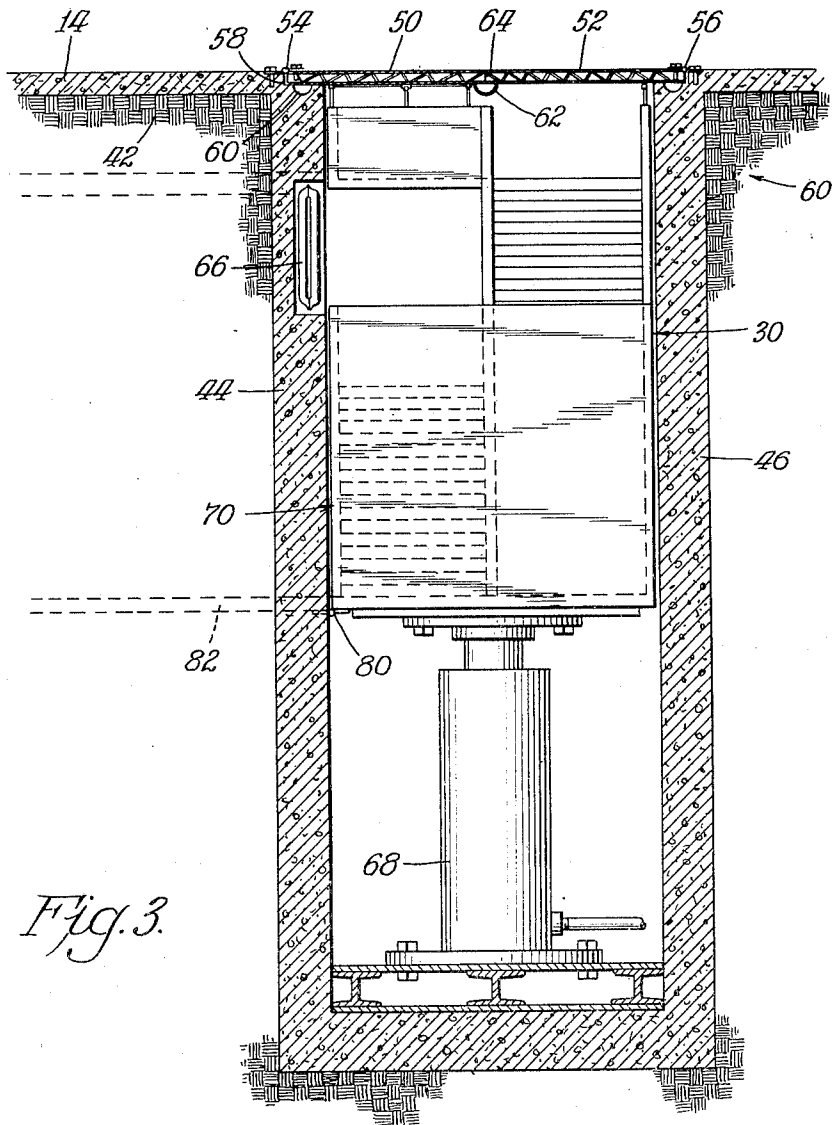


Fig. 3.

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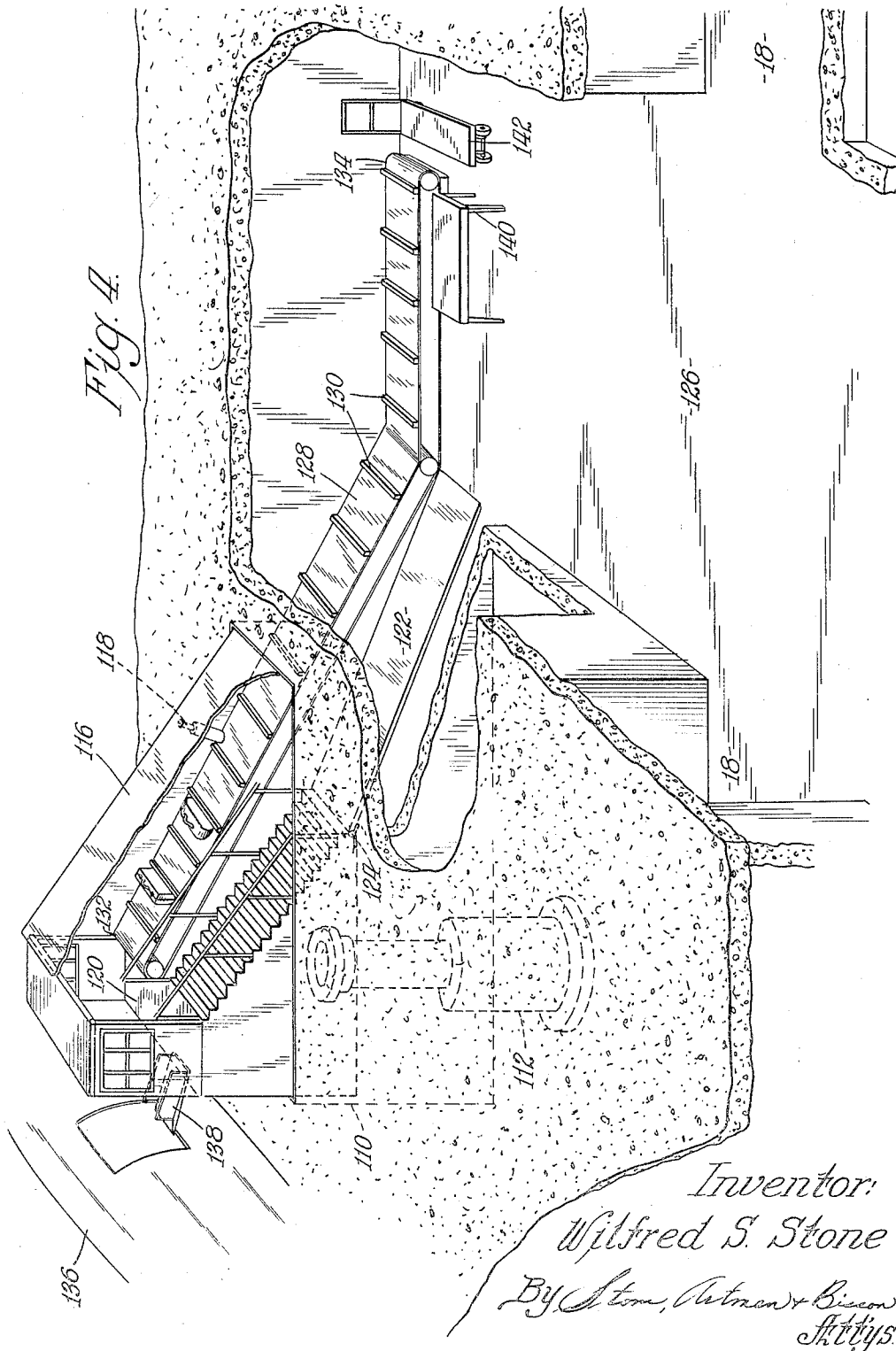
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AIRPORT AND AIRPORT GANGWAY

Filed Oct. 19, 1946

4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,487,613

AIRPORT AND AIRPORT GANGWAY

Wilfred S. Stone, Chicago, Ill.

Application October 19, 1946, Serial No. 704,395

15 Claims. (Cl. 244—114)

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This invention relates to a disappearing airport gangway and to an airport.

While great strides have been made in developing the airplane's reliability in flight and while the airplane itself has been made larger and more versatile for the handling of passengers, freight and mail, progress in ground facilities has remained almost at a standstill. An airplane executive recently remarked that the airlines can transport a passenger from Chicago to Detroit in the same length of time frequently required to deliver into that passenger's hands after he has stepped off the airplane, his own baggage.

The problem faced by the airlines is essentially the same as the problem handled by trains or boats. The problem is to get passengers and their luggage, freight, mail and express, onto a plane from an airport terminal or a postal substation or a field freight station or from some other plane; or conversely, to get passengers and luggage into a passenger terminal where they can get ground transportation, or freight, mail or express to terminal facilities for handling them or to move either passengers or merchandise from a plane to some other plane. At a small field, the problem is not difficult. At a large field, the problem is becoming almost impossible. TWA in Chicago is loading passengers in their hangar.

By way of example, at New York's LaGuardia Field, the row of gates through which passengers, passenger luggage and some freight and express move into or out of an airplane is over a mile long. Special ground transportation from the terminal building to the airline gate is desirable in good weather, and bad weather complicates the loading problem. The Idlewild Field in New York has several times as many gates as the LaGuardia Field. It is little wonder, therefore, that passengers frequently wait half an hour after getting off a plane before getting their luggage.

Another element of the problem is the cost of safety. When an airplane pulls up to a gate, the airport personnel must be present in sufficient number to make certain that passengers walk a fairly straight line from the airplane gangplank to the gate, and if the plane is making merely an intermediate stop during which the passengers are permitted to leave the plane in order to exercise for a few minutes, it is necessary to maintain this personnel around the plane at all times.

Another factor in the problem is the growing freight load, including mail and express. Unlike passengers who can be guided to a gate, freight must be moved. It cannot be unloaded from an airplane onto an apron or stacked on an apron preparatory to loading onto an airplane without impairing free movement of the airplane on the apron. The result is that freight moves directly

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with the availability, more particularly, the timing of ground transportation.

An entirely new approach to the problem is indicated. Basically, the problem has been considered as a two-dimensional problem—that is the airplane and the ground transportation facilities operate on the same surface—an airport landing apron. Railroads had a similar problem in large terminals and solved it by utilizing the third dimension—height. Some railroad stations have the passenger level elevated above the tracks with ramps, stairways, or elevators connecting the passenger level to the track platforms. Others utilize the ground level as the passenger level with ramps, stairways, or elevators connecting to elevated track platforms.

The presentation of the idea unaccompanied by equipment demonstrating feasibility to competent air transportation authorities has met with a flood of objection. First and foremost, they state that permanent structures on an airfield landing apron will be hazardous to costly planes. Thus, they argue that if the passenger or freight level is above the apron level, there must be supports extending upwardly from the apron, and airplanes can run into these supports. Or if subway approaches are built, structures above the field level are necessary in order to reach the cabin floor of the plane which is several feet above ground. In either case, free maneuverability is impaired. Again, it is asserted that mail, oil, gas, and freight trucks must operate on the apron and getting the passengers and some freight off the apron is not advantageous commensurate with the cost.

The general object of this invention is to provide means for loading and unloading passengers and freight on an airplane apron without obstructing the apron with permanent structures which impair the maneuverability of planes.

Another object of this invention is to provide a passageway from a plane door to a subway beneath the apron upon which the plane rests along which either passengers or freight may move. This passageway is to be constructed with elevators mounted in an apron well for raising either passengers or freight from a subway up to an airplane door. These have been suggested and rejected because they create numerous hazards. The feature of applicant's invention is a passageway which may be either a stairway or a ramp which, once in position next to an airplane, leads to a subway and is so constructed that passengers cannot get onto the apron. Gassing and other servicing of a plane may proceed without interfering with the passengers and without interference by the passengers. It is essential that the passengers be unable to make a mistake. The gangway provided requires no personnel to watch the passengers when it is positioned adjacent to

an airplane. It, therefore, cuts down the personnel required and it reduces insurance rates.

A further object of this invention is to equip the gangway with either a luggage slide or a movable luggage belt for carrying baggage from the door of an airplane down to a luggage collection platform in the subway. The purpose of this slide or belt is to provide for airplane luggage unloading advantages comparable to those of a standard Pullman car emptying operation in a station. As a train enters a terminal, the porter collects the bags in the vestibule of his car. In the station, with the aid of Red Caps, he delays the passengers from leaving the train while he first unloads the bags onto the station platform. When this has been done, the passengers get off the car, select their bags, and in a matter of minutes, thousands of pounds of luggage are moved off the train either by Red Caps or by passengers. In present airline operation, at a big field, the luggage from a plane is removed by a truck to a large check room so that passengers must wait long periods of time to get their luggage by an identifying check instead of performing the comparatively simple operation of reaching down and identifying their luggage on a railroad platform.

One of the features of the present invention is a luggage collection platform at the bottom of each apron gangway. The luggage is first shot down the slide to the luggage collection platform from the plane, and when the passengers reach the bottom of the gangway, they select their own bags. At this point, there is sufficient room for Red Caps to gather about without preventing passengers from moving along the subway into the terminal.

Another object of this invention is to provide a gangway which may be used either for moving freight up into a plane or passengers. The freight, baggage, and indeed luggage must still be stowed in a plane in such a manner as to properly balance the load, and there are several doors leading to the freight compartments. At the present time there are usually doors in the nose and in the tail in addition to the main passengers' door. New airliners have the passenger door forward of the wings. Additionally, some of the freight liners may have belly opening bays. It is obviously desirable to be able to take freight off of a plane whether it comes out of a side door high up on the fuselage or out of a bottom door only a foot or so above the apron. In one embodiment of this invention, applicants show a movable belt which has rubber treads and which will not attain an angle to exceed 20 degrees the horizontal. For moving all freight, luggage and the like this power driven belt will be used either to move the freight up, or to move it down.

Another object of this invention is to relate the apron wells and apron gangways to each other so that it is possible to load and unload a maximum number of planes close to a terminal. Airlines are well aware of the advantage of having a single airport in a city. A single airport makes it possible for passengers to change from line to line without using ground transportation. However, an airport such as Idlewild does not make it possible to change from airplane to airplane without using some sort of ground transportation. Most passengers do not like to walk a couple of miles to get on an airplane. The present invention contemplates a plurality of subways, either radiating from a sin-

gle focal point, or running off parallel to each other and at right angles to a main subway which may be along one side of an airfield. From these subways lead auxiliary subways connecting to the apron wells and apron gangways. The arrangement makes it possible to bring a large number of airplanes into a fairly small area around an airport so that passengers will not have to walk far in order to get into the terminal or in order to get to a taxi cab. The arrangement has the effect of simplifying many of the airplane service facilities such as gassing and oiling the planes. Importantly, it is possible to make rapid interchange of both passengers and freight between one plane and another plane. For example, a plane coming into Chicago may regularly every day have both passengers and freight destined both for the west coast and for Texas. The connection may be a fairly short one, say fifteen minutes for the Texas plane. In order to maintain the schedules, it is desirable to get the passengers and the freight easily from one plane to another, and it follows that adjoining apron gangways could be used to minimize the distance along which freight or passengers must move in order to get from one plane to another.

Another object of this invention is to promote the safety of airplanes by controlling the apron gangways from the top of the apron and not from the subway. This invention is predicated upon the desirability of having aprons which permit free maneuvering of airplanes on them. The apron gangways drop into the wells which are covered by tops sufficiently strong to withstand the weight of a 50, 60 or 70 ton airplane. Such airplanes are tremendously costly and they could be severely damaged either by running into an apron gangway or by having an apron gangway rise out of the gangway and hit a plane. Under standard airport practice today, the ground man is in control of the plane as it moves into and out of a gate position and applicants provide a switch in the apron floor adjacent each apron well for controlling the apron gangway, which will be operated by the man on the apron.

These and such other objects as may hereinafter appear are attained by the embodiments of the invention disclosed in the accompanying drawings wherein

Fig. 1 is a perspective view of an airport illustrating one arrangement of applicant's disappearing gangways;

Fig. 2 is a perspective view of one of applicant's disappearing gangways in elevated position;

Fig. 3 is a sectional view illustrating one means of raising and lowering applicant's gangway; and

Fig. 4 is a perspective view illustrating a preferred embodiment of applicant's invention.

Continuing to refer to the drawings, in Fig. 1, the numeral 10 identifies an airport terminal building having a main concourse 12 disposed substantially beneath ground level or the level of the airport landing apron designated by the numeral 14. Radiating from this concourse 12 are a series of subways 16, 18 and 20. Arranged along each side of each of these subways, as for example 18, are two lines of wells as 22, 24, 26, 28, 30, 32, 34, and 36. Each well, as 22 and 30, is connected by passageways such as 33 and 40 to the principal subway 18.

Before describing the spacing of these wells from each other, the apparatus within the well will be described. Referring to Figures 2 and 3, the numeral 14 designates the apron resting upon

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the ground 42. The well 30 is formed by concrete side walls 44 and 46 and similar end walls such as 48. The top of the well may be closed by a pair of heavy doors 50 and 52 pivoted along their sides at 54 and 56 so that the top of the doors 50 and 52 when in closed position will be in the same plane as the top of the apron 14. The doors are very heavy and will support a weight of 100 tons or so, should an airplane happen to drive over them. The top of the well walls is recessed at 58 to receive the ends of the doors and a trough 60 for draining off water extends around the recess. The door 52 carries a trough 62 draining into the trough 60 at either end for the purpose of catching any water that drains through the joint 64 between the two doors 50 and 52. Mounted in the well will be one or more heat radiators as 66, not only for the purpose of maintaining the passageway shortly to be described at a livable temperature, but to maintain the doors 50 and 52 above the freezing point so that snow and ice collecting thereon will melt and run off as water through the drains 60 and 62. Shoveling of snow and bad ice conditions on the field will not impair the functioning of applicant's disappearing gangway.

Mounted at the bottom of the well is a hydraulic lift 68 which functions much as the hydraulic lift for an automobile in a garage and will not be described. Mounted thereon is a staircase generally identified by the numeral 70. While this staircase is shown in solid outline, it will be constructed of light metal framework. It consists of a landing platform 72 connected by a first flight of steps 74 to an intermediate platform 76 which in turn is connected by a second flight of steps 76 to a small landing 78. The landing 78 has pivotally mounted upon its edge 80 one end of a ramp 82 which is disposed so that its edges 84 and 86 are very close to the walls of the passageway 40. The ramp 82 can slide along the surface 88 which is the floor of the passageway 40 and is on the same level as the floor of the subway 18.

The gangway or staircase can be raised to any height so that the platform or landing 72 may be positioned on a level with the airplane door sill such as 90 so that the small removable gangway 92 may be short and may be held in substantially horizontal position. It is evident that all that the pilot need do is to position the door 94 adjacent the platform 72. It is contemplated that the platform will be about eight feet wide, that is the dimension marked X, and that the staircase will be about four feet wide. These dimensions are important for several reasons. In the first place, the staircase must be able to accommodate comfortably one person moving in one direction with a large bag. In the second place, the wider the staircase, the wider the span that the doors 50 and 52 must cover, and the wider the span, the heavier the doors. Apparatus for raising and lowering these doors is not shown, as it will be conventional. It is anticipated that the doors will be operated by hydraulic pistons. It will be appreciated also that the width span of the two doors 50 and 52 could be reduced by half by simply having the flight 74 continued straight on down and moving the ramp 82 and the passageway 40 to the right. However, it is believed that pilots after some practice will never run across the doors at all, particularly if the doors have the comparatively short length indicated by the dimension Y in Fig. 2. If this dimension Y were doubled, as would happen if the flight 74 were

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continued on downwardly, the chances of running over the stairwell would be greatly increased. However, in the second embodiment, such a construction is shown.

The advantages of this disappearing gangway alone and in combination can be seen by referring to Fig. 1. We will assume that the present lack of standardization of airplanes will continue so that an airport must be able to accommodate airplanes having doors in the left side or the right side or both sides of the fuselage, airplanes having doors positioned in front of the wings or behind the wings, airplanes having the doorsill positioned ten feet above the concrete apron when at rest and airplanes having the doorsill three feet above the concrete apron when at rest, and airplanes having wing spans varying from 75 feet to 250 feet. The airport illustrated in Fig. 1 has three radiating subways. Airplanes arriving from the landing strips follow a pathway 96 or 98 and under the direction of the tower, assuming an airplane entering by route 96, the pilot will turn to the right or the left depending upon which side of the fuselage his door is located. If he has a right-hand door, he will turn to the left and may pull up in position 100. If he has a left-hand door, he will turn to the right and if the door is in the nose, he will stop in position 102. Pilots are now able to maneuver planes quite accurately on aprons and there will be no difficulty in positioning even a large DC-6 within two or three feet of the edge of a well.

In spacing of the wells from each other, the distance from well to well may be varied to accommodate different sized planes. The wells 30 and 32 will accommodate smaller planes and may be spaced one hundred feet apart. As one moves outwardly along the subway 18 more and more apron space is available so that the wells such as 104 and 106 may be spaced from each other by 150 or 200 feet and from the neighboring wells, 28 and 36, by a similar distance. The wells will be functioned from a single source of fluid under pressure indicated by the numeral 108.

When the plane has reached the position indicated by the numeral 100, the mechanism for raising the disappearing gangway is started, the doors 50 and 52 open and the platform 72 moves to the level of the door sill of the plane. The removable gangway 92 is then positioned and passengers can move in and out of the plane while the plane is in the terminal. They cannot get onto the apron so as to be endangered by the propellers. Attendants are not necessary to guard them and interference with the servicing of the plane or of the loading or unloading of freight need not occur.

Moreover, if there are usually passengers on the plane in position 100 to transfer at the airport for a plane going in another direction, it will be possible to locate that second plane either at the well 24 or the well 34 depending upon when the second plane arrives at the airport. Applicant's disappearing gangways make it possible to transfer passengers from plane to plane by letting them make the transfer themselves as they do in a railway station. Moreover, they do not have to carry luggage far.

A preferred embodiment of the invention is shown in Fig. 4. This comprises a well 110, an elevating mechanism 112 and an elevatable stairway 114. The well opening is closed by a single cover panel 116 which may be raised and lowered by a piston 118. The upper platform 120 is closed as is the stairway 114 which comprises

a single flight leading to a ramp 122 pivoted at 124 to the lower edge of the staircase. The ramp 122 terminates at its lower end in a comparatively large subterranean room 126. At one side of the ramp 122 and the flight of steps 120 is a conveyor 123, having transverse cleats 130 and driven in some conventional manner over end rolls 132 and 134. The conveyor's source of power is not shown and it can be operated in either direction. The conveyor may be about three feet wide and the flight of steps 120 will be somewhat narrower because it is not necessary to accommodate a person carrying luggage. The lower end of the conveyor is movable along the floor of the room 126 so that it will move to the left or right in accordance with the raising or lowering of the gangway. The room 126 opens directly into the subway 18.

The unloading operation that takes place with this disappearing gangway is as follows: The airplane 136 is brought into position adjacent to the well 110. The gangway 133 is positioned between the airplane door and the platform 130 and porters first unload baggage directly onto the conveyor 123 which carries the baggage into the room 126 where it may be stacked on a table such as 140. As soon as the baggage is unloaded, the passengers walk down to the room 126 where they select their baggage from the table 140. They may then carry their own baggage or porters may use a truck such as 142 to carry it directly to automobiles for transportation into a city, or they may carry their baggage along the passageway 13 to make a connection with some other outgoing plane. The delay involved in loading or unloading a plane is reduced to a minimum. The disappearing gangway can be raised or lowered very quickly and it is anticipated that freight may be loaded by this gangway either through the passenger door of the airplane or by bringing the freight door adjacent the platform 120 of the disappearing gangway.

The gist of this invention turns on providing a continuous passageway from the plane door to the terminal building. This continuous passageway should be primarily a stairway or a ramp either with or without a conveyor for baggage, and it, of course, would be nice if the construction were sufficiently valuable to airlines to substitute for the stairways and the ramp an escalator, one end of which could be raised or lowered as the platform 120 was raised or lowered. The gangway provides a continuous means of ingress and egress as contrasted with an elevator which does not perform the function performed by the gangway.

Having thus described my invention, what I claim as new and wish to secure by United States Letters Patent is:

1. The improvement in airport facilities which comprises, a subway extending from a safe point of entry for passengers to a remote position underneath the airfield and adjacent an aircraft loading point, a well in the airfield at said loading point, said well opening at the top onto the airfield and connecting at its bottom with said subway, a door for the top of said well which, when closed, is substantially flush with the adjacent airfield runway surface, structure in said well in the nature of a stairway over which passengers can walk in making transit between the subway and aircraft stationed adjacent the well, and means for elevating said structure whereby its upper end can be brought to convenient

above-ground levels with respect to aircraft loading doors, said structure, when not elevated, being entirely below the level of the adjacent runway surface and a gangway having one end pivotally mounted on the lower portion of the stairway and having its other end resting on the subway floor.

2. The improvement in airport facilities which comprises, a subway extending from a safe point of entry for passengers to a remote position underneath the airfield and adjacent an aircraft loading point, a well in the airfield at said loading point, said well opening at the top onto the airfield and connecting at its bottom with said subway, and structure in said well in the nature of a stairway over which passengers can walk in making transit between the subway and aircraft stationed adjacent the well, means for elevating said structure whereby its upper end can be brought to convenient above-ground levels with respect to aircraft loading doors, said structure, when not elevated, being entirely below the level of the adjacent runway surface and a gangway having one end pivotally mounted on the lower portion of the stairway and having its other end resting on the subway floor.

3. The improvement in airport facilities which comprises, a subway extending from a safe point of entry for passengers to a remote position underneath the airfield and adjacent an aircraft loading point, a well in the airfield at said loading point, said well opening at the top onto the airfield and connecting at its bottom with said subway, an elevatable stairway in said well leading from the bottom to the top thereof, a door for closing the top of the well, said door, when closed, being substantially flush with the adjacent runway and a gangway having one end pivotally mounted on the lower portion of the stairway and having its other end resting on the subway floor.

4. The improvement in airport facilities which comprises, a plurality of subways radiating from a common passenger concourse to different loading points on the airfield and each connecting with one or more wells, each of said wells opening at its top onto the airfield and extending upwardly only to the level of the runway surface, a unit in the nature of a stairway located in said well, power-operated means for elevating said unit to various levels above the runway surface and a gangway having one end pivotally mounted on the lower portion of the stairway and having its other end resting on the subway floor.

5. The improvement in airport facilities which comprises, a subway extending from a passenger terminal to a loading point on the airfield and connecting at said point with an opening onto the airfield, a door forming a closure for said opening and normally lying in a horizontal plane substantially flush with the airfield runway surface, stairway structure located within the subway below said opening, means for elevating said structure to levels above said surface when said door is open, the arrangement being such that the top of the structure can be leveled with the door sills of various aircraft and a gangway having one end pivotally mounted on the lower portion of the stairway and having its other end resting on the subway floor.

6. The improvement in airport facilities which comprises, a subway having a terminus at a safe point of entry adjacent an airfield and underlying the airfield, a plurality of wells located at

spaced loading points on the airfield and each connecting at its bottom with said subway, each of said wells opening at its top onto the airfield runway, a door for each well closure, said doors, when closed, being substantially flush with said runway so as to present no obstruction to aircraft proceeding along the runway, a stairway unit located in each of said wells, power means operating to lift each of said units individually and to open the associated doors and a gangway having one end pivotally mounted on the lower portion of the stairway and having its other end resting on the subway floor.

7. The improvement in airport facilities according to claim 6 wherein the power means comprises a hydraulic lift.

8. The improvement in airport facilities which comprises, a subway extending underneath an airfield from a safe point of entry adjacent the airfield, to an opening on the airfield, a stairway structure located in said subway and adapted to be projected upwardly through said opening so that the top of the stairway can be brought to a level above the airfield runway, a continuous conveyor laterally adjacent the stairway and connected at one end to said structure, said one end terminating at the upper end of said structure and adapted to be elevated therewith, the other end of said conveyor terminating at a lower level and adapted to receive and discharge baggage near the level of the subway floor, power means for lifting said structure, and a door normally serving as a closure for said opening, said door, when closed, lying substantially flush with the airfield runway surface.

9. An airport comprising an apron over which airplanes may move, a well in the apron, a removable cover capable of supporting an airplane over said well, a subway connecting the lower portion of the well to a selected point off that portion of the apron over which airplanes are intended to move, a gangway associated with the well, and means for raising one end of the gangway upwardly through the well above the apron to the height of an airplane door when the cover is removed while the other end of the gangway remains at a point below the apron so that passengers may move down it into the subway.

10. An airport comprising an apron over which airplanes may move, a well in the apron, a removable cover capable of supporting an airplane over said well, a subway connecting the lower portion of the well to a selected point off that portion of the apron over which airplanes are intended to move, a gangway having one end in the well, and means for raising said end of the gangway upwardly through the well above the apron to the height of an airplane door when the cover is removed while the other end of the gangway remains at a point below the apron so that passengers may move down it into the gangway.

11. An airport comprising an apron over which airplanes may move, a well in the apron, a removable cover capable of supporting an airplane over said well, a subway connecting the lower portion of the well to a selected point off that portion of the apron over which airplanes are intended to move, an elevatable platform disposed in the well, a gangway pivotally mounted at one end to the platform with its other end resting on the subway floor, and means for raising the gangway to a selected height above the apron when the cover is removed.

12. An airport comprising a terminal building, an apron adjacent the building over which airplanes may roll, a subway extending from the building beneath the apron, a well on the apron, a removable cover capable of supporting an airplane over said well, a loading room connecting the well and the subway, a gangway associated with the well, and means for raising one end of the gangway upwardly through the well above the apron to the height of an airplane door when the cover is removed while the other end of the gangway remains at a point below the apron so that passengers may move down it into the loading room.

13. An airport comprising a terminal building, an apron adjacent the building over which airplanes may roll, a subway extending from the building outwardly beneath the apron, a well having a rectangular plan positioned in the apron with its long dimension substantially parallel to the subway and spaced therefrom, a removable cover capable of supporting an airplane over said well, a loading room connecting the well and the subway, a gangway in the well, and means for raising one end of the gangway upwardly through the well above the apron to the height of an airplane door when the cover is removed while the other end of the gangway remains at a point below the apron so that passengers may move down it into the loading room.

14. An airport comprising a terminal building, an apron adjacent the building over which airplanes may roll, a subway extending from the building outwardly beneath the apron, a pair of wells positioned in the apron, one on each side of the subway and in transverse alignment with each other, a passageway connecting each well to the subway, a gangway positioned below the apron for each well, and means for raising one end of a gangway upwardly through the top of the associated well above the apron to the height of an airplane door when the cover is removed while the other end of the gangway remains below the apron so that passengers may move down into the subway.

15. An airport comprising a terminal building, an apron around a portion of said building and over which airplanes may roll, a plurality of subways radiating from the building outwardly beneath the apron, pairs of wells positioned in the apron, astride each subway, a passageway connecting each well to the subway, a gangway beneath the apron for each well, and means for raising one end of each gangway upwardly through the top of the associated well above the apron to the height of an airplane door when the cover is removed while the other end of the gangway remains below the apron so that passengers may move down into the subway.

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