Oct. 17, 1944. E. G. HILL 2,360,495

DELIVERING AND RECEIVING MECHANISM FOR AIRPLANE-CARRIED LOADS

Filed April 15, 1942 2 Sheets-Sheet 1

Fig. 1.

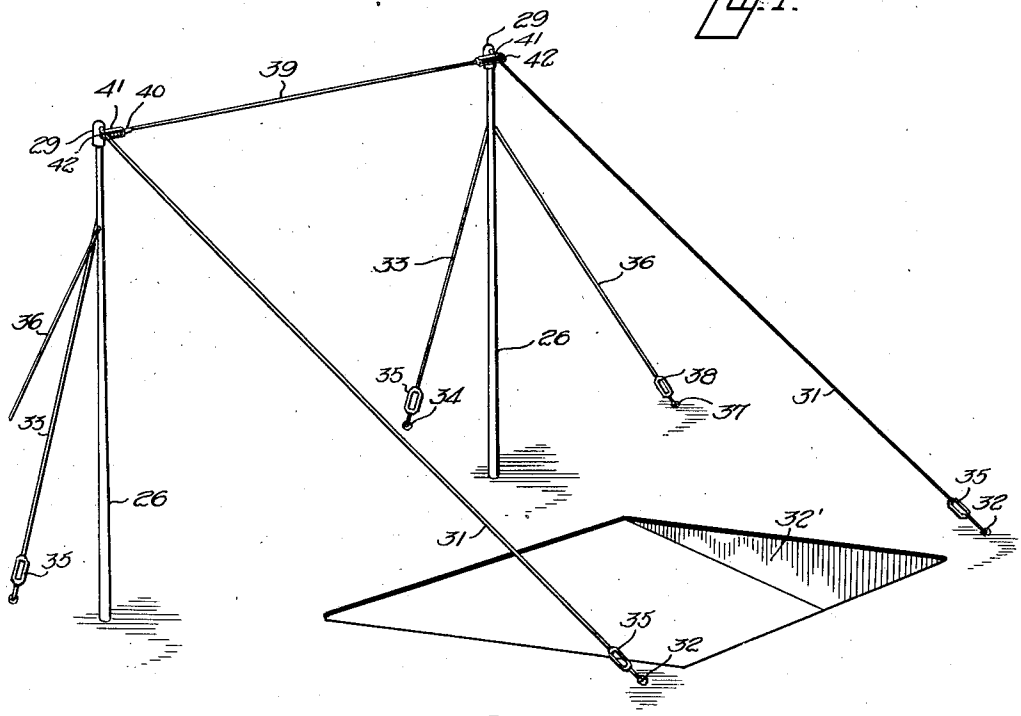
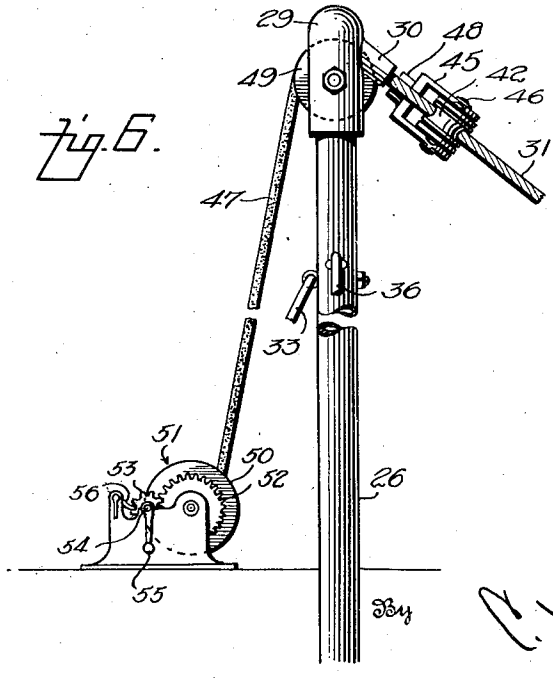


Fig. 6.



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Fig. 2.

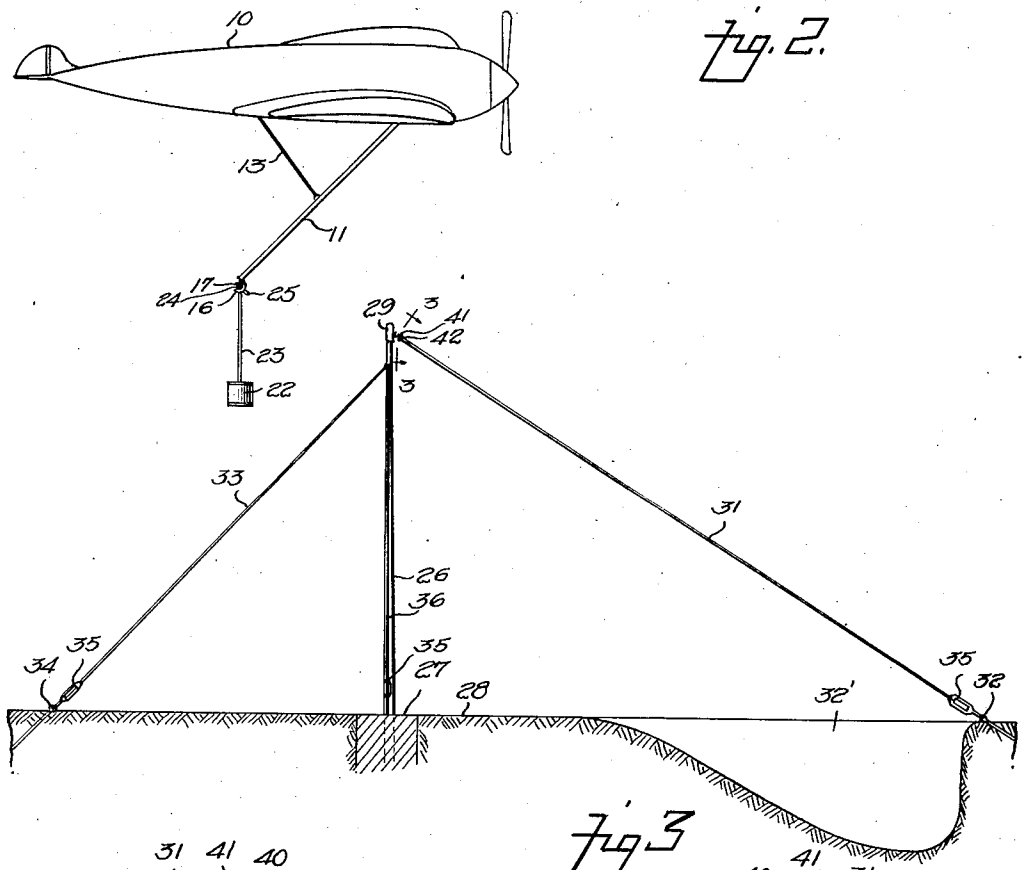


Fig. 3

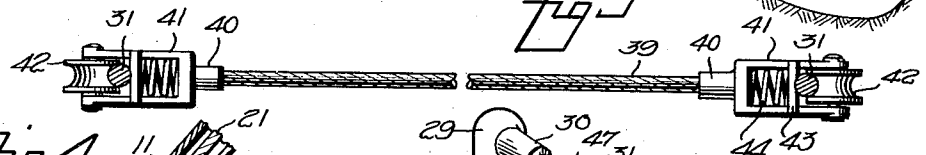


Fig. 4.

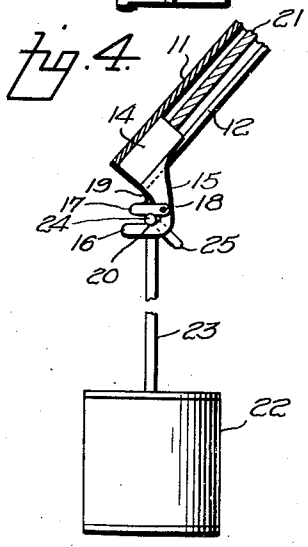
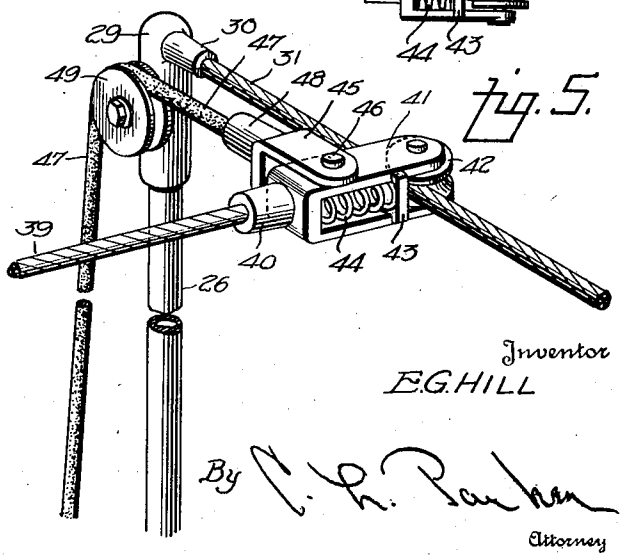


Fig. 5.



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DELIVERING AND RECEIVING MECHANISM FOR AIRPLANE-CARRIED LOADS

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Application April 15, 1942, Serial No. 439,114

12 Claims. (Cl. 258—1.2)

This invention relates to delivering and receiving mechanism for airplane-carried loads.

An important object of the invention is to provide a novel apparatus whereby articles carried by airplanes in flight may be delivered from a plane to a novel receiving mechanism without any necessity for the plane's having to land and wherein the receiving mechanism cushions the shock of the landing of the article to prevent any damage thereto.

A further object is to provide an apparatus of this character wherein the article is suspended from the airplane by a novel suspension device and wherein the receiving mechanism is provided with an element which automatically detaches the article from the suspension mechanism and brings it to a stop by novel cushioning or braking means so as to avoid shock and injury to the article.

A further object is to provide an apparatus for suspending from the plane the article to be delivered and wherein the suspension means adequately supports the article against accidental dislodgement but provides for its easy release when brought into cooperative relationship with the receiving mechanism.

A further object is to provide an article receiving element normally occupying a position adapting it to be engaged by an article carried by a plane and provided with means for guiding it roughly in the direction of what would be the trajectory of the delivered article if it were freely released from the plane at the point of contact of the article with the receiving element.

A further object is to provide means cooperating between the article receiving element and the guiding means therefor whereby a braking force is applied to the article receiving element to bring it to a relatively gradual stop after it has been engaged by the article being delivered by the plane.

A further object is to provide means for supplementing the braking action referred to whereby a progressively increasing force may be applied to the article-receiving element as the latter moves away from its normal position after having received the article, thus facilitating the bringing to a stop of relatively heavy articles without causing any injury thereto.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawings I have shown two embodiments of the invention. In this showing—

Figure 1 is a perspective view of one form of the receiving apparatus,

Figure 2 is a side elevation of the same showing an airplane and associated elements approaching an article releasing position, the portion of the ground being shown in section,

Figure 3 is an enlarged transverse sectional view on line 3—3 of Figure 2, the receiving cable being broken away,

Figure 4 is an enlarged fragmentary detail sectional view of the article supporting mechanism of the plane showing an article suspended therefrom, parts being shown in elevation,

Figure 5 is an enlarged fragmentary perspective view of a portion of a modified form of receiving mechanism, and,

Figure 6 is an enlarged fragmentary side elevation of a portion of the same, parts being broken away.

Referring to Figure 2, the numeral 10 designates an airplane beneath which is suspended a guide arm 11 which is split in its under side as at 12 for a purpose to be described. This arm may be pivotally connected to the bottom of the fuselage of the plane in any suitable manner and may be pulled up flat against the fuselage when not in use by a suitable cable 13. The fuselage will be provided with a door, (not shown) through which access may be had to the upper end of the arm 11. The specific forms of the means for connecting the arm 11 to the plane, the means for swinging the arm 11 upwardly by the cable 13, and the means for winding the cable within the arm 11, to be described, form no part per se of the present invention.

The arm 11 is provided with a head 14 slidable therein from end to end, and this head is provided with a depending arm 15, extending through the slit 12 and terminating in a horizontally and rearwardly extending finger 16. An upper horizontal finger 17 is pivoted as at 18 to the arm 15 and is spring pressed downwardly as at 19. The fingers 16 and 17 have their adjacent edges notched as at 20 preferably in vertical alignment with the center of the mass of the head 14 for a purpose to be described. A cable 21 within the guide 11 is provided for pulling the head upwardly into the airplane and for lowering the head downwardly to the operative position shown in Figure 3. Any suitable form of windlass or the like may be arranged in the plane for operating the cable 21.

The article to be deposited has been shown in the present case as comprising a case 22 provided with a vertically extending arm 23 the

upper end of which terminates in a cross member 24 receivable between the fingers 16 and 17 in the notches 20. Thus it will be apparent that the weight of the article is suspended directly in vertical alignment with the center of the head 14 and has no tendency to overbalance this head to turn it and possibly cause it to bind in the guide arm 11. At its upper end, the rod 23 is also provided with a downwardly and forwardly extending hook element 25, for a purpose to be described.

The receiving mechanism shown in Figures 1, 2 and 3 comprises a pair of relatively rigid stationary masts 26 the lower ends of which may be fixed in any suitable manner as by being embedded in concrete bases 27 recessed in the ground 28, as shown in Figure 1. The upper end of each mast 26 is provided with a cap which may be the same in both forms of the invention and is indicated in Figure 5 by the numeral 29. Each cap 29 is provided with a socket 30 receiving one end of a cable 31 and these cables slope downwardly away from the masts in a common plane at an approximate angle to be referred to later. The lower ends of the cables 31 are substantially fixed with respect to the ground, for example, by means of ground anchors 32. The ground 28 may be provided with a suitable pit 32' having one wall generally following the slope of the cables 31 for a purpose to be described.

At the opposite sides of the masts, guy wires 33 are connected between the masts 26 and ground anchors 34. Each guy wire 33 is obviously arranged in a common plane with its associated cable 31 to pull in direct opposition to each other and all of the cables 31 and 33 may be provided with turnbuckles 35 by means of which they may be properly tensioned. Each mast is further provided outwardly thereof with a similar guy wire 36 connected to a ground anchor 37 and also preferably provided with a turnbuckle 38. The guy wires 36 and the masts are arranged in a common plane transversely of the apparatus, as will become apparent.

The article receiving element comprises a cable 39 having its opposite ends anchored in sockets 40 formed integral with yokes 41. Each of these yokes carries a wheel 42 outwardly of and engaging one of the cables 31 as shown in Figure 3. Inwardly of each cable 31 the corresponding yoke carries a brake shoe 43 urged into engagement with the inner side of the associated cable 31 by a spring 44. It will be apparent that the wheels 42 guide the cable 39 for movement downwardly along the cables 31 while the brake shoes provide a predetermined amount of resistance against such movement. The article 22 will be delivered to the cable 39 in a manner to be described and the momentum of the article moves the cable 39 downwardly along the cables 31 and the braking means referred to is provided to bring the article to a relatively gradual stop.

The receiving mechanism may be provided with auxiliary means for increasing resistance to the movement of the cable 39, such additional resistance being highly desirable when relatively heavy loads are being deposited. Referring to Figures 5 and 6, the numeral 45 designates a yoke straddling each yoke 41 and pivotally connected thereto as at 46. One end of a shock cord 47 is fixed within a socket 48 formed integral with each yoke 45. Each shock cord 47 passes over a pulley 49 rotatable with respect to the associated cap 29. Each shock cord passes downwardly around a drum 50 of a small windlass 51, the drum being provided with a gear 52 engaged by a pinion 53 mounted on a shaft 54. A handle 55 is provided for rotating the shaft 54 and a pawl 56 may engage the teeth of the pinion 53 to prevent reverse rotation of the drum 50 whereby each shock cord 47 may be maintained under tension. The elements 47 have been described as "shock cords" which elements, as is well known, are made up of numerous rubber cords or strings enclosed in a woven fabric casing which is adapted to elongate upon the stretching of the rubber cords. Any suitable elastic means may be provided instead of using the shock cords as such, as will be apparent.

The operation of the apparatus is as follows:

The shock cords 47 are preferably employed when relatively heavy loads are to be deposited but their use is unnecessary in the depositing of relatively light loads such as small packages of mail. The apparatus will be first described without the use of the shock cords referred to. The receiving cable 39 is normally arranged at the upper end of the cables 31 adjacent the masts 26. The receiving cable will remain in the position referred to for the reason that the cables 31 will always be engaged by the brake shoes 43.

When a plane approaches a field equipped with a receiving mechanism to which an article is to be deposited, an attendant within the plane will lower the arm 11 to its relative operative position shown in Figure 2. With the head 14 arranged at the upper end of the arm 11 the attendant will connect the cross member 24 of the article case 22 to the fingers 16 and 17, the member 24 engaging in the notches 20 to be properly positioned. These notches are very shallow and do not offer any material resistance to lateral rearward movement of the cross member 24. The finger 17 maintains the cross member 24 in the notch 20 of the finger 16 and this finger, being horizontal and preferably integral with the head 14, will positively support the article 22 against downward movement.

The plane will approach the receiving mechanism at such height that the cable 39 will be intermediate the vertical limits of the rod 23. When this rod strikes against the cable 39 the substantial retarding of the article 22 and the elements carried thereby will pull the cross member 24 loose from the fingers 16 and 17, and the hook member 25 will drop into engagement with the cable 39. The force applied to the cable 39 by virtue of the inertia of the article 22 and the elements connected therewith will cause the cable 39 and yokes 41 to start to move downwardly in the plane of the guide cables 31. The distance of movement of the cable 39 and associated elements will depend upon the inertia of the article 22 as determined by its weight and speed, and will depend upon the braking action effected by the brake shoes 43. For relatively light loads, for example, up to 10 or 15 pounds, it is practicable to design the apparatus to provide the braking action necessary to completely arrest movement of the article 22 before it reaches a position adjacent the lower ends of the cables 31.

The pit 32 is provided for the purpose of increasing the distance along which the article can move before striking the ground, as will be apparent. As soon as movement of the article is arrested, an attendant may release the hook 25 from the cable 39, open the case 22 and remove the contents therefrom.

The cables 31 necessarily are relatively straight. However, the inclination of the plane of these

cables roughly approximates the trajectory which the article tends to follow. This trajectory would not be the normal trajectory of an article released for free movement at the point normally occupied by the cable 39 since this cable in progressively retarding movement of the article greatly foreshortens what would be the normal free trajectory of the article. Therefore, the cables 31 slope downwardly at an angle substantially less than an angle which would approximate the free trajectory of the article. It will be apparent that the angle of slope of the wires will depend upon the speed of the plane from which it is desired to receive an article, and aviators familiar with the apparatus may readily approach it at the proper speed for its most efficient operation. The shock cords 47 are employed where relatively heavy loads are to be received. It is highly desirable not to initially retard the load to too great an extent in order to avoid any injury to the article incident to the shock of striking the cable 39. However, where relatively heavy loads are received and a relatively light braking action is provided, such braking action will not be efficient for stopping the load within the length of the cables 31. For the receiving of relatively heavy loads, therefore, the shock cords 47 are preferably employed and these shock cords are wound by the windlasses 51 preferably to provide the shock cords with a relatively slight degree of tension when the cable 39 is in the receiving position. When the article is deposited, the cable 39 will move in the manner previously described and the brake shoes 43 will exert uniform pressure against the cables 31 to provide a uniform braking action. However, movement of the yokes 41 will elongate the shock cords 47, thus causing these elements to progressively resist movement of the receiving cable 39 as it moves downwardly lengthwise of the cables 31. Thus it will be apparent that a relatively heavy load may be received without the exertion of a substantial initial shock thereto while the apparatus at the same time functions tot bring such a relatively heavy load to a complete stop before it reaches the lower ends of the cables 31.

From the foregoing it will be apparent that the present apparatus provides a novel and simple mechanism whereby articles may be transferred from a moving airplane to the ground without damage to the articles. The apparatus comprises relatively few parts, all of which are relatively cheap and simple to manufacture, and the apparatus may be quickly set up for operation.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. A mechanism for receiving an article delivered by an airplane in flight, comprising a receiving element contactible with the article carried by the plane to detach the article from the plane and to engage and support the article, a pair of parallel guide members carrying said receiving element and sloping downwardly in the direction of movement of the plane, said receiving element being normally arranged adjacent the upper ends of said members, and means having mechanical connection with said receiving element to tend to hold it in its normal position and to resist movement of said element away from its normal position downwardly along said guide means.

2. A mechanism for receiving an article delivered by an airplane in flight, comprising a receiving element contactible with the article carried by the plane to detach the article from the plane and to engage and support the article, a pair of parallel guide members carrying said receiving element and sloping downwardly in the direction of movement of the plane, said receiving element being normally arranged adjacent the upper ends of said members, and a brake device carried by said receiving element adjacent each end thereof and engaging the adjacent guide member to resist movement of said receiving element along said guide members.

3. A mechanism for receiving an article delivered by an airplane in flight, comprising a pair of supports, a pair of guide members parallel to each other and each connected at one end to one of said supports and sloping downwardly therefrom in the direction of travel of the airplane, a receiving element extending transversely between said guide members and provided at its ends with heads engaging said guide members, said receiving element having a central flexible cable element connected between said heads and engageable by the airplane-carried article, said receiving element being normally arranged adjacent the upper ends of said guide members, and means for resisting movement of said receiving element downwardly along said guide members.

4. A mechanism for receiving an article delivered by an airplane in flight, comprising a pair of supports, a pair of guide members parallel to each other and each connected at one end to one of said supports and sloping downwardly therefrom in the direction of travel of the airplane, a receiving element extending transversely between said guide members and provided at its ends with heads engaging said guide members, said receiving element having a central flexible cable element connected between said heads and engageable by the airplane-carried article, said receiving element being normally arranged adjacent the upper ends of said guide members, and a brake device carried by each of said heads and engaging the adjacent guide member to resist movement of said receiving element downwardly along said guide members.

5. A mechanism for receiving an article delivered by an airplane in flight, comprising a pair of vertical supports, a pair of guide cables arranged parallel to each other and each connected at one end to the upper end of one of said supports, said guide cables sloping downwardly in the direction of flight of the airplane and being anchored to the ground at their lower ends and maintained under tension, a receiving device extending transversely between said guide cables and normally arranged at the upper ends thereof, said receiving device comprising a central flexible cable portion having heads at the ends thereof each provided with a wheel engaging one of said guide cables outwardly thereof, and means for resisting movement of said receiving device downwardly along said guide cables.

6. A mechanism for receiving an article delivered by an airplane in flight, comprising a pair of vertical supports, a pair of guide cables arranged parallel to each other and each connected at one end to the upper end of one of said supports, said guide cables sloping down-

wardly in the direction of flight of the airplane and being anchored to the ground at their lower ends and maintained under tension, a receiving device extending transversely between said guide cables and normally arranged at the upper ends thereof, said receiving device comprising a central flexible cable portion having heads at the ends thereof each provided with a wheel engaging one of said guide cables outwardly thereof, and a brake device carried by each of said heads and including a brake shoe engageable against the adjacent guide cable inwardly thereof to resist movement of said receiving device downwardly along said guide cables.

7. A mechanism for receiving an article delivered by an airplane in flight, comprising a receiving element contactible with the article carried by the plane to detach the article from the plane and to engage and support the article, a pair of parallel guide members carrying said receiving element and sloping downwardly in the direction of movement of the plane, said receiving element being normally arranged adjacent the upper ends of said members, means having mechanical connection with said receiving element to tend to hold it in its normal position and to resist movement of said element away from its normal position downwardly along said guide means, and separate means for progressively resisting movement of said receiving element away from its normal position.

8. A mechanism for receiving an article delivered by an airplane in flight, comprising a receiving element contactible with the article carried by the plane to detach the article from the plane and to engage and support the article, a pair of parallel guide members carrying said receiving element and sloping downwardly in the direction of movement of the plane, said receiving element being normally arranged adjacent the upper ends of said members, a brake device carried by said receiving element adjacent each end thereof and engaging the adjacent guide member to resist movement of said receiving element along said guide members, and resilient means connected to said receiving element to be increasingly tensioned thereby upon movement thereof away from its normal position to progressively resist such movement of said receiving element.

9. A mechanism for receiving an article delivered by an airplane in flight, comprising a pair of supports, a pair of guide members parallel to each other and each connected at one end to one of said supporting members and sloping downwardly therefrom in the direction of travel of the airplane, a receiving element extending transversely between said guide members and provided at its ends with heads engaging said guide members, said receiving element having a central flexible cable element connected between said heads and engageable by the airplane-carried article, said receiving element being normally arranged adjacent the upper ends of said guide members, a brake device carried by each of said heads and engaging the adjacent guide member to resist movement of said receiving element downwardly along said guide elements, and resilient means connected to each of said heads to be increasingly tensioned upon movement of said receiving element away from its normal position to progressively resist such movement of said receiving element.

10. A mechanism for receiving an article delivered by an airplane in flight, comprising a pair of vertical supports, a pair of guide cables arranged parallel to each other and each connected at one end to the upper end of one of said supports, said guide cables sloping downwardly in the direction of flight of the airplane and being anchored to the ground at their lower ends and maintained under tension, a receiving device extending transversely between said guide cables and normally arranged at the upper ends thereof, said receiving device comprising a central flexible cable portion having heads at the ends thereof each provided with a wheel engaging one of said guide cables outwardly thereof, a brake device carried by each of said heads and including a brake shoe engageable against the adjacent guide cable inwardly thereof to resist movement of said receiving device downwardly along said guide cables, resilient means connected to each of said heads to be increasingly tensioned upon movement of said receiving device away from normal position to progressively resist such movement of said receiving device, and means for varying the tension of each of said last named means.

11. A mechanism for receiving an article delivered by an airplane in flight, comprising a receiving element extending transversely of the direction of flight of the airplane and contactible with the article carried by the plane to detach it therefrom and to engage and support the article, a pair of parallel guide members having mechanical connection with said receiving element adjacent the ends thereof, said receiving element being normally arranged adjacent the ends of said guide members in the direction of approach of the airplane, and a brake device carried by said receiving element adjacent each end thereof and engaging the adjacent guide member to resist movement of said receiving element along said guide members.

12. A mechanism for receiving an article delivered by an airplane in flight, comprising a pair of supports, a pair of guide members parallel to each other and each connected at one end to one of said supports, a receiving element extending transversely between said guide members and provided with an intermediate flexible section and with heads engaging said guide members, said receiving element being normally arranged adjacent the ends of said guide members in the direction of approach of the airplane, and a brake device carried by each of said heads and engaging the adjacent guide member to resist movement of said receiving element along said guide members.

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