Oct. 26, 1943. C. A. GUSTAFSON ET AL 2,332,712

LIFT MECHANISM

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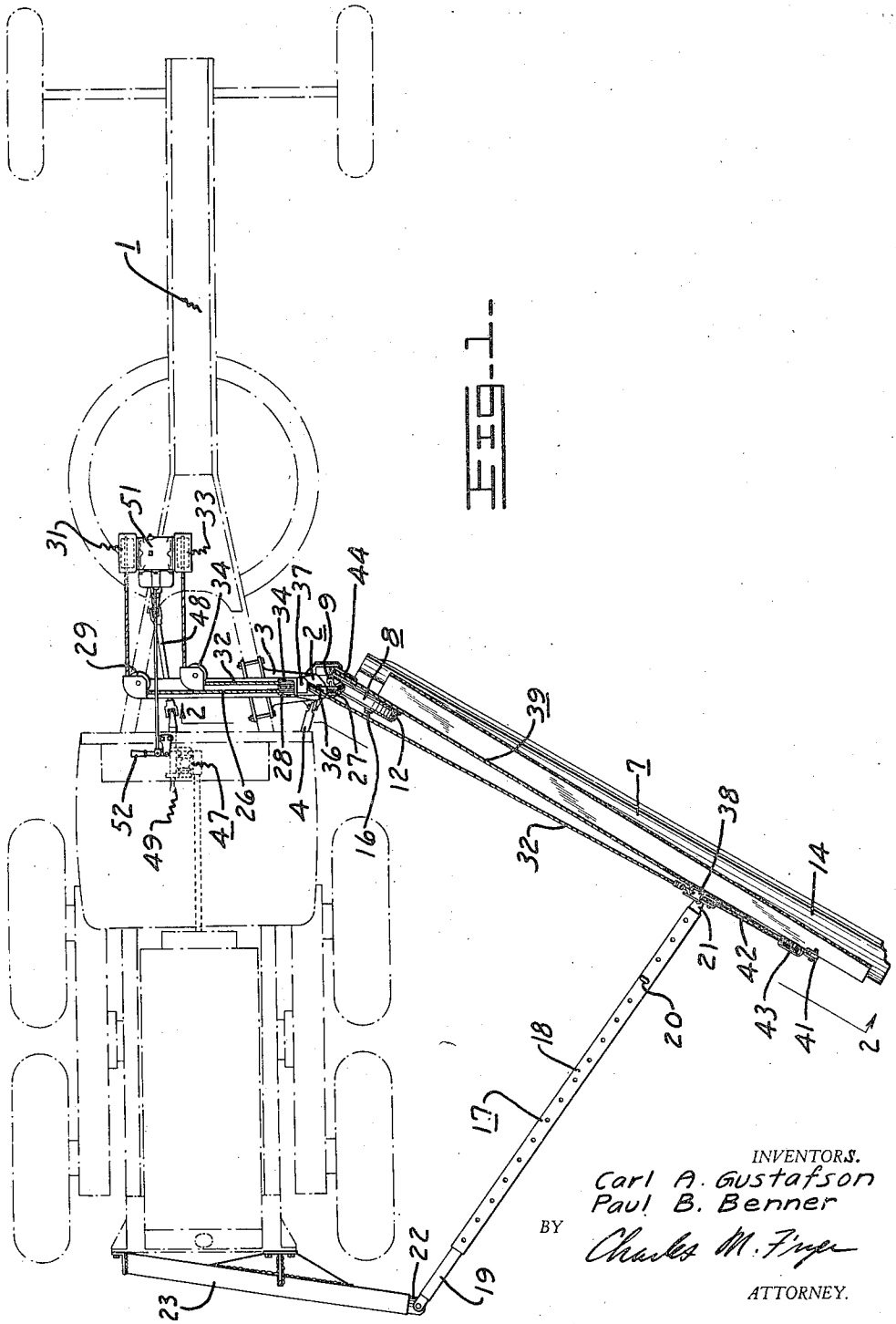


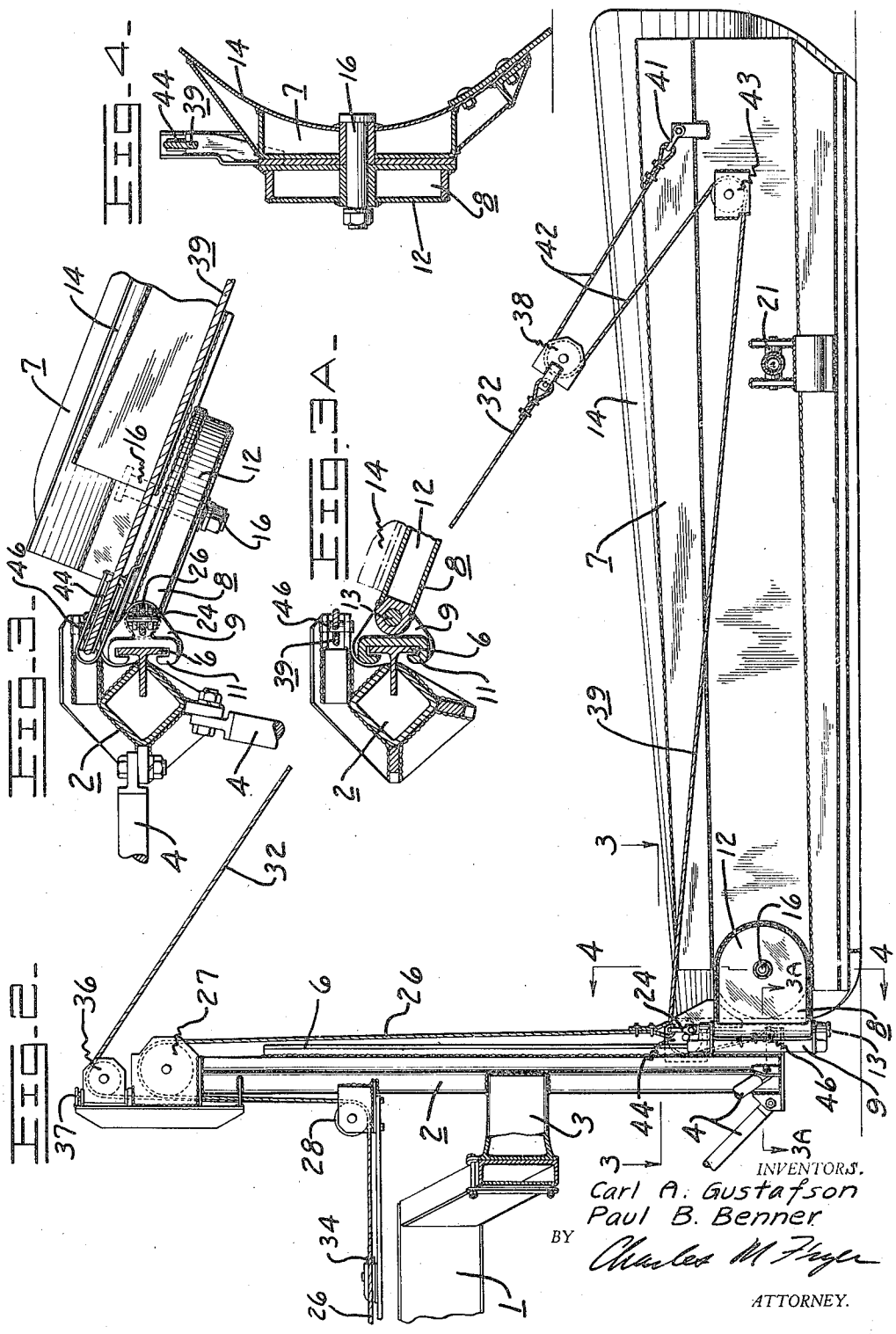
Fig. 1.

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FIG-6-

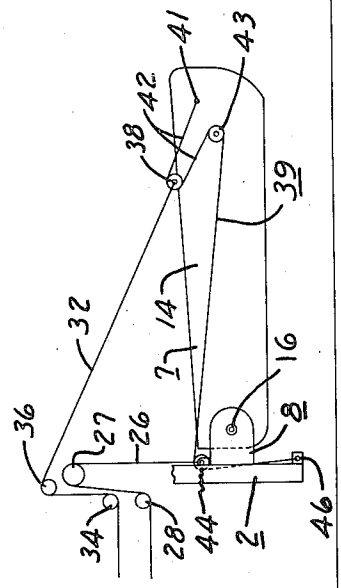


FIG-8-

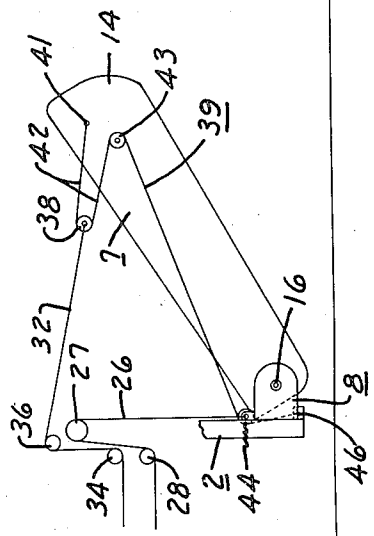


FIG-5-

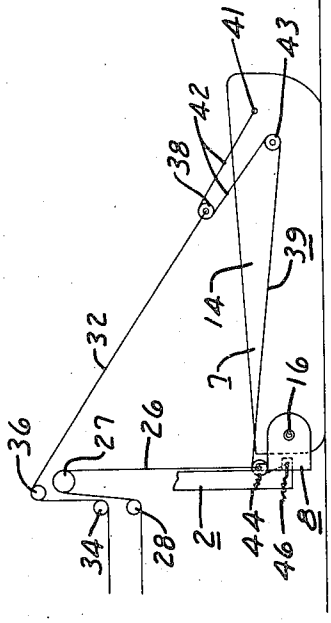
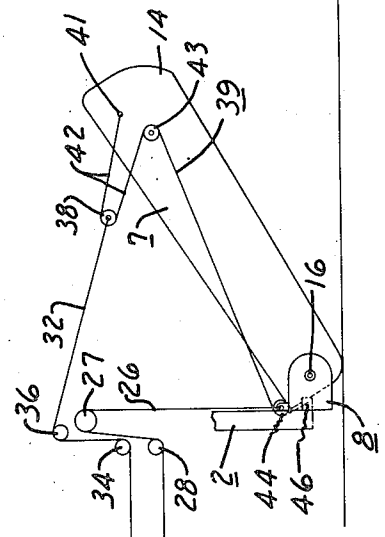


FIG-7-



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LIFT MECHANISM

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13 Claims. (Cl. 37—42)

Our invention relates to lift mechanism, and more particularly to such mechanism for controlling movement of both ends of a structure mounted for back and forth movement on a support and which extends outwardly from such support, such as a wing-type snow plow structure.

Wing-type snow plow structures to which the mechanism of our invention is particularly applicable generally comprise an upwardly extending supporting mast, a bracket part mounted for up and down movement on such mast, and a snow plow part movably connected to such bracket part for pivotal movement in an upright plane. Heretofore, a cable was connected to the bracket part to move such part; and an independent cable was connected to the snow plow part. As a result, when it was desired to move the entire snow plow structure bodily to adjust the level of the snow plow part with respect to the ground, it was necessary to manipulate two cables. This arrangement is not all to be desired; as it is rather difficult to obtain, by manipulation of two separately adjustable cables, accurate adjustment of both parts of the snow plow structure to a predetermined level, after they have been moved from such level.

Our invention is designed to overcome the above described problems, and has as its objects, among others, the provision of improved lift mechanism for a structure of the character related, which: enables both ends of such structure to be lifted simultaneously by manipulation of a single cable; embodies means to enable the entire structure to be lifted or lowered to the same extent, thereby, in the case of a snow plow structure, facilitating proper adjustment for obtaining an even cut; provides for adjustment of the outer or snow plow part independently of the inner or bracket part; permits all adjustments to be made easily and without binding of any of the parts; and which is of simple and economical construction. Other objects of our invention will become apparent from a perusal of the following description thereof.

Referring to the drawings:

Fig. 1 is a top plan view of the lift mechanism of our invention connected to a snow plow structure which is shown mounted on a type of vehicle suitable therefor, namely, a self-propelled motor grader shown in phantom lines.

Fig. 2 is a sectional rear elevation taken in planes indicated by line 2—2 in Fig. 1.

Fig. 3 is a horizontal section taken in a plane indicated by line 3—3 in Fig. 2.

Fig. 3A is a horizontal section taken in a plane indicated by line 3A—3A in Fig. 2.

Fig. 4 is a vertical section taken in planes indicated by line 4—4 in Fig. 2.

Fig. 5 is a schematic elevational view illustrating the position of the lift mechanism with the snow plow structure at substantially ground level.

Fig. 6 is a view similar to Fig. 5 illustrating the position of the control mechanism after the entire snow plow structure has been lifted a fixed distance above the ground, with the snow plow part substantially parallel to the ground.

Fig. 7 is a view similar to Fig. 5 illustrating the position of the control mechanism after the snow plow part of the snow plow structure has been adjusted angularly.

Fig. 8 is a view similar to Fig. 7 illustrating the position of the control mechanism, after the entire snow ploy structure has been lifted bodily upwardly from the position shown in Fig. 7.

Usually snow plow structures of the character to which our invention relates are mounted so as to extend laterally or outwardly from a self-propelled vehicle such as motor grader 1 which for this purpose is provided with an upright mast structure 2 secured to a side of the vehicle by intermediate supporting bracket 3 and bottom struts 4. Secured to the outer side of mast 2 is a rail member 6 upon which the entire snow plow structure 7 is mounted for adjustment back and forth in a vertical direction. Such snow plow structure comprises two main parts, the inner one of which is a bracket part 8 including bracket element 9 having C-shaped shoe 11 embracing, and slidably mounted for up and down movement on rail 6. Also forming part of bracket part 8 is bracket element 12 movably connected to element 9 for pivotal movement in a horizontal plane, about upright pivot pin 13. The outer part of the snow plow structure comprises snow plow part 14 pivotally connected to bracket element 12 for pivotal movement in an upright plane, about horizontally positioned pivot pin 16.

Snow plow part 14 is thus angularly adjustable with respect to the line of draft of the vehicle, about upright pivot pin 13. For bracing snow plow part 14 in any angularly adjusted position with respect to the line of draft, adjustable compression strut 17 is provided. Such strut comprises sleeve 18 in which is telescoped rod 19 held against axial movement within sleeve 18 by a pin 20 passing through a selected one of a plurality of apertures in sleeve 18 and an aperture in rod 19, depending upon the length of strut

desired. The forward end of strut 17 is provided with a suitable universal connection at 21 to the rear of snow plow part 14; and the rear end of strut 17 is universally connected at 22 to bracket 23 attached to the rear of the vehicle. In any angularly adjusted position with respect to the line of draft, snow plow part 14, can be also angularly adjusted in a vertical plane by movement about pivot pin 16. The universal connections 21 and 22 for strut 17 will permit such angular adjustment in a vertical plane with slight change in the angular position of the snow plow part with respect to the line of draft.

Depending upon conditions, there are numerous operating positions for the snow plow. For example, snow plow part 14 may be so adjusted as to have its lower edge in substantial contact with the ground to remove snow from the ground; or the plow may be adjusted upwardly so as to have such edge above and parallel to the ground to make a horizontal step-cut with respect to the ground. Also, snow plow part 14 may be adjusted at various inclinations in an upright plane with its inner edge at various heights above the ground for making various banked or inclined step-cuts. In any given position at which the plow may be cutting, it is sometimes desirable to make a rapid adjustment of the entire plow structure including bracket part 8, so as to allow the plow structure to clear an obstruction which may be in the way. The lift mechanism of our invention is designed to provide for such bodily adjustment of the entire snow plow structure by manipulation of only one cable, thus facilitating restoration of the entire structure to its original position. At the same time, such lift mechanism enables independent adjustment of the outer part of the snow plow structure; namely, snow plow part 14 on bracket part 8 in any position of bracket part 8. Such lift mechanism will now be described.

Attached to the inner end of the snow plow structure, by means of clevis 24 pivotally connected to the top of pivot pin 13 on bracket part 8, is a flexible cable 26 which extends upwardly along mast support 2 and passes over guide sheave 27 journalled adjacent the top of such mast. From guide sheave 27, cable 26 passes under a second guide sheave 28, thence around guide sheave 29, mounted on the vehicle, to winding drum 31. Downward or upward movement of cable 26 causes corresponding movement of bracket part 8. Another flexible cable 32, which serves as an anchoring cable, as well as a lift cable for the outer end of the snow plow structure, in a manner to be subsequently described, is windable and unwindable from a drum 33 adjacent drum 31, and passes around guide sheaves 34, from which it extends upwardly and over a guide sheave 36 journalled on the top of mast 2 for pivotal movement about an upright pivot axis 37. Because of the pivotal mounting of sheave 36 to swing about upright axis 37, the portion of the cable 32 extending beyond sheave 36 can turn angularly with reference to the line of draft of the machine together with snow plow part 14 to which the lower end of such cable 32 is connected.

At its lower end, anchoring cable 32 has secured thereto an anchoring sheave 38 over which passes a third cable 39 which serves in cooperation with cable 32, as a motion transmitting connection for effecting simultaneous movement of snow plow part 14 together with bracket part 8 when the latter is moved upwardly or downwardly by cable 26. The outer end of cable 39 is secured to snow plow part 14 adjacent the outer end thereof, by means of clevis 41; and a half speed reduction loop comprising substantially parallel strands 42 is formed in such cable 39 by passage over sheave 38 and a sheave 43 mounted on snow plow part 14 adjacent clevis 41. From sheave 32, cable 39 passes over a sheave 44 mounted on the top of bracket element 12 of bracket part 8; and the inner end of cable 39 is fixedly attached to the lower end of mast support 3, at fixed anchoring point 46.

Any suitable means may be provided for effecting winding and unwinding of drums 31 and 33. The form of means illustrated comprises reversible drive clutching mechanism 47 preferably of the type illustrated in our assignee's Patent No. 2,192,439, by which shafting 48 may be driven in either one of opposite directions by manipulation of control lever 49. Shafting 48 is connected to any suitable clutch mechanism in clutch box 51 for establishing a drive, by manipulation of control lever 52, to either one of drums 31 or 33.

In operation, when snow plow part 14 is working at ground level, and it is desired to adjust the entire snow plow structure upwardly, this can be done by manipulation of only cable 26. For example, with reference to Figs. 5 and 6, upward movement of cable 26 will cause upward movement of bracket part 8. With cable 32 taut so that it can move in an arc on sheave 36 as an anchor, movement of bracket part 8 will cause sheave 44 on bracket part 8 to serve as a motion controlling member for shortening the length of cable 39 between sheave 44 and anchor point 41, to the same extent as the length of cable is increased between fixed point 46 and sheave 44. As a result, the reduction loop, comprising strands 42, in cooperation with anchoring sheave 38, cause the outer end of snow plow 14 to be moved simultaneously with bracket part 8.

If sheave 38 were journalled on a fixed point, such movement of the outer end of plow 14 would be about one-half the extent of movement of bracket part 8 because of reduction loop 42. However, anchoring sheave 38 being secured to anchoring cable 32 which must move upwardly in an arc as the length of cable between sheave 44 and point 41 is shortened, causes the outer end of snow plow part 14 to be lifted greater than half the extent of bracket part 8. Preferably, the angle of inclination and the length of cable 32 with respect to the snow plow structure, as is determined by the position of sheave 36, are so chosen as to cause, in cooperation with the reduction loop in cable 39, the snow plow part 14 to move substantially the same extent as bracket part 8; so that parallel lifting and lowering of the entire snow plow structure may obtain with respect to the ground by manipulation of cable 26.

In the described manipulation of the lift mechanism wherein the entire snow plow structure may be adjusted bodily as a unit with respect to the ground merely by manipulation of cable 26, movement of cable 32 other than swinging in an arc, does not occur because as was previously mentioned, the cable is anchored on sheave 36 during such operation. However, cable 32 may be adjusted along its length by winding or unwinding from drum 33, to serve as a means for adjusting the angle of inclination of snow plow part 14 in an upright plane; and when such adjustment is made, the bracket part 8 does not move, as can be observed by comparison of Figs.

5 and 7. With snow plow part 14 adjusted angularly in an upright plane, the entire snow plow structure may be moved bodily as a unit without changing substantially the angle of inclination of snow plow part 14, merely by adjustment of cable 26, as can be observed by comparison of Figs. 7 and 8. In making any of the described adjustments, no binding will occur between snow plow part 14 and bracket part 8 at pivot point 16; nor will there be any binding of shoe 11 on rail 6 in any position of bracket part 8 on rail 6. As a result, all adjustments can be made easily and rapidly from the operator's station of the machine.

Although we have described our lift mechanism in relationship with a wing-type snow plow structure of the character illustrated, it is apparent that such lift mechanism may be employed in combination with any other type of structure extending in cantilever fashion from a support and which is designed for back and forth movement on such support.

We claim:

1. Lift mechanism for a structure having an end thereof mounted for back and forth movement on a support and which extends from said support, comprising means connected to said structure adjacent said end for moving said end; and means for effecting movement of the opposite end of said structure simultaneously with said first mentioned end including anchoring means, flexible means connected to said anchoring means and having a portion connected to said structure adjacent said opposite end and another portion connected to an anchoring point, and a motion controlling member on said structure engaging said flexible means.

2. Lift mechanism for a structure including a part mounted for back and forth movement on a support and another part movably connected to said first mentioned part, comprising means connected to said first mentioned part for moving said part; and means for effecting movement of said another part simultaneously with said first mentioned part including anchoring means, a flexible member connected adjacent one end thereof to said another part and adjacent its opposite end to an anchoring point and passing over said anchoring means, and a motion controlling member on said first mentioned part engaging said flexible member.

3. Lift mechanism for a structure including a part mounted for back and forth movement on a support and another part movably connected to said first mentioned part, comprising means connected to said first mentioned part for moving said part; and means for effecting movement of said another part simultaneously with said first mentioned part including anchoring means, a flexible member connected adjacent one end thereof to said another part and adjacent its opposite end to an anchoring point and passing over said anchoring means, and a motion controlling member on said first mentioned part engaging said flexible member; said anchoring means being movable to enable independent movement of said another part.

4. Lift mechanism for a structure including a part mounted for up and down movement on a support and another part movably connected to said first mentioned part, comprising means connected to said first mentioned part for moving said part; and means for effecting movement of said another part simultaneously with said first mentioned part including an anchoring member mounted above said structure to swing in an arc and having an anchoring element adjacent said structure, a flexible member connected adjacent one end thereof to said another part and adjacent its opposite end to an anchoring point and having a reduction loop passing over said anchoring element, and a motion controlling member on said first mentioned part engaging said flexible member; said anchoring member being at such inclination with respect to said structure that when said first mentioned part is moved it cooperates with said reduction loop to cause said another part to be moved to substantially the same extent as said first mentioned part.

5. Lift mechanism for a structure including a part mounted for up and down movement on a support and another part movably connected to said first mentioned part, comprising means connected to said first mentioned part for moving said part; and means for effecting movement of said another part simultaneously with said first mentioned part including an anchoring cable mounted above said structure to swing in an arc and having an anchoring sheave adjacent said structure, a second cable connected adjacent one end thereof to said another part and adjacent its opposite end to an anchoring point and having a reduction loop passing over said anchoring sheave, and a motion controlling member on said first mentioned part engaging said second cable; said anchoring cable being at such inclination with respect to said structure that when said first mentioned part is moved it cooperates with said reduction loop to cause said another part to be moved to substantially the same extent as said first mentioned part; and said anchoring cable being movable to enable independent movement of said another part.

6. Lift mechanism for a wing-type snow plow structure including a bracket part slidably mounted for up and down movement on a support and a snow plow part pivotally connected to said bracket part for movement in an upright plane, comprising means for moving said bracket part; and means for effecting movement of said snow plow part simultaneously with said bracket part upon operation of said moving means comprising an anchoring cable mounted on said support above said snow plow structure to swing in an arc and having an anchoring sheave adjacent said snow plow structure, a second cable connected adjacent one end thereof to said snow plow part and adjacent its opposite end to an anchoring point on said support, said second cable passing over said anchoring sheave, and a motion controlling sheave on said bracket part engaging said second cable; said anchoring cable being independently movable to adjust the angle of inclination of said snow plow part.

7. The combination with a structure comprising parts movably connected together and a support upon which one of said parts is mounted for back and forth movement; of lift mechanism for said structure including first means connected to said one part for moving said part, second movable means, and means including a motion transmitting connection connected to an anchoring point, to said parts and to said second movable means for effecting movement of another part simultaneously with said one part upon movement of said first means and enabling movement of said another part independently of said one part upon movement of said second movable means.

8. The combination with a wing-type snow plow structure comprising a snow plow part and a bracket part to which said snow plow part is pivotally connected, and a support upon which said bracket part is slidably mounted for up and down movement; of lift mechanism for said structure including a cable connected to said bracket part for moving said part; a second cable mounted on said support; and means for effecting movement of said snow plow part simultaneously with said bracket part upon movement of said bracket part including a third cable connected to said snow plow part, said second cable, an anchoring point on said support and engaging a motion controlling member on said bracket part.

9. The combination with a wing-type snow plow structure comprising a snow plow part and a bracket part to which said snow plow part is pivotally connected, and a support upon which said bracket part is slidably mounted for up and down movement; of lift mechanism for said structure including a cable connected to said bracket part for moving said part; a second cable mounted on said support; and means for effecting movement of said snow plow part simultaneously with said bracket part upon movement of said bracket part including a third cable connected to said snow plow part, said second cable, an anchoring point on said support and engaging a motion controlling member on said bracket part; said third cable being connected to said second cable through a reduction loop and the inclination of said second cable being such that said snow plow part is moved to substantially the same extent as said bracket part upon movement of said bracket part.

10. The combination with a wing-type snow plow structure comprising a snow plow part and a bracket part to which said snow plow part is pivotally connected, and a support upon which said bracket part is slidably mounted for up and down movement; of lift mechanism for said structure including a cable connected to said bracket part for moving said part; a second cable mounted on said support to swing in an arc; and means for effecting movement of said snow plow part simultaneously with said bracket part upon movement of said bracket part including a third cable connected to said snow plow part, said second cable, an anchoring point on said support and engaging a motion controlling member on said bracket part; said third cable being connected to said second cable through a reduction loop and the inclination of said second cable being such that said snow plow part is moved to substantially the same extent as said bracket part upon movement of said bracket part; said second cable being independently movable to move said snow plow part independently of said bracket part.

11. The combination with a wing-type snow plow structure which includes a bracket part slidably supported for up and down movement and a snow plow part pivotally connected to said bracket part for movement together with or independently of said bracket part; of lift mechanism for said structure comprising movable means, second movable means for moving said bracket part, and a motion transmitting connection connected to an anchoring point, to both of said parts and to said first mentioned movable means for effecting movement of said snow plow part simultaneously with said bracket part upon movement of said bracket part by said second movable means and enabling movement of said snow plow part independently of said bracket part upon movement of said first mentioned movable means.

12. The combination with a wing-type snow plow structure which includes a bracket part slidably supported for up and down movement and a snow plow part pivotally connected to said bracket part for movement together with or independently of said bracket part; of lift mechanism for said structure comprising movable means, second movable means for moving said bracket part, and a motion transmitting connection connected to an anchoring point, to both of said parts and to said first mentioned movable means for effecting movement of said snow plow part simultaneously with said bracket part upon movement of said bracket part by said second movable means and enabling movement of said snow plow part independently of said bracket part upon movement of said first mentioned movable means, said motion transmitting connection cooperating with the first mentioned movable means to cause said snow plow part to be moved to substantially the same extent as said bracket part upon movement of said bracket part.

13. The combinaton with a vehicle having a supporting mast, and a wing-type snow plow structure which includes a bracket part slidably supported for up and down movement on said mast and a snow plow part pivotally connected to said bracket part for movement together with or independently of said bracket part; of lift mechanism for said structure comprising movable means, second movable means for moving said bracket part, and a motion transmitting connection connected to an anchoring point, to both of said parts and to said first mentioned movable means for effecting movement of said snow plow part simultaneously with said bracket part upon movement of said bracket part by said second movable means and enabling movement of said snow plow part independently of said bracket part upon movement of said first mentioned movable means.

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