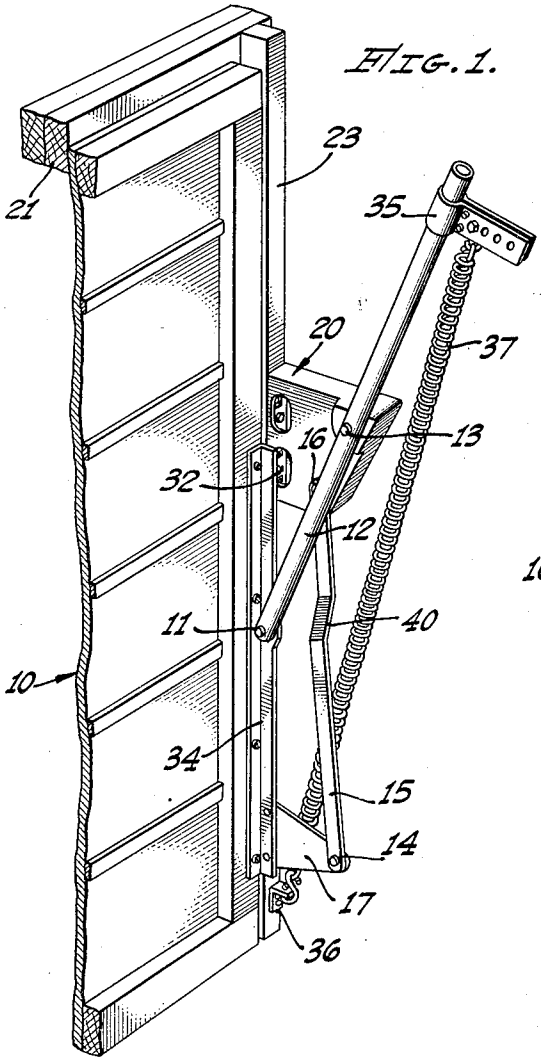
July 22, 1952 W. J. BOBISCH 2,603,826

MULTIPLE PINTLE HINGE FOR OVERHEAD DOORS

Filed May 21, 1948 2 SHEETS—SHEET 1

FIG. 1.



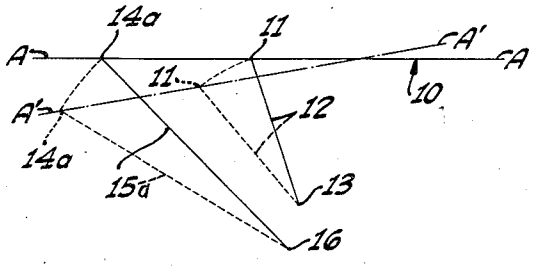


FIG. 4.

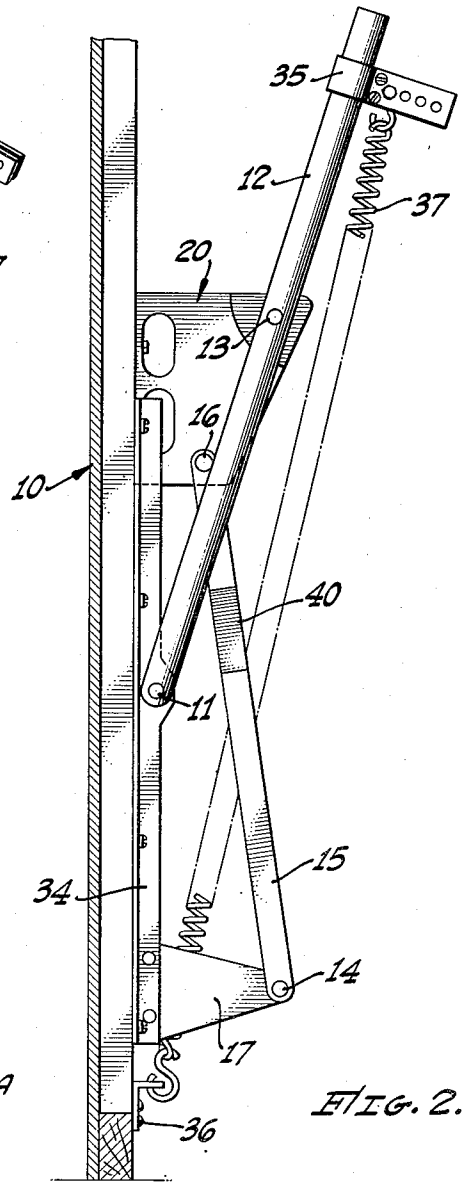


FIG. 2.

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MULTIPLE PINTLE HINGE FOR OVERHEAD DOORS

Filed May 21, 1948 2 SHEETS—SHEET 2

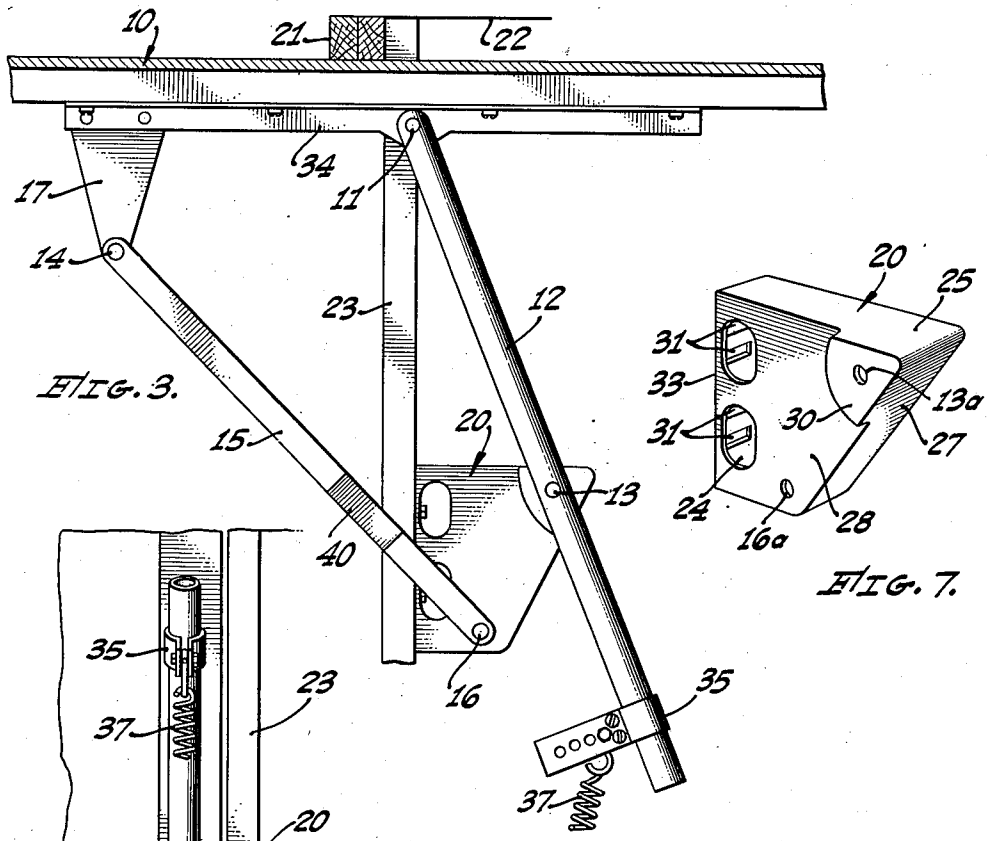


FIG. 3.

FIG. 7.

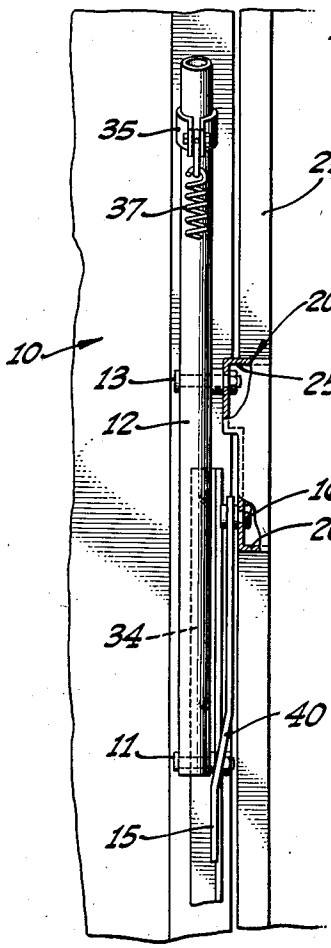


FIG. 6.

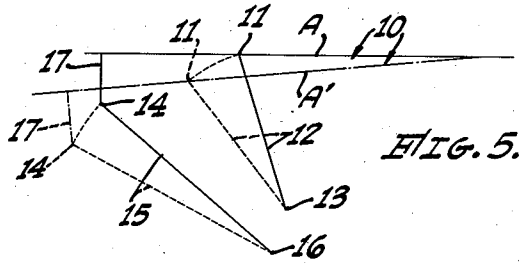


FIG. 5.

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UNITED STATES PATENT OFFICE

2,603,826

MULTIPLE PINTLE HINGE FOR OVERHEAD DOORS

William J. Bobisch, Altadena, Calif., assignor to The R. H. Osborne Company, Los Angeles, Calif., a corporation of California

Application May 21, 1948, Serial No. 28,360

10 Claims. (Cl. 16—163)

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My invention relates generally to overhead door hardware and more particularly to such hardware that is adapted to permit the installation of a door of this general type where there is a minimum of clearance.

The use of an overhead door on a garage has a number of advantages to recommend its installation, some of these being its ease and simplicity of operation, and its general freedom from being blown closed by a wind. However, to permit such an installation to be made on many existing buildings, it is necessary that the door have hardware which will require a minimum of upward movement of the top of the door as the latter is opened or closed. For example, in many garages the vertical distance between the ceiling and the upper edge of the opening of the door is approximately six inches or less, providing a minimum of clearance or headroom. Consequently, if an overhead door is to be installed in such a garage, it is necessary that the hardware be of the type which does not require the upper edge of the door to travel more that this small distance vertically in moving from closed to open position. Previously, certain hardware has been available which meets this requirement but has permitted a relatively large portion of the door to extend outwardly beyond the outer face of the building when the door is in open position, this being known as overhang. Since a door of this type is rather delicately balanced, this overhang has prevented the use of such hardware in localities where snow is likely to accumulate upon the projecting portion of the open door.

It is therefore a major object of my invention to provide an improved overhead door construction.

Another object of my invention is to provide an overhead door construction which has a relatively small overhang, when open.

A further object of my invention is to provide a construction of this type wherein the vertical space or headroom necessary to operate the door may be quite small, for example, four inches.

Still another object of my invention is to provide such a door whose operation is very smooth and easy, requiring a minimum of effort to move it from one limiting position to another.

It is a still further object of my invention to provide hardware for a door of this type which may be inexpensively manufactured, and installed by relatively unskilled labor.

These and other objects and advantages of my invention will become apparent from the following description of a preferred form thereof, and

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from the drawings illustrating that form, in which:

Fig. 1 is a perspective view of my improved hardware installed where there is a very small amount of headroom available for the operation of the door, the latter being shown in its closed position;

Fig. 2 is a side elevational view of the hardware shown in Fig. 1, it being understood that there is a similar set of hardware at the opposite end of the door which is substantially identical to the set of hardware shown;

Fig. 3 is a side elevational view similar to Fig. 2, but with the door in its open or upper limiting position;

Fig. 4 is a schematic view of a similar but unsatisfactory type of hardware which requires additional headroom because of the absence of the offset member of one of the arms;

Fig. 5 is a schematic view of a hardware constructed in accordance with the present invention showing the improved results obtained from the use of the offset pivotal connection;

Fig. 6 is a rear elevational view of the hardware shown in Fig. 2; and

Fig. 7 is a perspective view of the main pivot supporting member.

In order to secure the previously mentioned advantages, it will become apparent that the angle the door makes with the horizontal must be relatively small as the door approaches its upper limiting position. It is possible, by providing a horizontally extending slide or guideway for the upper end of the door and a vertically extending slide for the lower end of the door, to secure the advantages of minimum headroom requirements and substantially complete absence of overhang. However, guideways of this type are always subject to jamming and sticking, and are never satisfactory from the standpoint of ease of operation. In addition, the use of this type of hardware presents very difficult problems in connection with counter-balancing the weight of the door, and while these problems are not insoluble, they, combined with the disadvantages of a guideway, render a solution of this type impractical.

To achieve the best results, the door should be held substantially horizontal as it is moved downwardly, during the first portion of its travel from open to closed position. This movement is similar to that obtained by the use of a parallelogram linkage, but, as will be pointed out, other movements must be provided which cannot be secured by this type of linkage.

As the door proceeds in its downward path, the door must be rotated about a horizontal axis to a vertical position where it will close the opening in the garage. Both the downward movement and the rotation of the door can be secured by the use of a quadrilateral linkage operating in a manner generally similar to a parallelogram linkage but constructed so that no two sides of the linkage are of equal length. However, this alone will not secure the proper results, as indicated in the schematic diagram shown in Fig. 4. In this diagram, a door 10 is pivotally attached at a point 11 to a main supporting arm 12, the other end of which is pivotally attached at a point 13 to the wall or other convenient supporting structure. The forward or lower end of the door 10 is pivotally attached at a point 14a to an auxiliary or guiding arm 15a whose other end is pivotally connected to a point 16 to a wall or other similar rigid structure. As the door is moved from its upper limiting position, shown in solid line and indicated by the letter A, the forward end of the door moves downwardly and forwardly a considerably greater distance than the central portion of the door, resulting in the door's being moved to the position shown in dotted outline and designated by the letter A'. The tipping of the door 10 results in its rear end being raised above its normal horizontal position, requiring a considerable amount of headroom for a door of this type. While this type of construction represents a considerable advance over the majority of overhead doors now in use, it still requires more headroom than is often available when a door of this type is to be installed in an existing building.

The principal cause of this excessive tipping of the door is found in the length of the auxiliary or guiding rod 15a whose length is such that a given angular rotation of the arm causes a considerable vertical travel of the pivot point 14a. I have found that by providing a member to offset the pivot point from the surface of the door, I am able to shorten the length of the auxiliary arm 15a and thereby materially improve the operation of the door.

In Fig. 5, I have illustrated schematically the construction and operation of a door using my improved hardware, the door 10 being pivotally connected at a point 11 to a main arm 12 whose other end is pivotally attached to a wall or supporting structure 13. At the forward or lower end of the door I provide an offset member 17 having a pivotal connection 14 at its lower or rearward end to which an auxiliary arm 15 is pivotally attached, the other end of the arm being pivotally attached to a supporting structure at the point 16. As indicated, this shortens the length of the auxiliary arm 15, thereby decreasing its vertical travel downwardly for a given angular rotation. Consequently, when the door 10 is moved from its limiting position, shown in full line and designated by the letter A, to the position A', corresponding to the same position shown in Fig. 4, the rear end of the door is not appreciably raised but instead remains at substantially the same elevation.

Turning now to the preferred embodiment of my invention as illustrated in the remaining figures of the drawings, the numeral 10 designates generally a door of any suitable and well known type adapted for overhead operation. Attached to the door 10 at a point 11 is a main supporting arm 12 which is also pivotally attached at a point 13 to a pivot block 20 that is firmly and rigidly held as by the structure of the garage itself. An offset member 17 is attached at the lower end of the door 10, and carries a pivot point 14 to which an auxiliary or guiding arm 15 is attached, the other end of this arm being pivotally attached at a point 16 to the previously mentioned pivot block 20. These elements, with the exception of the pivot block 20, will be recognized as being the same elements previously mentioned in conjunction with the diagrams of Figs. 4 and 5. In addition, I have illustrated a beam 21 extending across the opening of the garage, and a ceiling 22 or other member which impairs the headroom available for the operation of the door 10, necessitating the use of this type of hardware. It will be appreciated that at each end of the door 10 there is a jamb 23, the jambs and the beam 21 framing the opening of the garage which the door 10 is adapted to close.

As indicated in Figs. 1 and 6, the pivot block 20 is mounted on the rear surface of the jamb 23, extending inwardly from the outer face of the garage and in a direction generally perpendicular to the door 10 when the latter is in its closed position. As best shown in these figures and in Fig. 7, the pivot block 20 is preferably formed of relatively heavy sheet metal 28 which may have a generally trapezoidal shape with a vertically extending forward wall 24, substantially horizontal upper and lower walls or edges 25 and 26 respectively, and an angularly positioned rear wall 27. As will become apparent, the shape of the pivot block 20 and its various walls is relatively unimportant so long as the relative positioning of the various pivot points is maintained. The outer face 28 of the pivot block 20 is provided with holes 13a and 16a near its rear edge 27, these holes corresponding to the pivot points 13 and 16 previously mentioned. The upper hole 13a is located rearwardly of the lower hole 16a, the exact positioning of these various holes being so correlated with the remainder of the hardware in a manner hereinafter described as to produce the desired results. In addition, a boss 30 is formed adjacent the upper hole 13a so that the bearing surface provided by the boss is offset to provide the proper clearance between the arms 12 and 15. The hole 16a, on the other hand, is not surrounded by a boss but instead is formed directly in the outer surface 28.

It will be appreciated that the sides 24, 25, 26, and 27 of the pivot block 20 act as reinforcing flanges to provide the latter with the requisite strength and rigidity. In addition, the forward wall 24 is provided with generally horizontally extending slots 31 adapted to receive lag screws, bolts, or other attaching means 32 for securely holding the pivot block 20 to the jamb 23. Adjacent these slots 31, I prefer to form generally elliptical or vertically extending cut-outs 33 in the outer face 28 of the pivot block 20 to permit a wrench to be inserted for tightening the screws or bolts 32. In many instances, the use of the apertures 33 will be unnecessary since there will be sufficient clearance between the jamb 23 and the side wall of the garage to permit the insertion of a wrench in that space. However, where there is insufficient space for the free movement of such a wrench, the apertures 33 may be used to considerable advantage.

To insure the correct positioning of the pivot points 11 and 14 and the offset member 17 with respect to the door 10, I provide an attaching member 34 preferably in the form of an angle member attached to the side or edge of the door.

As indicated in Figs. 1 to 3, the angle member **34** includes a flange which is bolted or otherwise securely held to the rear or inside surface of the door **10** while a perpendicular flange extends rearwardly, away from the surface of the door. At the proper location, the width of the rearwardly projecting flange may be increased, and a hole formed therein to receive a bolt or pin which acts as the pivot point **11**.

At the lower end of the angle **34**, I mount the offset member **17** which is preferably formed as a rearwardly projecting generally triangularly shaped member attached to the rearwardly projecting flange of the angle member as by bolting, riveting, welding, or other suitable means. At the rearmost end of the offset member **17**, a hole is formed to receive a bolt or pin adapted to act as the shaft constituting the pivot point **14**.

To form the main or supporting arm **12** extending between the pivot points **11** and **13**, I preferably select a section of tube, pipe, or other structural form of sufficient strength, form a hole at one end thereof to receive the bolt **11**, and form another hole near the center to receive the bolt or pin **13**. This leaves a section of the arm **12** extending beyond the pivot point **13** in a direction away from the door **10**, and an adjustable clamp **35** is securely attached to the arm at a point between its end and the pivot point **13**. Near the base of the jamb **23** I mount an angle bracket **36** which is securely held to the jamb, and between the clamp **35** and the bracket **36** I place a helical tension spring **37**. While the spring **37** is herein shown as extending the entire distance between the clamp **35** and bracket **36**, it is to be understood that if desirable, the length of the spring may be shortened and a tension adjusting member such as a turnbuckle inserted therein in the well known manner to control the force exerted by the spring. The spring **37** thus tends to rotate the arm **12** about the pivot point **13** in a clockwise direction, as seen in Figs. 1 and 2, while the weight of the door **10** opposes this rotation and tends to rotate the arm in a counterclockwise direction. By properly adjusting the tension of the spring **37**, these two opposing forces may be made substantially equal so that the door **10** will remain in either of its two limiting positions, but may be easily moved from one of those positions to the other.

The auxiliary or guiding arm **15** acts principally to direct the motion of the door **10** and carries only a relatively small proportion of the weight of the latter. Consequently, the auxiliary arm **15** may be formed of much lighter material than the main or supporting arm **12**, and in the drawings, I have shown the auxiliary arm formed as a relatively flat member having an offsetting portion **40** formed therein so that the pivot block end of the arm does not interfere with the main arm **12**, while the opposite or door end is properly aligned with the offset member **17**.

From a study of the geometry of the hardware and its operation, it will be seen that my improved overhead door mounting may be used with doors of any height provided that the pivot block **20** is maintained a predetermined distance below the header or beam **21**. However, since the various elements of the hardware are attached to the rear or inward surface of the door, while it is the outer surface which bears against the beam **21** and which would bear against the ceiling **22** if the hardware were improperly placed, provision must be made for these variations in door thickness. I have solved this problem by

mounting the pivot block **20** a distance below the lower surface of the beam **21** equal to a predetermined fixed distance, plus the thickness of the door **10**. In this way, I am able to provide a set of mounting instructions which may easily be followed by inexperienced personnel, while at the same time providing very satisfactory hardware which is suitable for doors of different heights, the height of the door determining the amount of overhang which exists when the door is in its open or upper limiting position.

By way of example only and not as a limitation, I have found that if the following dimensions are used, very satisfactory results will be obtained. The pivot point **13** is located 10¼" rearwardly from the rear face of the stud **23**, and a distance equal to 26½" plus the thickness of the door beneath the lower surface of the beam **21**. The pivot point **16** which attaches the auxiliary arm **15** to the pivot block **20** is located 10⅛" below the pivot point **13** previously mentioned, and is located 5⅛" rearwardly of the stud **23**.

The pivot point **14** in the end of the offset member **17** is located 10¼" rearwardly of the rear face of the stud **23**, and that pivot point is located 38" from the pivot point **16**, measured along the auxiliary arm **15**. The pivot point **11**, which connects the main arm **12** to the angle member **34**, is located 28⅜" from the pivot point **13** measured along the arm **12**. It will be recognized that these dimensions completely define the location of the various pivot points, and while other dimensions may be used so long as the proportions and ratios remain the same, I have found these values give very satisfactory results with almost all of the standard size doors now in use.

The use of a quadrilateral linkage having these general proportions gives rise to new and beneficial results in addition to the advantages of reduced headroom and clearance. It may be shown by experiment and analysis that as the door **10** is lowered from its open position, the turning moment exerted by the door because of its weight increases gradually until it reaches a maximum near the mid-position of the door. Thereafter the turning moment decreases until the door is completely closed, giving a moment curve having the general shape of a parabola, while the spring **37** exerts a turning moment upon the main supporting arm **12** in a direction opposite to that provided by the door, the moment curve of the spring generally following the moment curve of the door. However, because of the particular type of linkage used, the moment exerted by the door suddenly decreases as the fully closed position is approached, while the moment of the spring decreases relatively uniformly. As a result, a checking effect is had which slows the movement of the door as it is lowered, greatly reducing the possibility of any banging or slamming, and also acting to render the opening of the door easier. The action of the spring **37** may be varied by changing its tension, moving the collar **35** along the arm **12**, and by shifting the point of connection of the spring with respect to the axis of the arm **12**. This latter action may be secured by providing the collar **35** with a series of connecting holes in the manner illustrated, thus making use of the means and effect disclosed in the co-pending application of Ralph H. Osborne, entitled "Improved Hardware for Overhead Doors," Serial No. 760,857, filed July 14, 1947, now abandoned.

By locating the pivot point 13 substantially the same distance rearwardly of the stud 23 as is the pivot point 14 on the extension 17, I secure what I believe to be the optimum results. By varying the various distances and ratios, the amount of headroom required and the amount of overhang may be changed. While others have slightly offset the point of pivotal connection of the lower or auxiliary arm, this has previously been done merely for manufacturing convenience, and for ease in installation and operation. So far as I am aware, I am the first to offset this pivotal connection rearwardly for the purpose of securing superior operation, and also am the first to recognize the importance of having the pivot points 13 and 14 substantially vertically aligned. With this construction, I am able to mount an overhead door where the clearance above the bottom of the beam 21 is no more than 3", and with a minimum amount of overhang when the door is in its open position. While the actual amount of overhang will vary with the thickness of the door, a seven foot door will project approximately 30" beyond the vertical line passing through the pivot point 11, or expressed differently, approximately 30" outwardly from the rear face of the stud 23. As the height of the door is increased, this increase will be added directly to the amount of overhang, but will seldom if ever become objectionable with doors of conventional size.

While I have shown and described a preferred form of my invention, it is apparent that modifications may be made therein without departing from the spirit of the invention as defined herein. Consequently, I do not wish to be restricted to the particular form or arrangement of parts herein described and shown, except as limited by my claims.

I claim:

1. Overhead door hardware which includes: a pivot block adapted to be rigidly attached to a structure; a mounting plate adapted to be rigidly attached to a door associated with said structure; a main supporting arm pivotally attached to said pivot block adjacent the rearwardmost part thereof, and pivotally attached to said mounting plate; an offset member rigidly connected to said mounting plate and extending rearwardly therefrom; and an auxiliary arm pivotally attached to said pivot block at a point forward of the pivotal attachment of said main supporting arm to said pivot block and to said offset member adjacent the rearwardmost part thereof, and adapted to extend downwardly and rearwardly from said pivot block when said door is in a vertical position, while said main arm is adapted to extend downwardly and forwardly from said pivot block.

2. Overhead door hardware which includes: a pivot block adapted to be rigidly attached to a structure; a mounting plate adapted to be rigidly attached to a door associated with said structure; a main supporting arm pivotally attached to said pivot block adjacent the rearwardmost part thereof at a point located a predetermined distance rearwardly from said plate, and pivotally attached to said mounting plate; an offset member rigidly connected to said mounting plate and extending rearwardly therefrom; and an auxiliary arm pivotally attached to said pivot block at a point forward of the pivotal attachment of said main arm to said pivot block, and pivotally attached to said offset member adjacent the rearwardmost part thereof at a point located said predetermined distance rearwardly of said plate, whereby said auxiliary arm is adapted to extend downwardly and rearwardly from said pivot block when said door is in a vertical position.

3. Overhead door hardware for a structure and a door associated therewith, the door being movable from a vertical position closing the doorway to an open, horizontal position at the top of the doorway, the hardware including: a pivot block adapted to be rigidly mounted on said structure, having a first pivotal support at a point spaced rearwardly a predetermined distance from the rear surface of said door; a main supporting arm adapted to be pivotally attached to said door at a point adjacent the rear surface thereof and to said first pivotal support; an offset member adapted to be rigidly attached to said door near the lower edge thereof, having a second pivotal support located at a point substantially vertically aligned with said first pivotal support when said door is in its vertical position; and an auxiliary arm pivotally connected to said pivot block at a point forward of said first pivotal support, and to said second pivotal support, whereby said auxiliary arm is adapted to extend downwardly and rearwardly from said pivot block when said door is closed.

4. Overhead door hardware for a structure and a door associated therewith, the door being movable from a vertical position closing the doorway to an open, horizontal position at the top of the doorway, the hardware including: a pivot block adapted to be rigidly connected to said structure and having first and second pivotal supports therein, said first pivotal support being located at a point spaced a predetermined distance rearwardly from said door, and said second pivotal support being located at a point intermediate said door and said first pivotal support and below the latter; a main arm adapted to be pivotally connected to said door and to said first pivotal support; and an auxiliary arm adapted to be pivotally connected to said door and to said second pivotal support, whereby a quadrilateral linkage is formed having the characteristic of moving said door substantially horizontally outward during the first portion of the travel thereof from open to closed position, said auxiliary arm, when said door is in closed position, extending downwardly and rearwardly from said second pivotal support, while said main arm extends downwardly and forwardly from said first pivotal support.

5. Overhead door hardware for a structure and a door associated therewith, the door being movable from a vertical position closing the doorway to an open, horizontal position at the top of the doorway, the hardware including: a first pivotal support adapted to be attached to said structure at a point located a first predetermined distance rearwardly of said door and a second predetermined distance below the top of said doorway; a second pivotal support adapted to be attached to said structure at a point located below said first pivotal support and intermediate the latter and said door; a third pivotal support adapted to be attached to said door at a point below said second pivotal support; a fourth pivotal support adapted to be attached to said door at a point located below said third pivotal support and rearwardly thereof a distance equal to said first predetermined distance; a main arm pivotally connected to said first and third pivotal supports; and an auxiliary arm pivotally connected to said second and fourth pivotal supports, whereby said door is rotatable about said first pivotal support while simultaneously being rotated about said third pivotal support, thereby causing said door

to be held and moved substantially horizontally while near its open position, said auxiliary arm extending downwardly and rearwardly from said second pivotal support when said door is closed, while said main arm extends downwardly and forwardly from said first pivotal support.

6. Overhead door hardware for a structure and a door associated therewith, the door being movable from a vertical position closing the doorway to an open, horizontal position at the top of the doorway, the hardware including: a pivot block adapted to be attached to said structure and having a first and second pivotal support therein, said first pivotal support being at a point located a first predetermined distance rearwardly of said door and a second predetermined distance below the upper margin of said doorway, and said second pivotal support being at a point located intermediate said door and said first pivotal support and below the latter; a connecting member adapted to be attached to said door, having a third pivotal support at a point located immediately adjacent the rear surface of said door and below said second pivotal support; an offset member rigidly attached to said connecting member, having a fourth pivotal support therein at a point located below said third pivotal support and said first predetermined distance rearwardly thereof; a main supporting arm pivotally connected to said first and third pivotal supports; and an auxiliary arm pivotally connected to said second and fourth pivotal supports, whereby a quadrilateral linkage is formed comprising a portion of said pivot block, said main arm, said auxiliary arm, and said connecting member and said offset member, and said door is so guided by said linkage that said door is held and moved substantially horizontally when near its open position.

7. Hardware as described in claim 6 in which said pivot block is adapted to be mounted so that said first predetermined distance is approximately 82 units of length and said second predetermined distance is approximately 212 units of length plus the thickness of said door, said second pivotal support is approximately 81 units of length below and 41 units of length forward of said first pivotal support, the distance between said first and third pivotal supports, measured along said arm, is 227 units of length, and the distance between said second and fourth pivotal supports, measured along said second arm, is 304 units of length.

8. Overhead door hardware of the class described, for a structure and a door associated therewith, the hardware including: a first pivotal support adapted for attachment to said structure at a point located a predetermined distance rearwardly of said door; a second pivotal support adapted for attachment to said structure at a point located a shorter distance rearwardly of said door and below said first pivotal support; a third pivotal support adapted for attachment to said door at a point located immediately adjacent the rear surface thereof and at a point below said second pivotal support; a fourth pivotal support adapted for attachment to said door at a point located said predetermined distance rearwardly of said third pivotal support and below the latter and at a point near the lower end of said door; a main arm connected to said first and said third pivotal supports for pivotal movement about the axes of such pivotal supports with respect to said structure and said door; and an auxiliary arm connected to said second and said fourth pivotal supports for pivotal movement about the axes of such pivotal supports with respect to said structure and said door.

9. Overhead door hardware for a structure and a door associated therewith, the door being movable from a vertical position closing the doorway to an open, horizontal position at the top of the doorway, the hardware including: a pivot block adapted for rigid mounting on said structure adjacent said door, said pivot block having a first pivotal support at a point located a predetermined distance rearwardly of said door, and a second pivotal support at a point located between said first pivotal support and said door and below said first pivotal support; a main supporting arm adapted to be pivotally connected to said door and to said first pivotal support; an offset member for rigid attachment to said door, having a third pivotal support located at a point near the lower end of said door and spaced rearwardly said previously mentioned predetermined distance from said door; and an auxiliary arm pivotally connected between said second and third pivotal supports.

10. Overhead door hardware for a structure and a door associated therewith, the door being movable from a vertical position closing the doorway to an open, horizontal position at the top of the doorway, the hardware including: a pivot block adapted for rigid mounting on said structure adjacent said door, having a first pivotal support at a point located a predetermined distance rearwardly of said door, and a second pivotal support at a point spaced rearwardly from said door a distance less than said first pivotal support and located lower than said first pivotal support; a third pivotal support adapted to be attached to said door at a point immediately adjacent the rear surface thereof, below said second pivotal support; an offset member adapted to be connected to said door near the lower end thereof, said member carrying a fourth pivotal support at a point located said previously mentioned predetermined distance rearwardly of said third pivotal support and located below said third pivotal support; a main arm pivotally connected between said first and third pivotal supports; and an auxiliary arm pivotally connected between said second and fourth pivotal supports.

WILLIAM J. BOBISCH.

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