This invention relates to anti-sag means for doors and the like, and, more particularly, to a new and improved brace which is readily applicable to doors and windows of the casement type for strengthening and reinforcing the same to thereby effectively prevent sagging at the lower corner remote from the vertical hinge axis and which brace is manually adjustable to maintain the no-sagging condition of the door or window or to correct or remedy sagging condition of a door or casement window if such sagging has already occurred. It is well known that doors of all types as well as horizontally swinging casement windows regardless of whether constructed of wood or metal and regardless of the relative weight of the same, have an inherent tendency to sag once they are installed. After extended periods of use the lowest or outermost corner portion of a door or casement window, spaced furthest from the vertical hinge axis thereof, generally drops or sags slightly and, oftentimes the sagging becomes so severe as to impair the proper closing of the door or window. The lowest, outer corner portion strikes or rubs against the door or window frame or sill and makes closing and opening of the door or window difficult.

Another object of the invention is to provide a brace of relatively light weight but sturdy construction which can be easily and quickly applied to a door of any type and from a variety of materials, and which will effectively prevent the door from sagging at its lowest, outer corner, and which will permit the taking up of the sag in a door, should the same be already out of line.

Still another object is to provide an improved anti-sag brace of the above character for doors and casement windows, which is durable and efficient in use, simple and easy to manufacture, and, hence inexpensive to manufacture, and, consequently, can be sold commercially at a reasonable price.

Heretofore, one of the serious drawbacks of brace devices of the type to which the present invention pertains was due to the manner in which the brace devices had to be applied to or incorporated into the door or window. Invariably, the bracing was visible when operatively connected to the door or window, and, consequently, the door or window was rendered unsightly. It is, therefore, another objective of the present invention to provide an anti-sag brace which can be used on either right or left swinging doors or windows and which is substantially invisible and does not impair the appearance of the door or window when applied thereto to any degree.

A still further object of the invention resides in the provision of anti-sag means for the purposes described hereinbefore which embodies an adjusting screw for selectively adjusting the anti-sag brace when the door to the extent necessary for removing the sag in the door and which adjustment may be made without employing any special tools and by an average person not possessing any particular mechanical skills.

The foregoing and other important objects and desirable features inherent in and encompassed by the invention, together with many of the purposes and uses thereof, will become readily apparent from a reading of the ensuing description in conjunction with the annexed drawings, in which:

FIGURE 1 is a front elevational view of a door embodying the invention, a portion of the door is broken away to better illustrate the invention;

FIGURE 2 is an enlarged front elevational view of the anti-sag means, a portion of the door structure is broken away to better disclose the construction of the anti-sag means;

FIGURE 3 is a top plan view of the door;

FIGURE 4 is an end elevational view of the anchor plate;

FIGURE 5 is a vertical sectional view taken substantially along line 5-5 of FIGURE 2;

FIGURE 6 is a vertical sectional view taken substantially along line 6-6 of FIGURE 2; and

FIGURE 7 is a vertical sectional view of a modified form of anchor plate.

Referring to the drawings in detail, wherein like reference characters represent like elements throughout the various views, the invention is shown applied to a screen door 10. However, it is to be understood that the invention is applicable to other types of doors as well as horizontally swinging casement windows. The door 10 illustrated includes a pair of vertical frame members 11, 12 which are suitably joined to transverse or cross frame members 13 at the top, 14 substantially midway of the door 10, and 15 at the bottom. All of the cross frame members 13, 14 and 15 have their ends jointly connected to the vertical frame members 11, 12 in a conventional manner. From the foregoing, it will be appreciated that the frame members 11, 12, 13, 14 and 15 form a rectangular frame which may support screen fabric 16, as shown, or solid paneling, or glass or any other conventional door material.

The door 10 is hingedly connected to a door frame, designated generally by numeral 17, by means of a pair of vertically spaced hinges 18. Each hinge 18 has one leaf attached to the edge of the vertical frame member 11 of the door 10 and its other leaf firmly secured to an upright door frame member 19, as shown in FIGURE 1. From the foregoing, it will be appreciated that the door 10 is swingable about a vertical axis passing through the hinge pins (not shown) of the hinges 18. The door 10, when properly hung, swings freely between its fully opened and closed positions since there is a slight clearance space between the outermost edges of the door vertical and cross members 11, 12, 13 and 15 and the innermost edges of the door frame 17. However, if improperly hung or after a period of use, the door 10 sags and the sag is apparent at the lowermost corner of the door 10, remote from the hinge side which corresponds to the corner of the door 10 defined by the juncture of the bottom cross frame member 15 and the vertical frame member 12. The door 10 ceases to be in alignment with the opening defined by the door frame 17 and the bottom edge portions of the bottom cross member 15 and the vertical door frame member 12 rubs or strikes the door sill 20. Oftentimes, the door 10 is out of alignment or warped to such extent that edge portions of the door 10 other than those described hereinbefore also engage the innermost edge surface of the door frame 17. In order to correct and eliminate the sagged condition of a door 10 if such has already occurred and/or to prevent subsequent sagging of the door, the anti-sag means, designated generally by numeral 21, is applied to the door. The anti-sag means 21 is essentially an adjustable brace or device, which, when applied to the door 10 is completely invisible and will not impair the appearance of the door 10 regardless of the side from which the door is viewed. The entire anti-sag brace or device 21 is sub-
stantially housed within a shallow pocket 22 formed in an upper portion of the side edge surface 23 of the vertical door frame member 11 and a groove 24. The side edge surface 23 is the same surface to which the hinges 18 are attached. The groove 24, which is elongated and relatively narrow, is formed in the uppermost or outermost edge surface 25 of the cross member 13 and the uppermost edge surface 26 of the vertical frame member 11 flush or in alignment with the edge surface 25. It will be noted that the groove 24 extends transversely from a point intermediate the vertical door frame members 11, 12 and opens into the undercut surface 27 defining the portion of the pocket 22 and has a length, measured transversely of the door 10, more than one-half the width of the door 10.

As best shown in FIGURES 2, 3 and 6, a vertical, generally cylindrical recess 28 is provided in the uppermost or outermost edge surface 25 of the top cross member 13. The recess 28 intersects and has a depth equal to the depth of the groove 24 and is spaced closely adjacent to the end of the groove 24 remote from the pocket 22, as best illustrated in FIGURES 2 and 3. The purpose of the recess 28 will be pointed out hereinafter.

A second vertical cylindrical recess 29, of smaller diameter than the recess 28, intersects the groove 24 at a point closely adjacent to the juncture of the vertical frame member 11 and the cross member 13, as best illustrated in FIGURE 2. The recess 29 extends vertically downward from the uppermost edge surface 26 of the vertical door frame member 11 and has a length greater than the depth of the groove 24. The section of the recess 29 disposed below the level of the surface 30 defining the bottom of the groove 24 serves as a seat into which a hard metal plug 31, preferably made of steel, is firmly pressed. A portion 32 of the plug 31 is substantially frusto-conically shaped and projects above the level of the surface 30.

The anti-sag device 21 also includes a generally flat anchor plate 32. The anchor plate 32 is made of metal and is generally rectangular in shape. The anchor plate 32 illustrated in FIGURE 4 has an integrally formed tongue 33 projection from the back side at the lower end thereof. The tongue 33 is wedge-shaped and is adapted to be firmly driven into the bottom surface 27 of the pocket 22 to secure the anchor plate 32 to the vertical door frame member 11. Additional fastening means in the form of three spaced wood screws 34 are employed for rigidly securing the anchor plate 32 to the door frame member 11. When the anchor plate 32 is firmly bolted to the door frame member 11, it is completely disposed within the pocket 22 and a centrally located, generally rectangular slot 35 formed therethrough lies substantially in the same plane as the groove 24. In effect, the anchor plate 32 closes the end of the groove 24 opening into the pocket 22 with the exception of that portion of the slot 35 which extends above the level of the bottom surface 30 of groove 24.

As best shown in FIGURES 2 and 3, a flat, elongated bar-like lever 36, preferably made of steel or like material, and arranged on edge, is positioned entirely within the groove 24. It will be noted that the lever 36 is only slightly less in thickness than the thickness of the groove 24 and, thus, while sliding movement between the door 10 and the lever 36 is permitted, relative lateral movement is restricted by the side walls of the groove 24. One end of the lever 36 is provided with an integrally formed lug 37 which projects into the cylindrical recess 28, as shown in FIGURE 2. The opposite end of the lever 36 is defined by an integrally formed hook-like portion 38 which is adapted to extend through that portion of the rectangular slot 35 which extends above the level of the bottom surface 30 of the groove 24. With the hook-like portion 38, downward pressure on the lug 37 causes the hook-like portion 38 to engage the upper end 39 of the slot 35 and the lower-most edge surface 40 of the lever 36 to bear against the frusto-conical abutment portion or head of the plug 31 projecting above the bottom surface 30 of groove 24.

In order to apply downward pressure to the lever lug 37, an adjustment screw 41, disposed coaxially with respect to the recess 28, is threaded into the top cross member 13, as shown in FIGURES 2, 3 and 6. As hereinbefore, the lug 37 projects into the recess 28 and, consequently, it is in a position to be engaged by the annular underside 42 of the enlarged head 43 of the screw 41. From the foregoing, it will be appreciated that rotation of the screw 41 in a direction to retract the adjustment screw vertically downward along the longitudinal axis thereof causes the underside 42 of the screw head 43 to engage the lug 37 and apply a downwardly directed force thereto. It will also be appreciated that the magnitude of force applied to the lug 37 is dependent upon the amount the screw 40 is threaded into the top cross member 13.

From the foregoing description, it is believed the operation of the anti-sag means 21 for eliminating door sag and/or continuously maintaining the door in proper alignment with the door opening is obvious. By adjusting the screw 41 by turning the same in a direction to extend the conventional screw driver in a direction to move the head 43 thereof vertically downward, pressure from the adjusting screw 41 is applied to one end of the lever 36 and since the lever 36 is, in effect, a cantilever because the end thereof opposite the lug 37 is rigidly anchored to the vertical door frame member 11, the lever 36 will be extended and incapable of moving with respect thereto, a reaction force is applied to the vertical door frame member 12 tending to urge the same vertically upwardly and thereby elevate the lower corner of the door 10 remote from the hinge axis and maintain the same elevated. Thus, any sag which may have developed in the door 10 is eliminated. Inasmuch as the bar-like lever 36 has a length greater than one-half the width of the door 10 and, consequently, the effective movement arm afforded thereby is relatively large, a very small movement of the adjusting screw 41, once the underside 42 of the head 43 is in operative engagement with the lug 37, causes a tremendous force to be applied to the vertical door frame member 12 to elevate the same. The extent of elevation of the vertical door frame member 12 may be varied by turning or adjusting the adjusting screw 41. Thus, by rotating the screw 41 in the proper direction, the sagging tendency of the door 10 may be corrected easily and quickly, without the need of any special tools or without the need of any special skills or talents. Furthermore, the anti-sag means 21 strengthens and rigidifies the door 10.

A modified form of anchor plate 44 is illustrated in FIGURE 7. The anchor plate 44 functions in exactly the same manner as the anchor plate 32 described hereinbefore. However, there are certain structural differences between the anchor plates 32 and 44 and the anchor plate 44 is attached to the vertical door frame member 11 in a manner which is different from that employed to fasten the anchor plate 32 to the frame member 11. A generally cylindrical plug 45 is driven securely into the bottom surface 30 of the pocket 22. The anchor plate 44 is provided with a circular opening 46 which has a diameter only slightly larger than the diameter of the section of the plug 45 which projects from the bottom surface 30. Thus, when the anchor plate 44 is positioned within the pocket 22, the annular surface defining the opening 46 frictionally engages the plug 45 snugly. A pair of wood screws 47 are also utilized to further secure the anchor plate 43 to the door frame member 11. It will be appreciated that when the anti-sag means 21 is applied to a door 10 and is in operation the anchor plate is subjected to a large upwardly directed force by virtue of the action of the tension 38. However, it is to be understood that both forms of anchor plates 32 and 44 efficiently resist such force and prevent upward movement of the hook-like portion 38 with
respect thereto, when the anti-sag means 21 is in operation.

The embodiment of the invention chosen for the purpose of illustration and description herein is that preferred for achieving the objects of the invention and developing the utility thereof in the most desirable manner, due regard being had to existing factors of economy, production methods, simplicity of design and construction, and the improvement sought to be effected. It will be appreciated, therefore, that the particular functional and structural aspects emphasized herein are not intended to exclude, but rather to suggest, such adaptations and modifications of the invention as fall within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. Anti-sag means for a door capable of swinging horizontally about a vertical axis, said door having a generally rectangular frame including a pair of horizontally spaced, substantially vertical frame members, one of said vertical frame members being closely adjacent to the pivotal axis of the door, said frame further including a transverse frame member extending between and having each of its ends connected at an upper end portion of a respective vertical frame member whereby the uppermost edge surfaces of said vertical frame members and said transverse frame member lie substantially in a common plane, comprising, a transversely extending, flat, elongated bar-like lever, said lever being arranged on edge and being disposed substantially completely in a transversely extending, relatively narrow groove formed in the uppermost edge surfaces of said transverse frame member and said vertical frame member closely adjacent the pivotal axis of the door, said lever having a hook-like portion on one end thereof adjacent to the other end of said lever to said vertical frame member adjacent the pivotal axis of the door including an anchor plate rigidly secured to an upper portion of said one vertical frame member closely adjacent the pivotal axis of the door, said anchor plate having a slot formed therethrough, said slot lying in a plane common to said groove, said hook-like portion extending through and engaging a surface of said anchor plate defining the upper end of said slot; and adjustable means carried by said transverse frame member for relative movement along a generally vertically extending axis, said adjustable means being disposed within a recess extending from the uppermost edge surface of said transverse frame member and intersecting said groove, said adjustable means being operably engageable with the end of said lever opposite said hook-like portion to apply a force thereto in a generally vertically downward direction, said downwardly directed force being counteracted by a vertically upwardly directed force tending to elevate said vertical frame member remotely spaced from the pivotal axis of the door, said adjustable means being movable along said generally vertically extending axis relatively to said transverse frame member to vary the magnitude of force applied to the end of said lever opposite said hook-like portion and the counteracting force.

2. Anti-sag means for a door as set forth in claim 1, wherein said lever has a length measured in a transverse direction more than one-half of the width of the door.

3. Anti-sag means for a door as set forth in claim 1, wherein said anchor plate is disposed entirely within a shallow pocket formed in the outer side edge surface of said one vertical frame member closely adjacent the pivotal axis of the door, said pocket being at the uppermost end of said one vertical frame member.

4. Anti-sag means for a door capable of swinging horizontally about a vertical axis, said door having a generally rectangular frame including a first vertical frame member adjacent to the pivotal axis of the door and a second vertical frame member horizontally spaced from said first vertical frame member, said frame further including a transverse frame member extending between and having each of its ends connected to an upper end portion of a respective first and second vertical frame members whereby the uppermost edge surfaces of said vertical and transverse frame members lie substantially in a common plane, comprising, a transversely extending, flat, elongated bar-like lever, said lever being arranged on edge and being disposed substantially completely in a transversely extending, relatively narrow groove formed in the uppermost edge surfaces of said transverse frame member and said first vertical frame member, said lever having a hook-like portion on one end and a projecting lug on its opposite end; a metal plug fixedly secured to said first vertical frame member having a generally frusto-conical projection disposed above the level of the bottom wall of said groove, said projection having a lower edge portion of said lever abutting in; an anchor plate rigidly secured to said first vertical frame member, said anchor plate being disposed entirely within a shallow pocket formed in the outer side edge surface of said first vertical frame member at the uppermost end thereof, said anchor plate having a vertical slot formed therethrough lying in a plane common to said groove, said hook-like portion extending through and engaging a surface of said anchor plate defining the upper end of said slot when said lower edge portion of said lever abuts said frusto-conical projection; and an adjustable element connected to said transverse frame member for relative rotation about a generally vertically extending axis, said element having an enlarged head portion movable along the rotational axis of said element upon rotation thereof, said element being disposed within a recess extending from the uppermost edge surface of said transverse frame member and intersecting groove, the underside of said head being engageable with said lug to apply a force thereto in a generally vertically downward direction, said downwardly directed force being counteracted by a vertically upwardly directed force tending to elevate said second vertical frame member, said adjustable element being rotatable to move said head along the rotational axis thereof to vary the magnitude of force applied to said lug and the counteracting force.

5. Anti-sag means for a door as set forth in claim 4, wherein said lever has a length measured in a transverse direction more than one-half of the width of the door.

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