Aug. 6, 1957 P. E. DAVEY 2,801,870

MAGNETIC LATCH

Filed Dec. 22, 1954

FIG. 1

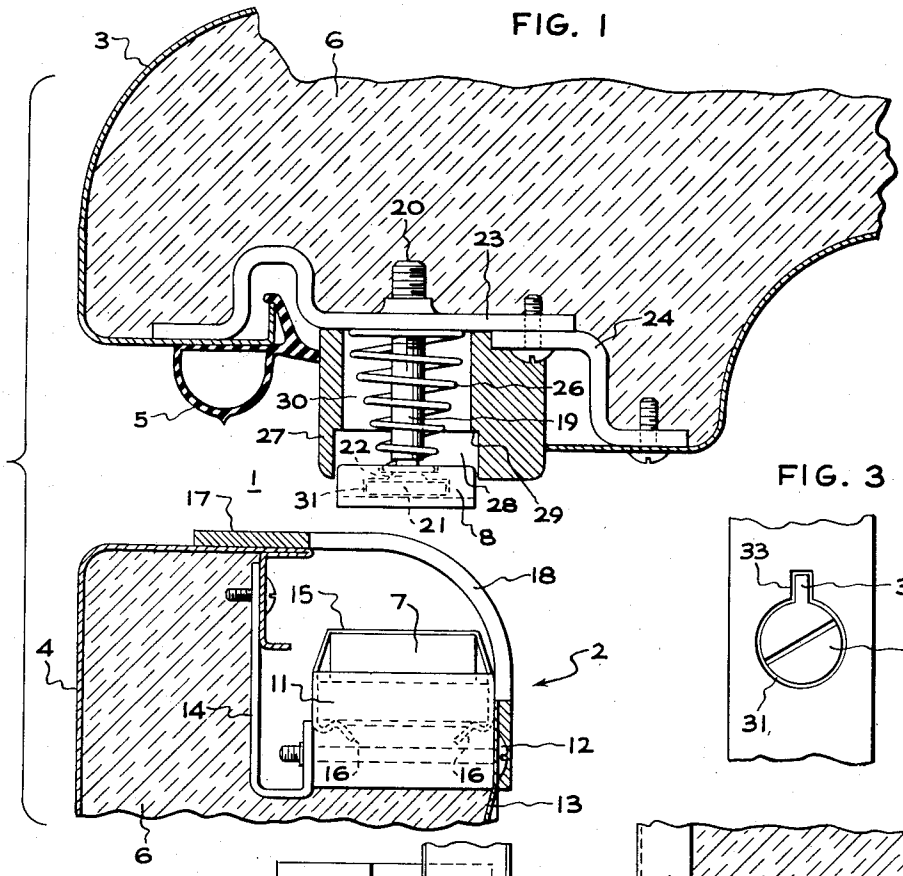
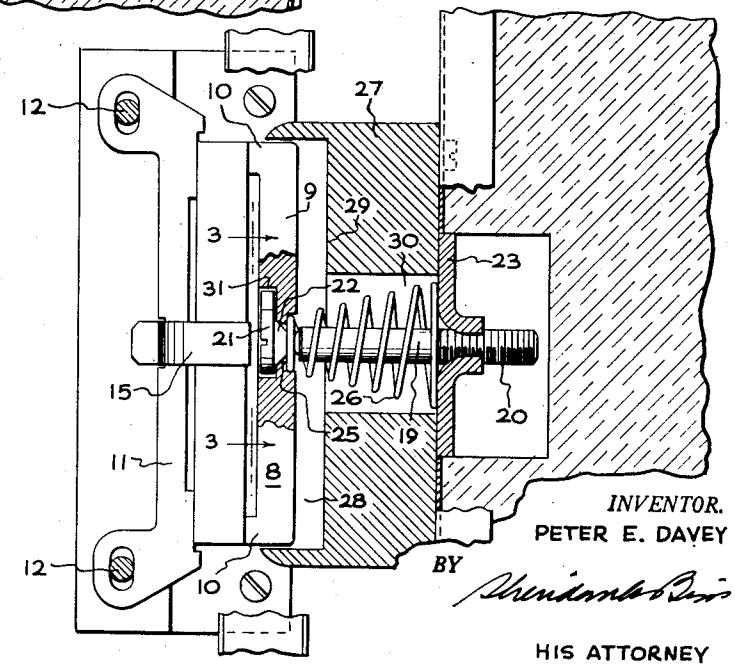


FIG. 3

FIG. 2



INVENTOR.
PETER E. DAVEY
BY
HIS ATTORNEY

United States Patent Office 2,801,870 Patented Aug. 6, 1957

2,801,870

MAGNETIC LATCH

Peter E. Davey, Fern Creek, Ky., assignor to General Electric Company, a corporation of New York

Application December 22, 1954, Serial No. 476,991

7 Claims. (Cl. 292—251.5)

My invention relates to magnetic latches and more particularly to magnetic latches for use with relatively heavy doors, such as the doors of refrigerator cabinets.

It is an object of my invention to provide a new and improved magnetic latch particularly adapted for use with refrigerator cabinets.

It is another object of my invention to provide an improved magnetic latch in which the position of one of the cooperating magnet and armature elements may be adjusted relative to the face of the door or cabinet member mounting it.

A further object of my invention is to provide an improved magnetic latch in which one of the cooperating magnet and armature elements is adapted to swivel on its mount to correct for any misalignment between the cabinet and door members mounting them.

Another object of my invention is to provide an improved magnetic latch in which one of the cooperating magnet and armature elements is resiliently mounted to cushion the impact as the door is closed.

Still a further object of my invention is to provide an improved magnetic latch in which all of the above functions are incorporated in the mounting means for one of the magnetic elements, i. e. adjustability, swiveling to correct for misalignment, and a resilient mounting to cushion impact.

In carrying out my invention I provide a magnetic latch which is adapted to hold a door member in a closed position against a cabinet member. The latch includes cooperating magnet and armature elements which are positioned opposite each other on the door and cabinet members. In accordance with my invention one of these magnetic elements is mounted on the member associated therewith by means of a novel supporting structure. This supporting structure includes an adjustable supporting member which has a tapered portion. The magnetic element is mounted to move on this supporting member; and a spring is provided which biases the magnetic element against the tapered portion, this position thereby being the normal position of the magnetic element. Since the element is only resiliently held in its normal position, it is therefore movable against the spring to cushion the impact as the door is closed. Also, because it engages the tapered portion of the supporting member, it is adapted to swivel on the tapered portion to correct for any misalignment of the cabinet member and the door member. A guide member included in the supporting structure limits the extent of the swiveling motion and constrains the magnetic element against rotational movement. The structure further includes means whereby the magnetic element may be adjusted in position relative to the face of the door or cabinet member on which it is mounted. This adjusting means comprises a means whereby the adjustable supporting member is moved in and out relative to the face of the door or cabinet member. The supporting member as it moves carries the magnetic element with it and thereby adjusts the normal position of the element to provide for variations in the closed position of the door member relative to the cabinet member.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention, however, both as to its organization and method of operation may be best understood by reference to the following description taken in conjunction with the accompanying drawing in which:

Fig. 1 is a horizontal view, partially in section, of a magnetic latch embodying my invention, the latch being applied to a refrigerator cabinet and shown with the refrigerator door slightly ajar;

Fig. 2 is a vertical view, partially in section, of the magnetic latch of Fig. 1, but showing the latch with the door closed against the cabinet; and

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 2.

Referring now to Fig. 1 I have shown therein a preferred embodiment of my new and improved magnetic latch. This latch, generally designated as 1, is shown in conjunction with a refrigerator 2 and is adapted to hold the refrigerator door 3 in a closed position against the cabinet 4. When the door is held in its closed position, a gasket 5 mounted on the door 3 is compressed between the door and the cabinet 4 to seal off the space within the refrigerator from the surrounding atmosphere. Both the door and the cabinet include spaced apart inner and outer walls, and in both the space between these walls is filled with suitable insulating material 6. The mounting of the door 3 is not shown but it will be understood that it is supported from the cabinet 4 by means of suitable hinges.

The magnetic latch 1 includes a magnet element 7 and an armature element 8 and it is the attraction between these elements which is operative to hold the door in the closed position. The magnet 7 is positioned on the cabinet 4 and the armature 8 is positioned on the door 3; and the magnet pulls the armature toward it to hold the door closed. The magnet 7 is a permanent magnet and it comprises a bar member which is formed of suitable magnetic material, as for example the material commercially known as Alnico or the like. For the particular magnet dimensions shown, i. e. for the particular ratio of magnet length to cross section, Alnico V would be the preferable material, but by adjusting the magnet dimensions other materials could also be used with good results. The armature 8 is a metallic member formed of a metal of high magnetic permeability, as for example mild steel, and preferably it comprises an elongated U-shaped part having a long bight 9 and short legs 10 which extend outwardly toward the magnet.

In my preferred embodiment the magnet 7 is mounted on the cabinet 4 by means of non-magnetic supporting member 11. This supporting member 11 may be formed of plastic or any other suitable non-magnetic material. It is held by means of a pair of bolts 12 which extend between the inner wall 13 of the cabinet and a bracket 14 attached to the outer wall of the cabinet. The magnet 7 is itself held on the supporting member 11 by means of a clip or strap 15. The strap 15 extends across the top of the magnet 7 and is locked in place by inturned legs 16 which are hooked underneath the supporting member 11. It will be noted that the magnet 7 is recessed behind the outer face of the cabinet 4. Specifically the magnet 7 is positioned behind the insulating breaker strip 17 which joins the inner and outer walls of the cabinet 4. A suitable aperture or slot 18 in the breaker strip allows the passage of the armature member 8 therethrough to contact the magnet as the door is moved to the closed position. This mounting of the magnet well behind the face of the cabinet 4 minimizes the danger of any stray flux from the magnet injuring the watches worn by the users of the refrigerator 2. The outer wall of the cabinet acts as a shield when the door is open, but does not affect the

ability of the magnet to hold the armature 8 when the door is closed.

The armature element 8 is mounted on the door 3 by means of a supporting structure which provides several desirable features. This supporting structure provides for adjustment of the armature element 8 in and out relative to the face of the door. It also provides for swiveling of the armature to correct for any misalignment between the cabinet and the door; and further, it provides a resilient action which cushions the impact as between the armature element and the magnet as the door is closed.

The structure for supporting the armature element 8 includes an adjustable supporting member or screw 19 which extends generally at right angles to the face of the door 3. This screw 19 has a threaded shank 20, a flanged head 21, and a tapered portion 22 which joins the shank and the head. The screw 19 is mounted on the cabinet 4 by the threaded shank 20 thereof being engaged with the threads of a tapped plate member 23 which is firmly secured within the door. Specifically, the plate 23 is welded to the outer wall of the door 3 at its one end and is bolted to a bracket 24 at its other end. The bracket 24 is in turn attached to the inner wall of the door. Due to the threaded engagement between the shank 20 and the plate 23 the screw 19 moves in and out relative to the face of the door 3 whenever it is turned. If the screw 19 is turned to the right it will move inwardly whereas if it is turned to the left it will move outwardly.

The armature member 8 is directly supported by means of the adjusting member or screw 19. Specifically, an aperture 25 is provided in the central portion of the armature element 8 and the screw 19 extends through this aperture to mount the armature element. The aperture 25 is of greater diameter than the shank 20 of the screw 19 and therefore the armature element is free to move along the shank 20. The outer end of the tapered portion 22 of the screw is however greater in diameter than the aperture 23 so that the armature element cannot move off the screw.

The armature element 8 is ordinarily held in a normal position against the tapered portion 22 of the adjusting screw by means of a coil spring 26 which is disposed around the shank 20 of the screw. This spring 26 at its outer end bears against the plate 23 and at its inner end bears against the armature element 8. Specifically its inner end fits within a recess provided in the inner surface of the armature element. The spring 26 thereby forces the armature element against the tapered portion of the screw so that the normal position of the armature member may be said to be when it is in engagement with the tapered potrion 22. Since the spring normally maintains the armature element in contact with the tapered portion of the screw, this means that whenever the screw is adjusted with respect to the face of the door, the armature element 8 will also be adjusted with respect to the door. In other words whenever the screw 19 is turned, the armature element as well as the screw will be adjusted relative to the face of the door.

As the door 3 is moved to the closed position, the armature element 8 passes through the aperture 18 in the breaker strip 17 and comes into contact with the magnet 7. Thereafter the attraction between the magnet 7 and the armature element 8 holds the door in the closed position. The spacing between the cabinet and the door when the door is in the closed position may be varied by adjusting the position of the armature element 8 with respect to the face of the door, or alternately, the position of the armature may be adjusted to allow for different spacings between the cabinet and the door. Turning the screw 19 in one direction moves the armature element so as to provide for a greater distance between the cabinet and the door whereas turning it in the other direction moves the armature element so as to decrease the distance. This adjustment feature is particularly desirable to take care of production variations in hinge operation and gasket thicknesses, both of which may result in slight changes in the spacing between the door and the cabinet. Merely by turning the screw 19 the armature element 8 can be adjusted in or out so as to allow for these variations.

In addition to providing for the adjustment of the armature element 8 relative to the face of the door, my improved supporting structure also incorporates two other desirable features. As mentioned above, it also provides for swiveling of the armature element to correct for any misalignment occurring between the cabinet and the door, and further provides a resilient action whereby the impact between the magnet and the armature element is cushioned as the door is closed. The cushioning action is provided by movement of the armature element 8 along the shank 20 of screw 19. As the door moves to the closed position, the armature element 8 of course strikes the magnet 7. However since the armature element is not rigidly secured to the screw 19 it is free to move up the screw shank 20 against the force of the spring 26. As the armature moves inwardly, it compresses the spring 26 so that the spring more or less gradually takes up the momentum of the door. This gradual stopping of the movement of the door cushions the impact between the magnet and the armature. The cushioning of the impact is desirable both because it results in less jarring of the components of the latch and also because it minimizes the tendency of the door to bounce back from the cabinet once it has been closed. Once the movement of the door has been absorbed, the spring then re-expands to the position shown in Fig. 2 to determine the final closed position of the door.

The swiveling effect to correct for any misalignment between the door and the cabinet is provided by means of the manner in which the armature element 8 engages the supporting screw 19. In the normal position of the armature element the edges of the aperture 25 engage the tapered portion 22 of the screw. In fact, the position of the tapered portion of the screw relative to the face of the door determines the normal position of the armature element relative to the face of the door. In order to correct for misalignment between the door and the cabinet the edges of the aperture 25, which engage the tapered portion 22, are rounded off to a slight degree. In other words, a curved rather than a straight edge is provided at the outer side of the aperture. This rounded edge permits the armature member 8 to turn or swivel slightly with respect to the screw. It can in fact turn slightly around two axes. It can turn about the vertical axis extending lengthwise through the bight 9, and it can turn about the horizontal axis extending at right angles to the axis of the screw 19. In other words it can turn about an axis perpendicular to the plane of the paper in Fig. 1 and about an axis perpendicular to the plane of the paper in Fig. 2. The spring 26 of course maintains the contact between the armature and the tapered portion 22 of the screw as the armature swivels about either of these axes. This swiveling action allows the armature to maintain good contact with the magnet 7 even if the magnet may become slightly cocked because of misalignment of the door with the case.

The swiveling action of the armature element 8 is however limited by means of a guide member 27. The guide member 27 includes a large recess 28 therein and the movement of the armature member is constrained by this recess. As shown, there is sufficient clearance between the sides of the recess and the sides of the armature 8 to allow for swiveling action of the armature to correct for misalignment. However the recess 28 prevents the armature from ever swiveling or cocking so far that it would jump off the spring 26 or otherwise move out of position. The recess 28 also prevents the armature element 8 from rotating about the axis of the screw 19 and thereby getting out of position in that manner. Additionally, if the armature element 8 is adjusted closer to the back wall 29 of the recess than the distance its legs 10 jut outwardly from its bight 9, then the back

wall 29 limits the inward movement of the armature element during the closing of the door. Normally though, the armature element 8 is adjusted further out from the back wall 29 of the recess so that the flanged head 21 of screw 19 limits the inward movement of the magnet and thus that of the armature. A slot 30 extending through the guide member 27 joins the recess 28 at its rear end to provide a passageway for accommodating the screw 19 and the spring 26.

In addition to the means preventing over-swiveling and rotation of the armature element 8, my improved structure also includes means whereby the screw 19 is prevented from turning except when adjustment of the armature element is required. This means comprises an arrangement whereby the screw is keyed to the armature element itself. In my preferred embodiment the keying arrangement is provided by means of the flanged head 21 of the screw. As shown, the flanged head 21 fits within a recess 31 in the front of the armature element 8, and to provide the keying action the head 21 includes an outwardly extending tab 32 which fits into an offset portion 33 of the recess 31. This engagement between the tab 32 and the recess extension 33 normally prevents rotation of the screw 19 relative to the armature element 8. Since the armature element 8 itself is prevented from rotating in the guide member 27, this means that the screw is also prevented from rotating. However, when adjustment of the armature element is desired, the armature element may then be pushed into the recess 28 against the spring 26. This clears the tab 32 from the recess extension 33 and allows turning of the screw. When the screw has been turned to the desired position, the armature may then be released and will thereafter be held by the screw in its new position. It is of course necessary to realign the tab 32 and the recess extension 33 in the new position of the screw and the armature element to insure that the screw is again locked against accidental rotation.

Summing up, it will be seen that by my invention I have provided a new and improved magnetic latch which incorporates three desirable features. Due to the manner in which the magnetic elements are mounted, one of them may be adjusted relative to the other so as to allow for variations in gasket thickness and spacing between the cabinet and the door. Also, the mounting of the one element allows it to swivel so as to correct for any misalignment between the door and the cabinet. Further, the one element is resiliently mounted so that it cushions the impact between it and the other element as the door is closed. It will be noted that in my preferred embodiment I utilize a bar magnet and a U-shaped keeper. A bar magnet is preferred because the leakage flux therefrom tends to link the armature rather than merely linking other parts of the magnet. This results in higher holding force per unit weight of magnet.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from my invention, and I, therefore, aim in the appended claims to cover any such changes and modifications as fall within the true scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a magnetic latch for holding a door member engaged with a cabinet member, and including cooperating magnet and armature elements positioned opposite each other on said members, a structure mounted on one of said members for supporting the associated one of said elements thereon, said structure including an adjustable supporting member having a tapered portion, means mounting said one element on said supporting member with said one element being movable therealong, a spring biasing said one element against said tapered portion of said supporting member thereby resiliently to hold said one element in a normal position, said one element being movable against said spring to cushion the impact as said door member is closed and being adapted to swivel on said tapered portion to correct for misalignment of said cabinet member and said door member, a guide member limiting the extent of the swiveling movement of said one element and constraining said one element against rotational movement, and means for adjusting the position of said supporting member relative to the face of said one member thereby to adjust said normal position of said one element to allow for variations in the closed position of said door member relative to said cabinet member.

2. In a magnetic latch for holding a door member engaged with a cabinet member, and including cooperating magnet and armature elements positioned opposite each other on said members, a structure mounted on one of said members for supporting the associated one of said elements thereon, said structure including an adjustable supporting member having a shank and a tapered portion attached to said shank, means mounting said one element on said supporting member with said one element being movable along said shank, a spring disposed around said shank and biasing said one element against said tapered portion of said supporting member thereby resiliently to hold said one element in a normal position, said one element being movable against said spring to cushion the impact as said door member is closed and being adapted to swivel on said tapered portion to correct for misalignment of said cabinet member and said door member, a non-magnetic guide member limiting the extent of the swiveling motion of said one element and constraining said one element against rotational movement, and means for adjusting said supporting member in and out with respect to the face of said one member, thereby to adjust said normal position of said one element to allow for variations in the closed position of said door member relative to said cabinet member.

3. In a magnetic latch for holding a door member in a closed position against a cabinet member, and including cooperating magnet and armature elements positioned opposite each other on said members, a structure mounted on one of said members for supporting the associated one of said elements thereon, said structure including a screw having a threaded shank, a flanged head and a tapered portion joining said shank and said head, means mounting said one element on said screw with said one element being movable along said shank, a spring disposed around said shank and biasing said one element against said tapered portion of said screw thereby resiliently to hold said one element in a normal position, said one element being movable against said spring to cushion the impact as said door member is closed and being adapted to swivel on said tapered portion to correct for misalignment of said cabinet member and said door member, a guide member limiting the extent of the swiveling motion of said one element and constraining said one element against rotational movement, and a tapped member on said cabinet member engaging said threaded shank to effect an adjustable mounting for said screw whereby said screw may be turned in and out to adjust the normal position of said one element to allow for variations in the closed position of said door member relative to said cabinet member.

4. In a magnetic latch for holding a door member in a closed position against a cabinet member, and including cooperating magnet and armature elements positioned opposite each other on said members, a structure mounted on one of said members for supporting said armature element thereon, said structure including a screw having a threaded shank, a flanged head and a tapered portion joining said shank and said head, means mounting said armature element on said screw with said armature element being movable along said shank, a

spring disposed around said shank and biasing said armature element against said tapered portion of said screw thereby resiliently to hold said armature element in a normal position, said armature element being movable against said spring to cushion the impact as said door member is closed and being adapted to swivel on said tapered portion to correct for misalignment of said cabinet member and said door member, a guide member limiting the extent of the swiveling motion of said armature element and constraining said armature element against rotational movement, and a tapped member on said cabinet member engaging said threaded shank to effect an adjustable mounting for said screw, whereby said screw may be turned in and out to adjust the normal position of said armature element to allow for variations in the closed position of said door member relative to said cabinet member, and means keying said flanged head of said screw to said armature element when said element is in its said normal position, thereby to prevent rotation of said screw and adjustment of said armature element except when said armature element is manually depressed against said spring.

5. A magnetic latch for holding a door member in a closed position against a cabinet member, said latch including cooperating magnet and armature elements positioned opposite each other on said members, means securely mounting said magnet element on the member associated therewith, said magnet element being recessed behind the face of said member to minimize the stray magnetic field when said door member is open and a structure mounted on the other of said members for supporting said armature element thereon, said structure including a screw having a flanged head and a threaded shank, said screw extending generally at right angles to the face of said other member with said flanged head outermost, means movably mounting said armature element on said screw with said element being movable along said shank, a spring biasing said armature element toward said flanged head of said screw thereby resiliently to hold said armature element in a normal position, said armature element being movable inwardly from said flanged head against said spring to cushion the impact as said door is closed, a guide member constraining said armature element against rotational movement, and a tapped member on said cabinet member engaging said threaded shank to effect an adjustable mounting for said screw, whereby said screw may be turned in and out to adjust said normal position of said armature element to allow for variations in the closed position of said door member relative to said cabinet member.

6. A magnetic latch for holding a door member in a closed position against a cabinet member, said latch including cooperating magnet and armature elements positioned opposite each other on said members, means for supporting said magnet element on said door member, said means comprising a non-magnetic member secured to said door member and a strap attaching said magnet element to said non-magnetic member, a structure for supporting the armature element on said cabinet member, said structure including a screw having a shank, a flanged head, and a tapered portion joining said shank and said head, said screw extending generally at right angles to the face of said cabinet member with said flanged head outermost, means mounting said armature element on said supporting member with said armature element being movable along said shank, a spring disposed around said shank and biasing said armature element against said tapered portion of said screw thereby resiliently to hold said armature element in a normal position, said armature element being movable against said spring to cushion the impact as said door member is closed and being adapted to swivel on said tapered portion to correct for misalignment of said cabinet member and said door member, a guide member limiting the extent of the swiveling movement of said element and constraining said element against rotational movement, and a tapped member on said cabinet member engaging said threaded shank of said screw to effect an adjustable mounting for said screw, whereby said screw may be turned in and out to adjust the normal position of said armature element on said cabinet member to allow for variations in the closed position of said door member relative to said cabinet member.

7. In a magnetic latch for holding a door member engaged with a cabinet member, and including cooperating magnet and armature elements positioned opposite each other on said members, a structure mounted on one of said members for supporting the associated one of said elements thereon, said structure including an adjustable supporting member having a tapered portion, means mounting said one element on said supporting member with said one element being movable therealong, a spring biasing said one element against said tapered portion of said supporting member thereby resiliently to hold said one element in a normal position, said one element being movable against said spring to cushion the impact as said door member is closed and being adapted to swivel on said tapered portion to correct for misalignment of said cabinet member and said door member, and means for adjusting the position of said supporting member relative to the face of said one member thereby to adjust said normal position of said one element to allow for variations in the closed position of said door member relative to said cabinet member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,521,885	Vasquez	Sept. 12, 1950
2,662,787	Horvay	Dec. 15, 1953
2,690,922	Teetor	Oct. 5, 1954