Jan. 7, 1930. W. K. FELLOWS 1,742,698

FRICTION HINGE

Filed Feb. 18, 1929

Fig. 1.

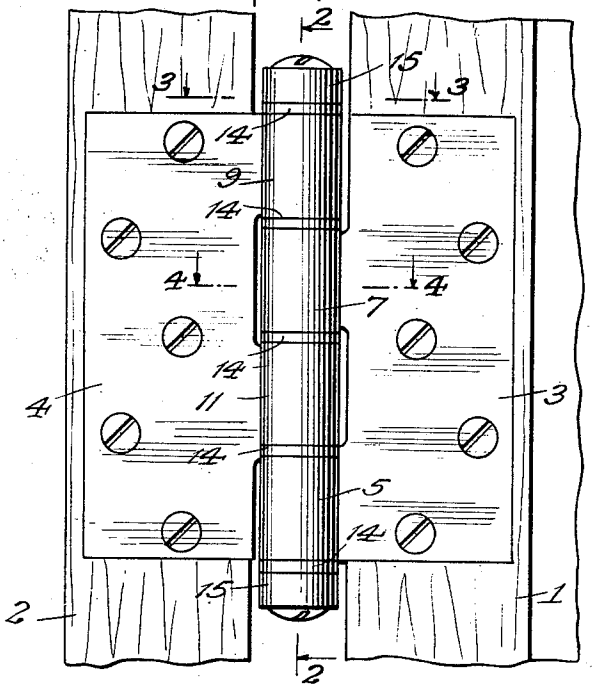


Fig. 2.

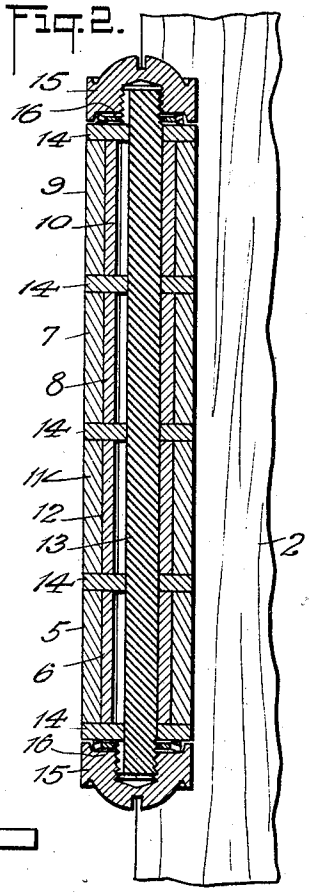


Fig. 3.

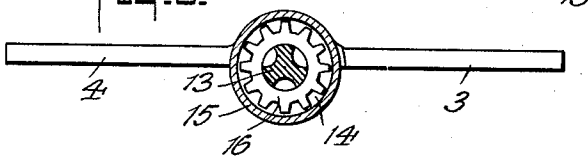


Fig. 4

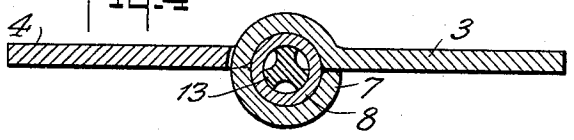


Fig. 5.

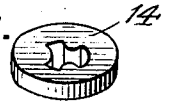


Fig. 6.

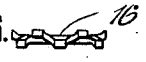


Fig. 7.

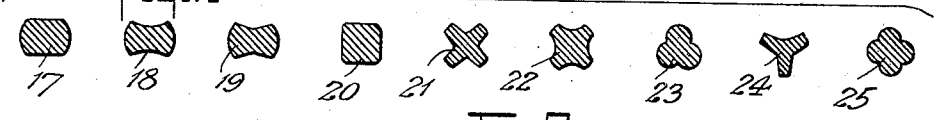


Fig. 8.

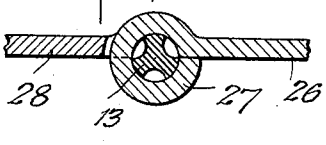
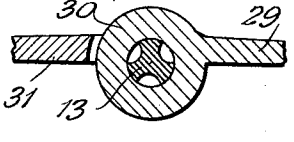


Fig. 9.



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UNITED STATES PATENT OFFICE

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FRICTION HINGE

Application filed February 18, 1929. Serial No. 340,701.

Friction hinges, beginning long ago with crude forms, have long been employed for a wide variety of uses in different kinds of installations. During recent years hinges of this type have come into gradually increasing use on the doors of buildings, more particularly in hospitals and schools as standard equipment, in office buildings for communicating doors not equipped with door closers, and for bed rooms, closets and bath rooms of hotels and residences, where they are of special advantage. While of course friction hinges in general have been more or less improved from time to time, the exacting requirements for the uses above noted have demanded further improvements in order particularly to adapt hinges of this type to such installations. For example, it is required that such hinges shall be noiseless in operation, that the frictional resistance to the swinging of the door shall be uniform throughout the swinging movement, that the friction shall be maintained substantially constant at all times, and that there shall be no likelihood of these hinges getting out of order.

A general object of the invention is to provide an improved friction hinge which will effectively meet the above noted rigid requirements, as well as having other desirable advantages. Another object is to provide a hinge of this kind in which the hinge pin is readily removable, for conveniently either hanging or demounting the door. Another object is to provide such a hinge which is adaptable to a wide variety of uses, such as upon swinging closures of various kinds, including windows, traps, scuttles, or other more or less similar devices; also for the doors of cabinets and book cases, where its action in preventing the breakage of glass is particularly desirable; and upon the doors of coaches and automobiles, which would prevent many accidents due to the swinging open of the doors, and also elminating the usual rattle which results from wear and looseness of the ordinary coach hinges heretofore commonly used on automobiles. Further objects are convenience of manufacture, economy, simplicity, reliability, durability, strength, convenient renewal of parts, and a handsome appearance. Other objects and advantages of the invention will hereinafter appear.

The invention includes various features of construction and combinations of parts, as will appear from the following description.

The invention is disclosed herein as embodied in a four-knuckle hinge having a loose hinge pin, with two knuckles on each leaf and with the knuckles on one leaf arranged alternately with the knuckles on the other leaf, although the same idea could be carried out with a larger even number of knuckles, such for example as six, with three knuckles on each leaf and with the knuckles of the respective leaves similarly alternately arranged. Also some of the advantageous features of the invention may be embodied in a two-knuckle hinge, which in other respects is of a general type commonly employed, and such a modified embodiment of the invention is disclosed in my copending companion application for Patent Serial No. 340,702 filed February 18, 1929, which became a patent of even date with this patent, and having the next higher number.

In carrying out the invention as disclosed herein, each hinge leaf together with its knuckles may be cast in one piece, or each hinge leaf together with its knuckles in one piece may be stamped or pressed out from suitable sheet metal, or each hinge leaf together with an outer knuckle portion or collar for each knuckle may desirably be pressed or stamped out with each such knuckle portion of oversize diameter and having a tubular metal sleeve or bushing fixed therein to form a part of the complete knuckle, for thereby desirably increasing the extent or area of the friction surfaces at the ends of the knuckles. Also, according to this disclosure, the transverse or cross sectional shape of the hinge pin may be changed or varied to a considerable extent while still effectively carrying out the invention, some of these shapes, however, being more advantageous than others.

In carrying out the herein disclosed embodiment of the invention, the hinge pin,

which is non-circular and of the same transverse shape and size throughout its length, extends freely or loosely through all of the axially aligned knuckles and projects at its ends beyond the terminal knuckles or end knuckles, one of which is carried by one of the hinge leaves and the other of which is carried by the other leaf. This hinge pin itself directly forms a journal for all of the knuckles and is provided uniformly throughout its length with a plurality of depressed portions which, according to the particular shape of the pin which may be employed, may be either in the form of two or more flat surfaces or may take the form of two or more longitudinal grooves, the shape of which may be varied. A suitable number of similar friction washers are carried by the hinge pin to be freely slidable thereon but which are prevented from rotating thereon by reason of having their apertures of a non-circular shape which is complementary to the non-circular shape of the hinge pin. One of these friction washers is located outward from each terminal knuckle and another is located inward from each terminal knuckle between the knuckles of the respective leaves, while a similar middle washer serves merely as a bearing. A cap nut is screwed over each projecting end of the hinge pin into adjustable engagement with a compression spring in the form of a spring washer.

One embodiment of the invention, together with some variations therein as to some of its parts, will now be described and thereafter the invention will be pointed out in claims, reference now being had to the drawings, in which:

Fig. 1 is an elevation of a friction hinge in which the invention is embodied, shown as installed upon a door jamb and door, with the latter in its fully open condition;

Fig. 2 is a somewhat enlarged vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a similarly enlarged horizontal section of the hinge on the line 3—3 of Fig. 1;

Fig. 4 is a similar section on the line 4—4 of Fig. 1;

Fig. 5 is a perspective view of one of the friction washers;

Fig. 6 is an elevation or wedge view of one of the spring friction adjustment washers;

Fig. 7 shows in cross section a plurality of hinge pins of different modified transverse shape which may be employed in carrying out the invention;

Fig. 8 is a view similar to Fig. 4, but showing a modification in the knuckle construction according to which the knuckles are of smaller diameter and have no bushing sleeves therein, and

Fig. 9 is a similar view of a further slight modification according to which the hinge leaves together with their knuckles are shown as cast, instead of being formed from sheet metal, as in the preceding views.

The illustrated embodiment of the invention will now be particularly described with reference to the accompanying drawings.

Referring first more particularly to Figs. 1 to 6 inclusive, it will be noted that in Fig. 1 there is shown a portion of a usual door jamb 1 and a view of the inner edge of a portion of a fully open door 2, a portion of the inner face of which appears in Fig. 2. The door 2 is shown as pivotally hung to the jamb 1 by means of a friction hinge embodying the present invention, comprising a jamb leaf 3 and a door leaf 4 which are countersunk and secured in place by means of screws in accordance with the usual practice and as indicated in Fig. 1. Each of the hinge leaves 3 and 4, together with the outer or peripheral portion of each of the knuckles carried thereby, is made from stamped or pressed sheet metal, such as steel, all in one piece.

The jamb leaf 3 carries an oversize lower terminal knuckle portion 5. The inner or bearing portion of this lower terminal knuckle having the outer peripheral portion 5 is formed by a metal sleeve or bushing 6 of even length therewith tightly fixed therein so as in effect to form a part thereof. The purpose in thus combining the outer collar 5 and the inner bushing 6 thereby to form the complete knuckle is to increase the extent of the friction surfaces provided by the ends of this knuckle. This bushing 6 may be made from a piece of steel tubing or of other suitable metal. In manufacturing, the outer collar portion 5 of the knuckle may be formed closely around the bushing 6 so as to grip the latter tightly, or the collar portion 5 may be first formed and then the bushing 6 may be forced into it with a rigidly tight fit.

The jamb leaf 3 is provided with an intermediate knuckle of the same construction as its terminal knuckle just described, this intermediate knuckle comprising an outer peripheral or collar portion 7 in one piece with the leaf and an inner bushing 8 similarly fixed therein, this bushing 8 being a replica of the bushing 6.

The door leaf 4 is provided with an upper terminal knuckle and an intermediate knuckle, both of the same construction and in each of which the construction of the above described knuckles on the jamb leaf 3 is duplicated. That is to say, the upper terminal knuckle comprises an outer collar portion 9 formed on the door leaf 4 and a similar inner sleeve or bushing 10 fixed therein, and the intermediate knuckle similarly comprises an outer collar portion 11 on the leaf and an inner metal bushing 12 fixed therein.

The purpose of forming each of the hinge knuckles with an outer collar part and an inner bushing fixed in the collar to form a part of the knuckle is the same, namely, to

provide more friction surface on the annular plane surfaces of the ends of the respective knuckles, as above described in reference to the lower terminal knuckle on the jamb leaf 3.

A non-circular hinge pin or pintle 13 of uniform size and shape throughout its length passes loosely and freely through and forms a journal for all of the axially aligned hinge knuckles and at its upper and lower ends projects beyond the above described upper and lower knuckles. This hinge pin 13 desirably has a plurality of equally circumferentially spaced circularly arcuate portions extending throughout its length to form a journal within the bearing sleeves or bushings of the respective knuckles, the hinge pin also having a corresponding plurality of intervening depressed portions extending uniformly throughout its length, a single such depressed portion having proved less satisfactory, as will hereinafter more clearly appear. While this hinge pin may be of various transverse shapes, as indicated in Fig. 7, a highly effective and generally desirable form of this pin 13 is shown in Figs. 2, 3 and 4. This latter hinge pin 13 throughout its length is transversely of a uniform triangular fluted shape, in which the three straight depressed portions are shown as in the form of longitudinal grooves with substantially circularly curved or rounded bottoms. The several variant forms of the hinge pin shown in Fig. 7 will be referred to more particularly hereinafter. In case the bearing bushings of the knuckles are of steel, then the hinge pin, such as 13, may desirably be of a different metal, such as bronze, for thereby reducing the wear.

The hinge pin 13 carries a plurality of five washers 14 which are rotatably locked thereto but which are slidable longitudinally thereon. The holes or apertures in these washers, as appears most clearly in Fig. 5, are complementary in shape to the transverse shape of the hinge pin 13, each such hole thus having three triangularly arranged outer arcuate surfaces with three intervening rounded inwardly projecting lugs which fit into the above noted corresponding grooves in the hinge pin 13, as shown in Figs. 2 and 3. These washers 14 are located respectively, between the respective hinge knuckles, above the upper terminal knuckle, and below the lower terminal knuckle. The middle one of this series of five individually located washers serves only as a bearing washer between the adjacent ends of the knuckles, as will presently more clearly appear, but all of the other four washers 14 serve as friction washers in cooperation with the adjacent end surfaces of the respective knuckles. These washers 14 may desirably be of bronze so as to provide a minimum of wear in frictional cooperation with the end surfaces of the steel knuckles.

In carrying out the invention the upper and lower projecting ends of the hinge pin are provided with head-forming members separably mounted thereon, one of which at least should have a screw threaded adjustment for thereby adjusting the friction. In the construction shown, each projecting end portion of the hinge pin 13 outwardly from the terminal friction washer 14 is screw threaded and has a cap nut 15 screwed thereon. In order to produce a more uniform frictional resistance as well as also to provide a more effective adjustment of the amount of friction developed, a compression spring desirably in the form of a spring washer 16 is interposed between each of the nuts 15 and the adjacent terminal friction washer 14. This spring washer 16 may have a round central hole to fit freely over the hinge pin 13 as shown in Fig. 3, since there is no reason for locking it against rotative movement relatively to the hinge pin. This spring friction adjustment washer 16 is desirably substantially of the form of construction shown in Figs. 2, 3 and 6.

This spring washer 16, as there shown, has an inner annular flat portion from which there projects an even number, shown as twelve, spring tongues forming a complete circumferential series with the tongues sufficiently spaced to avoid the possibility of any interference between them in their spring action. Alternately in the series, six of these tongues are bent in one direction out of the plane of the central portion of the washer, and the other alternate six tongues are similarly bent in the opposite direction, that is, in the hinge construction, six of these tongues, in each instance at the top and bottom of the hinge, are bent upward and the other six are bent downward so that each of these washers 16 thereby forms a compression spring.

It should be noted that these washers 16 are purely springs, and are not intended to serve as lock washers for the nuts 15. It is well known that lock washers are incapable of serving as springs independently of or in connection with their locking action, since this is prevented by their locking function. The terminal friction washers 14, by reason of their non-rotatable mounting on the hinge pin 13, prevent any tendency for the nuts 15 to unscrew. Accordingly, the nuts 15 may be manually turned in either direction, for thereby either increasing or decreasing the amount of compression of the spring washers 16.

Any one of the hinge pins shown in Fig. 7 may be substituted for the hinge pin 13 shown in Figs. 2, 3 and 4, the washers 14 also of course in each instance being replaced by other washers (not shown) having their holes similarly complementary in shape to the shape of the particular hinge pin upon which they are mounted. In the hinge pin 13 of the triangular fluted transverse shape shown in Figs. 2, 3 and 4, the three arcuate outer surfaces provide an effective journal in the bear-

ings of the knuckle, while the three intervening grooves provide an effective anchorage for the washers 14 in cooperation with their inwardly projecting rounded lugs.

Reference will now be had to Fig. 7, showing a variety of alternative hinge pins which differ from the hinge pin 13 only in their transverse shape, which similarly to the hinge pin 13 is the same throughout their length. It will also be noted that each of these hinge pins shown in Fig. 7 similarly has a plurality of equally circumferentially spaced outer arcuate portions together with corresponding intermediate depressed portions. It has been found in practice that a non-circular hinge pin having only a single depressed portion does not provide a sufficiently firm and strong anchorage for the friction washers, particularly of the terminal washers at the upper and lower ends of the series of knuckles. Looseness of these latter washers would have a tendency to cause the nuts 15 to work loose.

Conveniently starting at the left side in Fig. 7, it will be noted that the hinge pin 17 is provided with two diametrically opposite flat sides which provide for rotatively locking the friction washers thereto, and that this pin is provided with two diametrically opposite outer circularly arcuate portions by which the pin forms a journal for the hinge knuckles in their bearings.

The hinge pin 18 has similar outer circularly arcuate journal forming portions diametrically arranged, while the intervening depressed portions are hollowed out on a rather long arcuate curve to form shallow grooves which provide a somewhat firmer anchor for the friction washers than the flat surfaces.

The pin 19 is similar to the pin 18, differing therefrom only in the respect that the wide shallow grooves are shown as in the form of obtuse reentrant angles.

The hinge pin 20, it will be noted, has four right angularly arranged flat sides and circularly rounded corner portions which provide four journal surfaces, although each of these is of rather limited extent in this particular pin shown.

The hinge pin 21 has four equidistantly spaced circumferentially arcuate journal surfaces, with four intervening V-shaped grooves, thereby providing both a secure anchorage for the friction washers and journal surfaces of adequate extent.

The hinge pin 22 differs from the hinge pin 21 substantially only in that the four grooves shown therein are of arcuate or curved shape, and differs from the hinge pin 13, first described, in having four, instead of three, grooves and journal surfaces, respectively.

The hinge pin 23 has three inwardly angular grooves which gradually merge along outward curves with the circumferentially curved outer ends of three journal-forming outer portions.

The hinge pin 24 has three circularly arcuate outer journal portions with three intervening grooves of a wide V shape, it being noted that this pin 24 has considerable resemblance to the first described hinge pin 13.

The hinge pin 25, it will be noted, differs from the above described hinge pin 23 only in having four, instead of three, inwardly angular grooves which merge into the four outer circularly arcuate journal portions.

The construction of the friction hinge shown in part in Fig. 8 may be the same throughout as that described with reference to Figs. 1 to 6 inclusive, with the exception, as is shown in Fig. 8, which may be considered as corresponding to Fig. 4, that the hinge knuckles are formed entirely directly upon the hinge leaves all together in one piece therewith, these leaves and knuckles being stamped or pressed from sheet metal. In Fig. 8, the jamb leaf 26 thus carries a knuckle 27 which forms directly a bearing for the hinge pin 13, it being understood that all of the knuckles on this jamb leaf 26 are thus formed, of like construction, while the door leaf 28 is provided with similar knuckles. The friction washers employed are similar to but of course should be of sufficiently smaller diameter than the washers 14 so as to harmonize with and come flush peripherally with the outer surfaces of the smaller knuckles 27. The surfaces available for friction purposes of course will be considerably reduced from that shown in Figs. 1 to 6 inclusive, but this simplified construction shown in Fig. 8 may in some cases be advantageously employed for relatively small and light doors.

Fig. 9 shows the adaptation of the invention to a cast hinge. The construction in other respects is to be considered as the same throughout as that described with reference to Figs. 1 to 6 inclusive. In this somewhat modified construction, a cast metal jamb leaf 29 is shown as having a complete hinge knuckle 30 cast thereon. It will be noted that the axial bore or bearing aperture through this knuckle 30 forms a bearing directly for the hinge pin 13, while the outer diameter of this knuckle may be as great as desired and is shown as substantially the same as the outer diameter of the knuckle collars, such as the collar 7 shown in Fig. 4, Fig. 9 being considered as a similar section. It is to be understood that the door leaf 31 has knuckles similar to the knuckles 30 cast thereon. These cast knuckles, such as 31, therefore provide extensive friction surfaces similar to those provided by the two-part knuckles hereinbefore described with reference to Figs. 1 to 6 inclusive. Thus this cast hinge construction, in part shown in Fig. 9, indicates that the invention may be substantially equally well carried out by utilizing either sheet metal

or cast hinge parts as desired or as may be required for different installations.

Reference will again be had to Figs. 1 to 6 inclusive, for a description of the operation, which it may be noted is substantially the same for the slight modifications shown in the remaining figures of the drawings. The spring compression washers 16, abutting against the terminal nuts 15, press the terminal friction washers 14 against and into frictional engagement respectively with the upper end of the upper two-part terminal knuckle comprising the parts 9 and 10 on the door leaf 4, and similarly against and into frictional engagement with the lower end of the two-part terminal knuckle comprising the parts 5 and 6 on the jamb leaf 3. It will be noted, by reason of the friction washers being rotatably locked to the hinge pin 13, which together therewith is free to rotate or work around, that the friction and consequent wear will be substantially evenly distributed or divided between the inner friction surfaces of these two washers, and similarly upon the outer ends of the respective terminal knuckles, thereby not only evenly distributing the wear, but also resulting in less wear. It is understood of course, that the hinge pin 13 itself is free for endwise sliding movement through all of the hinge knuckles in the assembled hinge.

The compressed spring washers 16 of course draw the terminal or upper and lower hinge knuckles, which are carried by the respective leaves 3 and 4, towards each other, the result being that the weight of the door is supplemented by the downward pull of these springs, acting upon the two knuckles carried by the door leaf 4. Thus both of these forces, namely, that due to the weight of the door, and that developed by the spring washers 16, act to grip the uppermost of the three intermediate friction washers 14 between the lower end of the upper terminal knuckle, comprising the parts 9 and 10 on the door leaf 4, and the upper end of the knuckle comprising the parts 7 and 8 on the jamb leaf 3, and similarly act to grip the lowermost of these intermediate friction washers 14 between the lower end of the knuckle comprising the parts 11 and 12 on the door leaf 4 and the upper end of the lowermost knuckle comprising the parts 5 and 6 on the jamb leaf 3. It will be evident, for the reasons above set forth, that the friction and consequent wear is necessarily equally distributed between these two above noted intermediate friction washers 14, and in a similar manner will be substantially equally distributed between the opposite or upper and lower sides of each of these friction washers.

It will be noted that the upper or terminal knuckle on the door leaf 4 frictionally cooperates with the intermediate knuckle on the jamb leaf 3 through the intermediary of the interposed friction washer, while in a similar manner the intermediate knuckle on the door leaf 4 frictionally cooperates through the intermediary of the interposed friction washer with the lower terminal knuckle on the jamb leaf 3. Thus it will be seen that the four knuckles frictionally cooperate in pairs, one knuckle of each such pair being carried by one of the hinge leaves and the other knuckle of the same pair being carried by the other hinge leaf. Obviously the invention could in like manner be carried out by employing a larger even number of knuckles cooperating in pairs, such for example as a hinge having six knuckles, with three of these on each leaf, arranged in the manner shown and above noted. Also the invention could be carried out substantially in the manner shown and as above described, with a hinge having only two knuckles, that is, one knuckle on each hinge leaf, but in a two-knuckle hinge it has been found more advantageous to employ the modified form of this invention disclosed and claimed in my above noted copending companion application for patent.

It will be noted of the four-knuckle construction shown in the drawings, that the friction producing forces, that is, the weight of the door and the force exerted by the compressed washers 16, have a tendency to draw the two intermediate knuckles away from each other, it being noted that the upper one of these two knuckles, comprising the knuckle parts 7 and 8, is carried by the jamb leaf 3, while the lower one of these two knuckles, comprising the knuckle parts 11 and 12, is carried by the door leaf 4. As a consequence of this action, it is obvious that these forces cannot act for producing friction upon the interposed middle friction washer 14, so that thereby this particular washer forms only a spacing or bearing washer, and further results in a symmetrical construction which is of neat and handsome appearance. Therefore, this washer could be an ordinary washer.

The two spring compression washers 16 give an even or uniform friction, which they continuously maintain, since these spring washers constantly take up the wear on the ends of the knuckles and on the friction washers, caused by the friction thereon. Also the yieldability of these spring washers enables the desired amount of frictional resistance to be accurately obtained by turning the nuts 15 one way or the other, for thereby decreasing or increasing the amount of compression and consequently the amount of force exerted by these spring washers 16.

Two of these washers 16 of course do not exert any more force than would one, but nevertheless two such washers have important advantages. It will be obvious that these two spring washers act together with the force exerted by each balanced against that of the other. Thus they provide a dou-

ble amount of space or latitude of movement for effecting adjustment, by reason of which finer and more accurate adjustment of the friction may be secured. Furthermore, in the same manner, it should be obvious that two of such spring washers arranged as shown, as compared with one such washer, will be enabled to take up twice the amount of wear on the friction surfaces for a given amount of use or operation of the hinge.

Also each of these washers, considered individually, occupies a relatively small amount of space, so that thereby the hinge as a whole is not unduly and unnecessarily lengthened in an unsightly manner. It will be further noted that each of these spring washers 16 is countersunk into the adjacent face of its adjusting nut 15, substantially to the extent of the thickness of the central annular portion of this washer, so that these spring washers are thus at all times effectively concealed from view.

The cap nuts 15 each has a sufficient free space provided in its bore outward from the end of the hinge pin 13 to provide for the maximum amount of inward adjustment of these nuts in compressing the spring washers 16. Manufacturing operations are facilitated by making the hinge pin 13 of the same size or diameter and of the same cross sectional shape throughout its length, including its screw threaded end portions. Also, it will be noted of the construction shown that all of the five washers 14 and the hinge pin 13 are at all times firmly rotatively locked together for rotational movement as a unit. This construction assures a more even or uniform distribution of the wear over the several friction surfaces provided by the friction washers 14 in cooperation with the plane annular surfaces of the ends of the respective knuckles.

In the construction shown, it is essential of course that the upper and lower terminal friction washers must be rotatably locked to the hinge pin, in order thereby to cooperate with each other in their friction producing function, as hereinbefore described. However, also by reason of this particular construction, it will be noted that there are no relatively movable parts adjacent to the adjusting nuts 15, so that there is nothing to impart to these nuts any tendency to work loose, which obviously would reduce and eventually destroy the frictional resistance in the operation of the hinge. While it is of course desirable that the nuts 15 shall have a reasonably close or rather tight fit in their screw threaded engagement with the ends of the hinge pin, it is also to be noted that, while the spring compression washers 16 are not in the proper sense of the term to be considered as lock washers, still at the same time the thrust of these spring washers against the inner sides of the nuts 15 will have a tendency to prevent the uncrewing of these nuts. These spring washers 16 are desirably of steel and may be readily stamped out, as also may the bronze friction washers 14, all of which are exactly alike, thus facilitating manufacturing operations.

By reason of the hardness of the steel knuckles, the greater part of the wear which eventually and gradually takes place will be upon the bronze friction washers 14. These washers may be readily taken out and replaced by similar new washers, or in case eventually the ends of the hinge knuckles should become somewhat worn down then, if desired, otherwise similar but thicker friction washers may be inserted in the hinge. It should be obvious from Figs. 1 and 2 that the hinge may be readily and easily taken apart and reassembled, as well as conveniently initially assembled.

It will be noted that the loose or freely rotatable non-circular hinge pin, which carries the friction washers and at the same time provides a pivot for the hinge, is readily removable merely by taking off one of the cap nuts 15. This is of considerable importance in the hanging of a door and enables it to be mounted or hung easily and conveniently, and also similarly easily and conveniently to be taken down or demounted.

In regard to the non-circular hinge pin, which non-rotatably but slidably carries the friction washers, it may be noted that, so far as the operation is concerned, such hinge pin, instead of having straight or rectilinear outer journal-forming portions and intervening grooves or depressed portions, could have a gradual twist therein so that these portions would then form a long spiral.

In reference to the particular spring washers 16, it may be further noted that each of these washers, by reason of its peripheral series of alternately oppositely bent spring tongues, brings an even pressure to bear all around the circumference of the adjacent friction washer 14, which thus evenly distributes both the friction and wear on the washer and on the end of the hinge knuckle.

It should be noted that the embodiment of the invention shown in the drawings is so constructed in such a symmetrical manner as to render it immaterial which end of the hinge is placed uppermost. For example, referring to Fig. 1, if the hinge were turned around or rotated 180° in the plane of this figure, with the leaf 3 then attached to the door 2 and the leaf 4 attached to the jamb 1, there would result no change whatever either in the appearance of the hinge or in its manner of operation as hereinbefore described. Since it makes no difference which end of the hinge is at the top or bottom, obviously this is of considerable convenience in making installations. However, for a door mounted to swing in the opposite direction to that shown, the hinge construction would be correspondingly

reversed, in a usual manner, so that its leaves would then open and close in the opposite direction from that shown.

It is obvious that various modifications may be made in the friction hinge construction shown in the drawings as an embodiment of the invention and above particularly described, within the principle and scope of the invention as defined in the appended claims.

I claim:

1. In a friction hinge, the combination of a pair of hinge leaves, an even number of axially aligned hinge knuckles half of which are carried by each of the respective leaves, a hinge pin of uniform non-circular transverse shape and size throughout its length, a plurality of friction washers located individually at different points along the hinge pin fitting non-rotatably thereon but being longitudinally slidable thereon, at least one of the said washers being between knuckles belonging to the respective leaves and at least one of these washers being a terminal washer outward from a terminal knuckle, and terminal members on the hinge pin including screw means for applying adjustable compressive force to the interposed knuckles and friction washers thereby to provide frictional resistance to the relative swinging of the hinge leaves.

2. In a friction hinge, the combination of a pair of hinge leaves, an even number of axially aligned hinge knuckles half of which are carried by each of the respective leaves, a hinge pin of part-circular transverse shape including points on opposite sides of any diameter thereof and of uniform diameter throughout its length having a depressed smooth non-circular portion of uniform transverse shape extending continuously throughout its length, said pin directly forming a pivot, a plurality of friction washers located individually at different points along the hinge pin fitting non-rotatively thereon but being longitudinally slidable thereon, at least one of the said washers being between knuckles belonging to the respective leaves and at least one of these washers being a terminal washer outward from a terminal knuckle, and terminal head-forming members separably mounted on the ends of the hinge pin and one of which is a nut for appyling adjustable compressive force to the interposed knuckles and washers thereby to provide frictional resistance to the relative swinging of the hinge leaves.

3. In a friction hinge, the combination of a pair of hinge leaves, an even number of more than two axially aligned hinge knuckles, the same number of which are carried by each of the respective leaves with the knuckles on one leaf alternating with those on the other leaf in the axially aligned series of knuckles so that thereby the terminal knuckle at one end of the hinge will be carried by one of the leaves and the terminal knuckle at the other end of the hinge will be carried by the other leaf, each of the said knuckles throughout its axial length being provided with a circular bore of the same diameter as the said circular bore in all of the other knuckles, a hinge pin extending loosely through all of said knuckles and projecting at its ends beyond the terminal knuckles, the said hinge pin having a plurality of circumferentially spaced circularly arcuate portions extending throughout its length to form a journal for the knuckles and having a corresponding plurality of intervening depressed portions extending uniformly continuously and smoothly throughout its length, a plurality of friction washers in spaced relation along the hinge pin having a non-rotative but longitudinal sliding fit thereon, one of such washers being located outwardly from the end of each of the terminal knuckles and another of such washers being located between the knuckles of each successive pair of knuckles of which one of the knuckles is carried by one of the leaves and the other knuckle is carried by the other leaf, and head members in engagement with the oppositely projecting ends of the hinge pin of which one of said members is a nut for effecting adjustable frictional engagement between the ends of the hinge knuckles and the said friction washers.

4. The invention defined in claim 3, in which the said hinge pin throughout its length is transversely of uniform triangular fluted shape.

5. In a friction hinge, the combination of a pair of hinge leaves, an even number of axially aligned hinge knuckles half of which are carried respectively by each of the said leaves, a hinge pin of uniform non-circular transverse shape and size throughout its length passing slidably through the said knuckles in the assembled hinge, a plurality of friction washers slidably but non-rotatably mounted in spaced relation on the hinge pin, at least one of such washers being between hinge knuckles carried by the respective leaves and at least one of such washers being a terminal washer outward from a terminal hinge knuckle, terminal members on the hinge pin including screw means for drawing the friction washers and hinge knuckles into frictional engagement thereby to provide frictional resistance to the relative swinging of the hinge leaves, and a compression spring adjacently inward from one of the said terminal members so as to be subjected to compression by the said screw means so that thereby the said frictional resistance will be applied through the said spring.

6. In a friction hinge, the combination of a pair of hinge leaves, an even number of axially aligned hinge knuckles half of which are carried respectively by each of the said leaves, a hinge pin of uniform non-circular trans-

verse shape and size extending slidably through the hinge knuckles from end to end of the assembled hinge and projecting at its ends beyond the terminal knuckles, a plurality of friction washers slidably but non-rotatably mounted in spaced relation on the hinge pin, at least one of such washers being between hinge knuckles carried by the respective leaves and at least one of such washers being a terminal washer outward from a terminal hinge knuckle, terminal members on the projecting ends of the hinge pin at least one of which includes screw means for drawing the friction washers and hinge knuckles into frictional engagement thereby to provide frictional resistance to the relative swinging of the hinge leaves, and a compression spring adjacently inward from one of the said terminal members so as to be subjected to compression by the said screw means so that thereby the said frictional resistance will be applied through said spring.

7. In a friction hinge, a hinge pin which throughout its length is transversely of uniform triangular fluted shape comprising three circumferentially equidistantly spaced circularly arcuate portions with intervening grooves forming the flutes.

In witness whereof, I hereunto subscribe my signature.

WILLIAM K. FELLOWS.