4 Sheets—Sheet 1.

I. BUCKMAN

Spiral-Spring Hinge.

No. 217,054. Patented July 1, 1879.

Fig. 1.

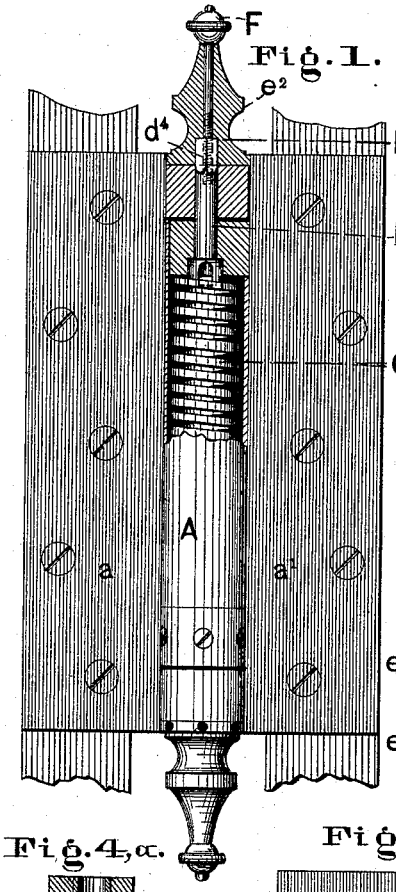


Fig. 1,a.

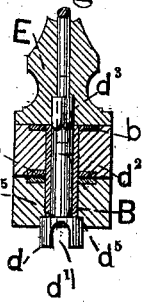


Fig. 2.

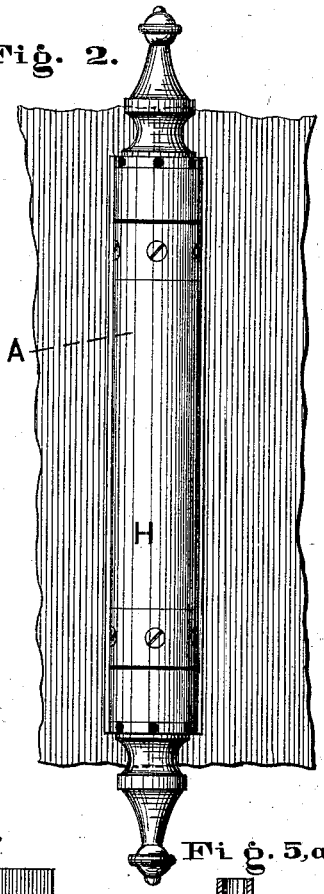


Fig. 3.

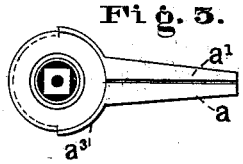


Fig. 3,a.

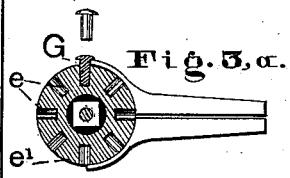


Fig. 4,a.

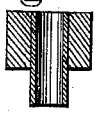


Fig. 4.

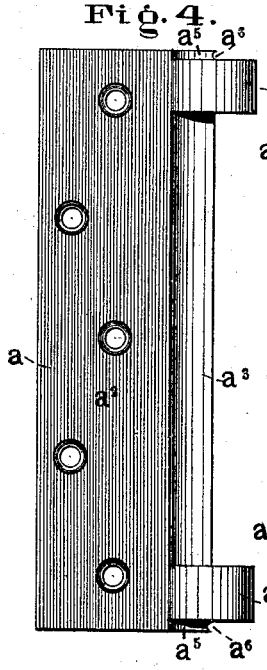


Fig 5.

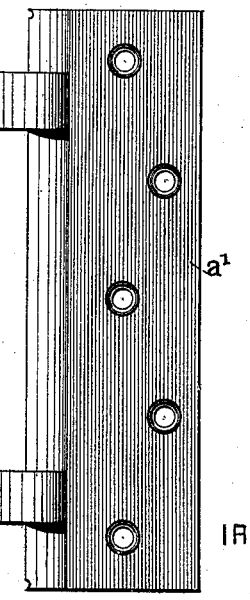
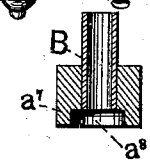


Fig. 5,a.



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4 Sheets—Sheet 2.

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Spiral-Spring Hinge.

No. 217,054. Patented July 1, 1879.

Fig. 6.

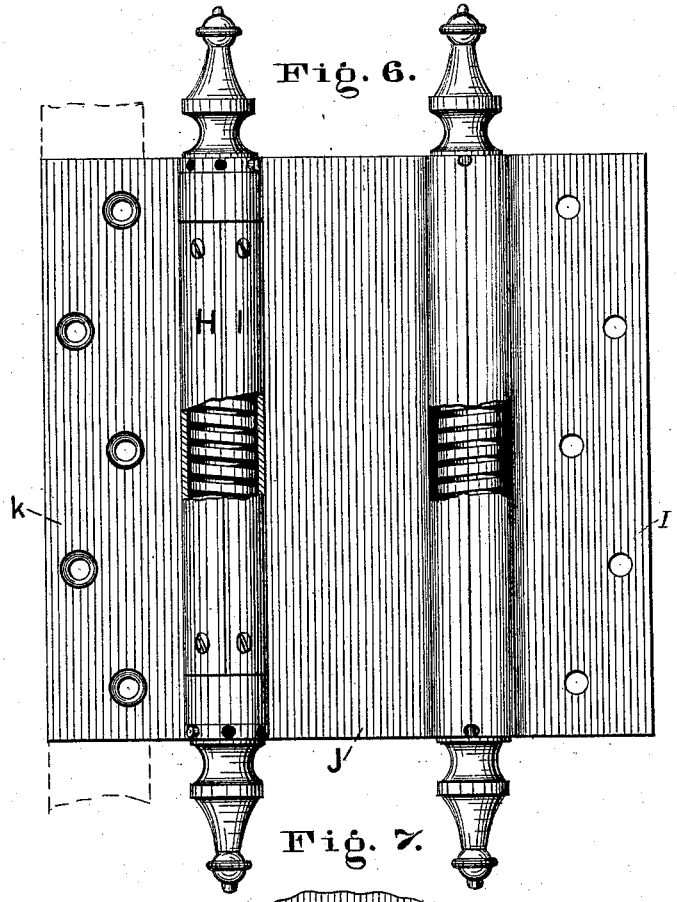

Fig. 7.

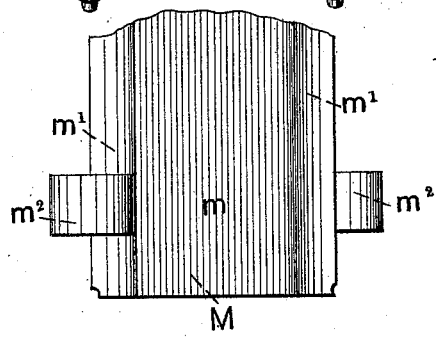

Fig. 8.

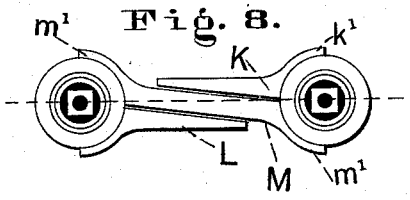

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Fig. 9.

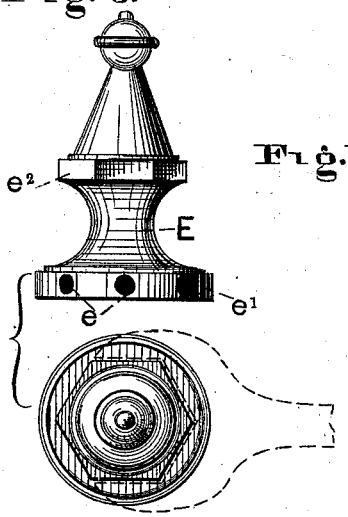
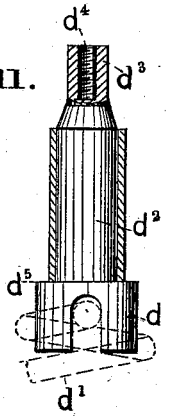


Fig. 11.



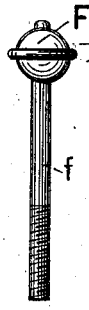


Fig. 12.

Fig. 10.

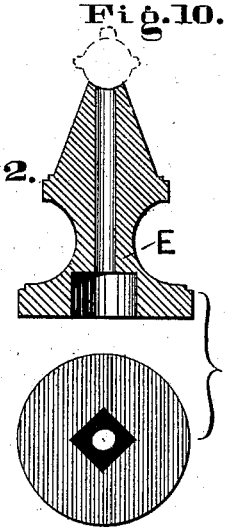


Fig. 13.

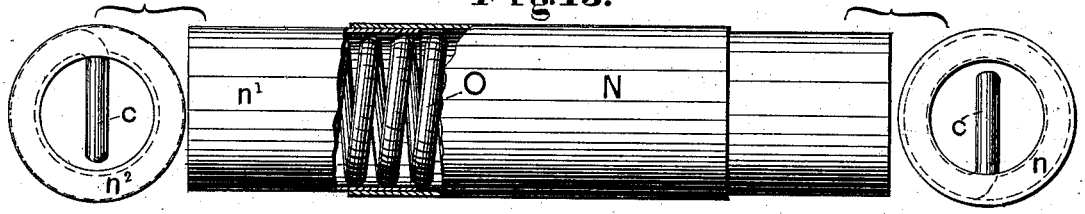


Fig. 14.

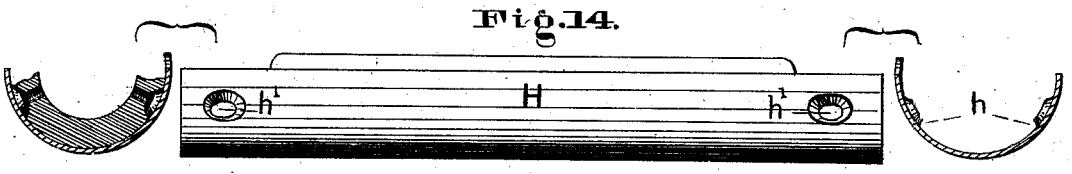


Fig. 15.

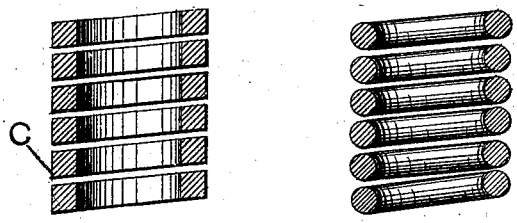
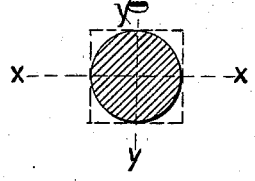


Fig. 16.



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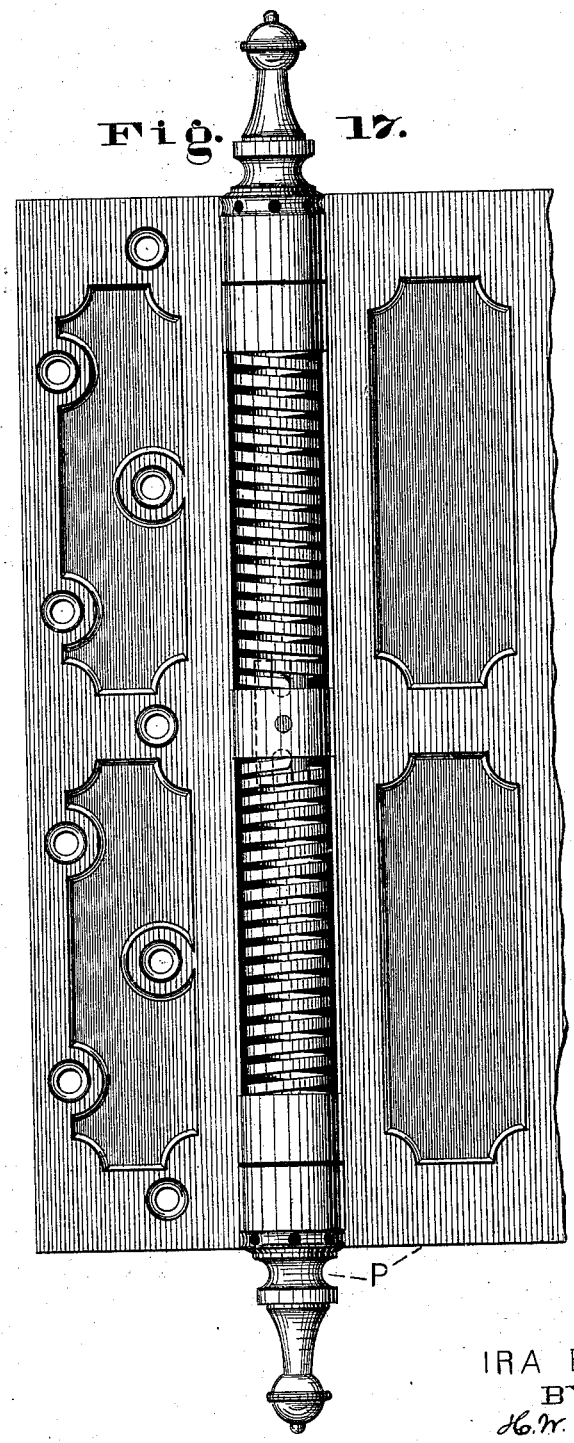
I. BUCKMAN

Spiral-Spring Hinge.

No. 217,054. Patented July 1, 1879.

Fig. 17.



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UNITED STATES PATENT OFFICE.

IRA BUCKMAN, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN SPIRAL-SPRING HINGES.

Specification forming part of Letters Patent No. **217,054**, dated July 1, 1879; application filed June 21, 1878.

To all whom it may concern:

Be it known that I, IRA BUCKMAN, of Brooklyn, county of Kings and State of New York, have invented new and useful Improvements in Spiral-Spring Hinges; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

This invention consists, mainly, first, in the special construction of the hinge, by means of which it is adapted to permit the removal or insertion of a spiral spring without taking the hinge apart; second, in the special construction of the spring *per se;* and, third, in the special construction of a double-acting hinge, by means of which the right and left hand spiral springs employed therein are made interchangeable.

It further consists in certain details of construction, all of which will be fully described hereinafter.

In the drawings, Figure 1 represents an elevation of a single-acting hinge with the leaves open; Fig. 2, an elevation of the same with the leaves closed; Fig. 3, a top view of the closed hinge with the wrench-cap removed. Figs. 4 and 5, side elevations of the separate leaves of the hinge; Fig. 6, an elevation of a double-acting hinge with the leaves open; Fig. 7, a partial view of the central plate; Fig. 8, a top view of the hinge with the leaves closed; Fig. 9, a side elevation and top view of the wrench-cap detached; Fig. 10, a vertical elevation and bottom view of the same; Fig. 11, an elevation, partially in section, of the arbor detached; Fig. 12, an elevation of the tip and its threaded rod; Fig. 13, a view of a sectional tube for inclosing the spring; Fig. 14, various views of the shield or cap; Fig. 15, sectional elevations of springs made of round and square wire; Fig. 16, a diagram representing the transverse sectional area of the same; and Fig. 17, an elevation of a duplex spring for large doors.

To enable others skilled in the art to make and use my invention, I will now proceed to describe fully its construction and manner of operation.

A, Figs. 1 and 2, represents a single-acting spring, having the usual leaves a a^1, Figs. 1 and 3, as shown. a^2, Fig. 4, represents the main portion of the leaf a, having the usual screw-holes; and a^3, a projecting portion, resembling in form one-quarter of a cylinder cut longitudinally, which is provided at each end with the knuckles a^4 and the projecting flange a^5, having the recess a^6, as shown, the purpose of which latter will be hereinafter explained.

The leaf a^1 is constructed in a similar manner to the leaf a, with the exception that the knuckles a^7 are located at the proper points in a vertical plane to bear against the inner surfaces of the knuckles a^4 when the parts are properly in place, as shown in Fig. 1.

a^8, Fig. 5^a, represents a recess formed in the inner sides of the knuckle a^7, the purpose of which will be hereinafter explained.

B, Figs. 1^a and 5^a, represent a steel bushing, which is rigidly secured in the eye of one of the knuckles and caused to project loosely into the other.

b b, Fig. 1^a, also represent bushings, consisting of washers, which are rigidly secured in proper recesses in the eye of the other knuckle, the internal diameters of which are large enough to permit the main bushing, B, to turn therein without undue friction. This bushing need not be employed if hard metal is used for the hinges, or when the same are made of small size; but when the hinges are large and of soft metal it may be advantageously used.

C, Figs. 1 and 15, represents a spring, preferably formed of square wire, which is spirally wound in any proper manner to form both right and left hand coils.

c, Fig. 13, represents a bent end of round or square wire, which extends across the center at each end, for the purpose of furnishing a suitable means of attachment, as will be hereinafter described.

D, Figs. 1, 1^a, and 11, represents an arbor, consisting of the enlarged head d, Figs. 1^a and 11, having the central slot, d^1, and also the shank d^2, having the angular termination d^3, with threaded recess d^4, Figs. 1 and 11, as shown. d^5, Figs. 1^a and 11, represents a bearing-face of the arbor-head d, which rests, when in place, upon the face of the recess a^8, these parts being accurately dressed, so that the one may move upon the other without undue friction.

E, Figs. 1, 9, and 10, represents a wrench-

cap, having a central opening through the same, as shown in Fig. 10, which is made angular at its large end for the purpose of engaging with the correspondingly-formed termination d^3 of the arbor, as shown. The bearing-face of the wrench-cap is accurately dressed, so that when the same is united to the arbor, as hereinafter described, the parts will move together upon the bearings without binding or cramping at any point.

e, Figs. 3ª and 9, represents a series of holes formed in the circumference e^1, any one of which is adapted to receive a stop-pin, hereinafter referred to.

e^2, Fig. 9, represents a hexagonal or other angular outline, by means of which the cap is adapted to receive a wrench when it is desired to turn the same.

F, Figs. 1 and 12, represents a knob or tip, and *f* a threaded rod attached to the same, by means of which and the threaded recess d^4 in the arbor the wrench-cap is securely attached to the latter. An arbor, wrench-cap, and tip are employed at each end of the hinge, as shown in Fig. 1.

The knuckles of the leaves having been properly adjusted, the arbors may first be inserted in place, and be then secured by the wrench-cap and tip. By this means, it will be observed, the knuckles are securely tied together, so that great strength is given to this part of the hinge. The hinge portion of the device is thus made complete, although the spring has not yet been inserted in place, and consequently, if desired, it may be placed upon the door in this condition. The spring, however, is readily inserted into place at any time by first slipping one end into its proper place in the case and then compressing the same in a vertical direction until the other end also will pass into the case. When the spring is in its proper position its bent ends rest in the slots of the arbors, as indicated in dotted lines, Fig. 11, so these parts are rigidly united together, so far as revolution is concerned. The ends, however, are not held, so far as vertical movement is concerned, and hence the spring may be readily removed at any time without taking the hinge apart or removing it from the door.

G, Fig. 3ª, represents a stop-pin inserted in any one of the holes of the series of the wrench-cap, by means of which the spring is connected at one end to one leaf of the hinge and at the other end to the other leaf in a single-acting hinge. The outer ends of the pins, it will be observed, rest in the recesses a^6 of the flange, by means of which arrangement the parts can be readily reached for purposes of adjustment, no matter what may be the position of the hinge on the door-frame. These recesses also furnish proper space for the pin when the hinge is opened to its widest extent, for, otherwise, either the movement of the hinge would be limited or the pins be crushed.

H, Figs. 2 and 14, represents a cap-plate of semi-cylindrical form, which is provided with the annular projections *h*, having the screw-holes *h'*, as shown. By means of these annular projections a largely-increased bearing-surface is obtained for the head of the screw, and consequently a much stronger connection is made between the parts when the same are united than would be otherwise the case.

This cap, which may be employed or not, as may be preferred, covers, when in place, the opening through which the spring is inserted or removed. It serves also, when in place, to tie the knuckles at the opposite ends of the hinge together, in order that it may resist more perfectly the vertical strain to which they are subjected.

I, Fig. 6, also represents a cap-plate permanently attached in place, which serves, in connection with the plate H, to entirely cover the spring.

J, Fig. 6, represents a double-acting hinge, having the main parts common to this class of hinges—that is, the outer leaves, K L, Fig. 8, and the central plate, M, as shown.

k, Fig. 6, represents the main portion of the outer leaf, K, having the usual screw-holes; and *k'*, Fig. 8, a projecting portion similar to that previously described upon the leaf *a*.

l, Fig. 6, represents the main portion of outer leaf upon the opposite site, which is constructed precisely like the leaf K, and need not therefore be particularly described.

M, Fig. 7, represents the central plate, before referred to, consisting of the main portion *m* and projecting portion m^1 on each edge, but upon opposite sides of a transverse center line, as shown in Fig. 8, which portions are similar in their general form to the corresponding parts of the leaves K and L, as shown. m^2 m^2 represent knuckles upon the projecting portions, which are located at the proper points in a vertical plane to bear against the inner surfaces of the knuckles of the leaves when the parts are properly in place.

When the parts are properly united, it will be observed that the outer face of each leaf is in a plane which is parallel with the transverse center line of the hinge, as shown in Fig. 8, and that the inner face, consequently, is inclined to fit the central plate, which necessarily extends in a diagonal direction from one knuckle to the other. By means of this special construction the hinges may be applied to the door and frame with perfect certainty by the use of the try-square.

The other portions of this hinge are precisely like those of the single-acting hinge already described, and hence they will not be set forth again in detail.

In the double-acting hinge, however, the manner of employing the springs is important, as will appear from the following statement:

In order to obtain the best results from a spiral spring, it should always be turned in that direction which will tend to wind it up, and never in the opposite direction, for the reason that movement in the former direction will have a tendency to increase the original

set of the spring, or at least not to diminish the same, while movement in the latter will tend to impair the original set, and ultimately destroy it. More power also is obtained by turning in this direction, because in one case the coils are brought closer together by the movement, and thus mutual support and rigidity are obtained, while in the other case the coils are separated from each other. By turning in the proper direction, also, the diameter of the coil is diminished, and hence more power is thus obtained, while by the opposite movement the diameter is increased and the power necessarily diminished. By the increase of diameter, also, when movement is made in the wrong direction, the spring is liable to be brought in contact with the case and be injured by friction.

In order, then, that the springs in the hinge may always be wound in the proper direction, I employ upon one side a right-hand spring, and upon the other a left-hand, and adjust both according to a fixed and definite rule, such as, for example, the following: Adjust at the top of the hinge, and always turn toward the door; or adjust at the bottom of the hinge, and always turn from the door. The precise rule determined upon is not important; but when adopted the hinges, if properly prepared, may always be adjusted by the rule with an absolute certainty that each spring will be turned in the proper direction. For example, if the first rule be adopted—adjust at the top of the hinge, and always turn toward the door—the following arrangement should be made: For a right-hand door (and by a right-hand door is meant one which swings from the jamb in a direction which would correspond with the forward movement of the right arm of a person occupying the place of the jamb) the hinge in the first place would be attached to the jamb in such manner that the outer leaf would swing inward with the door without carrying the central plate, this being carried in the reverse movement of the door. The outer knuckles then should have a right-hand spring, and the inner knuckles a left-hand one. When thus arranged both springs may be adjusted according to the rule, with an absolute certainty that each will be turned in the proper direction.

The same hinge may now be applied to a left-hand door by simply reversing the vertical position of the same, when it will be found that the outer leaf will swing inward without carrying the central plate.

The springs, however, must be interchanged, the left-hand spring now being placed in the outer knuckle, and the right-hand spring in the inner.

The adjustment, however, is made precisely in accordance with the rule—that is, both are turned at the top toward the door.

The operation is substantially as follows: The hinge having been properly put together, and the same having been properly secured to the door-frame and door, the general action in opening and closing in either direction will be similar to that of other hinges of this class. The action in detail, however, is different. By means of the arbor at each end the knuckles are securely tied together, and proper bearings are furnished for the necessary movements. The arbor at one end, it will be observed, serves as a fixed axle, upon which the moving knuckle turns, and that at the other as a shaft attached to the moving knuckle which turns in the fixed knuckle, the latter serving as a journal-bearing. By means of this construction it is possible to make the parts of such proportions relatively to each other as are best adapted to sustain the wear to which they are necessarily subjected.

The bearing parts upon the arbor-head, the wrench-cap, and the intermediate knuckle are accurately dressed, as before stated, so that this movement takes place with a minimum amount of friction.

The springs are adjusted by turning either wrench-cap in the proper direction until the proper tension is obtained, and then securing it in that position by inserting the stop-pin in the proper hole. The springs may be readily removed and replaced or be interchanged, if desired.

It will be observed that the adjusting-caps are located at each end of the hinge, and that the locking-pins in the caps are located on opposite sides, by means of which construction and arrangement it is possible always to adjust the springs properly, even if one half of one of the leaves is embedded in the jamb.

Some of the advantages of the described construction are as follows: By means of the special construction it is possible to see the condition of the springs, and also to remove and replace the same, without taking the hinge apart or removing it from the door. By the employment of a right-and-left hand spring in the manner described, the same may be adjusted according to a definite rule, with absolute certainty that the spring will be wound in the proper direction. The hinges, also, may be made up at the factory from a single pattern, without regard to the fact of their use upon a right or left hand door. They may, however, be specially prepared for either door by properly arranging the springs, and when prepared may be readily changed, if circumstances require it, by simply interchanging its springs.

The employment of a coiled spring formed of square wire within the cylindrical case is advantageous, because such a spring contains more material than a round-wire spring, and hence possesses more power. This will appear, it is believed, from the following explanation: The diameter of the coil, whether round or square wire is employed, must be the same, and cannot exceed the inner diameter of the inclosing-case, if an inclosing-case is employed. The transverse diameters *x x y y*, Fig. 16, of the two wires is also the same; but in the square wire the spaces in the angles be-

tween the ends of the diameters are filled to make a square corner, as shown.

It will be understood, of course, that the size of the round wire, when its circumference fills the inclosing-case, cannot be enlarged; but the vacant spaces between its corners may be utilized to obtain greater power without requiring additional space. By means of the square wire, also, a spring is obtained which is more rigid than the round under vertical strain, so that, if desired, it may be used without the support of an inclosing-case and still retain its proper vertical position, without any tendency to buckle or twist out of place.

By the employment of the annular projections in the cap-plate H it is possible to use a thin metal for the same and still obtain strength enough at the points of attachment to cause it to serve an important part in strengthening the hinge. By recessing the knuckles a perfect bearing is obtained for the head of the arbor, and also the end of the spring is caused to bear squarely upon the end of the knuckles.

Certain modifications will now be described, as follows: N, Fig. 13, represents a tube or cylinder, having one end partially closed by the annular flange *n*, as shown. n^1 also represents a short section of similar tubing, having the annular flange n^2 at one end, which is adapted to slide within the tube N, as shown. O represents a coiled spring, which is adapted to fill the case, as shown.

By means of this construction the spring may be inclosed before it is inserted in the hinge, the vertical movement necessary to its insertion being permitted by the sliding of one tube within the other. If desired, the tube may be used in place of the cap and be ornamented to any desired extent.

P, Fig. 17, represents a duplex hinge for very heavy doors. This has a right and left hand spring on each side of the hinge. The inner end of each is rigidly held by a knuckle or stud from the central plate, placed in vertical line with the knuckles, while the other ends of the springs are adjusted to or from the door, according to their arrangement. Both, however, are adjusted in the same way.

The duplex hinge here described is not claimed in this application, but may be made the subject of a future application.

I do not limit myself to the precise construction shown. For example, if desired, the tip-cap can be dispensed with, and the wrench-cap be secured directly to the arbor by means of a set-screw.

Instead of the arbor, any rotating cap may be employed with the right and left hand springs, or with a spiral spring of square wire.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination with a cylindrical case having an opening adapted to permit the removal of the spring and the arbors rigidly fixed, as far as vertical movement is concerned, a removable spiral spring, substantially as described, the construction being such that the spring may be removed or inserted without taking the hinge apart or removing it from the door.

2. In combination with the cylindrical case, having an opening as described, and a removable spring, a removable inclosing-cap adapted to inclose the spring, substantially as described, the construction being such that the cap may be removed without taking the hinge apart, removing it from the door, or removing the arbors.

3. In combination with the knuckles of the hinges, the independent arbors, each having a bearing in the knuckles of each part, substantially as described.

4. In combination with the knuckles of the outer leaf and central plate, the headed arbor and means, substantially as described, for securing the arbor in place, thus tying the knuckles together.

5. In combination with an arbor having a head, as described, the knuckles having a slot or recess, a^8, as and for the purpose set forth.

6. In combination with the knuckles having a slot, a^8, and the arbor having the head, as described, the spiral spring bearing upon the knuckle, as described.

7. In combination with the knuckles and the arbor, the removable wrench-cap E, having the series of holes and locking-pin, as described.

8. In combination with the arbor and wrench-cap, the tip having the threaded rod, as described.

9. A double-acting spring hinge having a right and a left hand spiral spring, interchangeable without taking the hinge apart, removing the same from the door, or removing the arbors.

10. The cap-plate H, having its annular projection *h*, as and for the purpose described.

11. In combination with a recessed arbor, a spiral spring of square wire having a bent end, the construction and arrangement being such that the power of the spring is torsionally applied, as set forth.

12. A spring butt-hinge having a central plate with knuckles on each side, outer leaves having knuckles on their adjacent edges, a spring or springs located between the knuckles of a central plate, and a slotted arbor, the power of the spring being transmitted through the knuckles of the central plate and the knuckles of the outer leaves by means of the slotted arbor, substantially as described.

13. In combination with a spiral spring, the sectional tube N n^1, as described.

This specification signed and witnessed this 7th day of June, 1878.

IRA BUCKMAN.

Witnesses:
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G. W. KELSEY.