June 4, 1963 H. B. CLARK 3,091,818

SPRING-CLOSED SWINGING SHOCK ABSORBING DOOR

Filed July 13, 1960

5 Sheets-Sheet 1

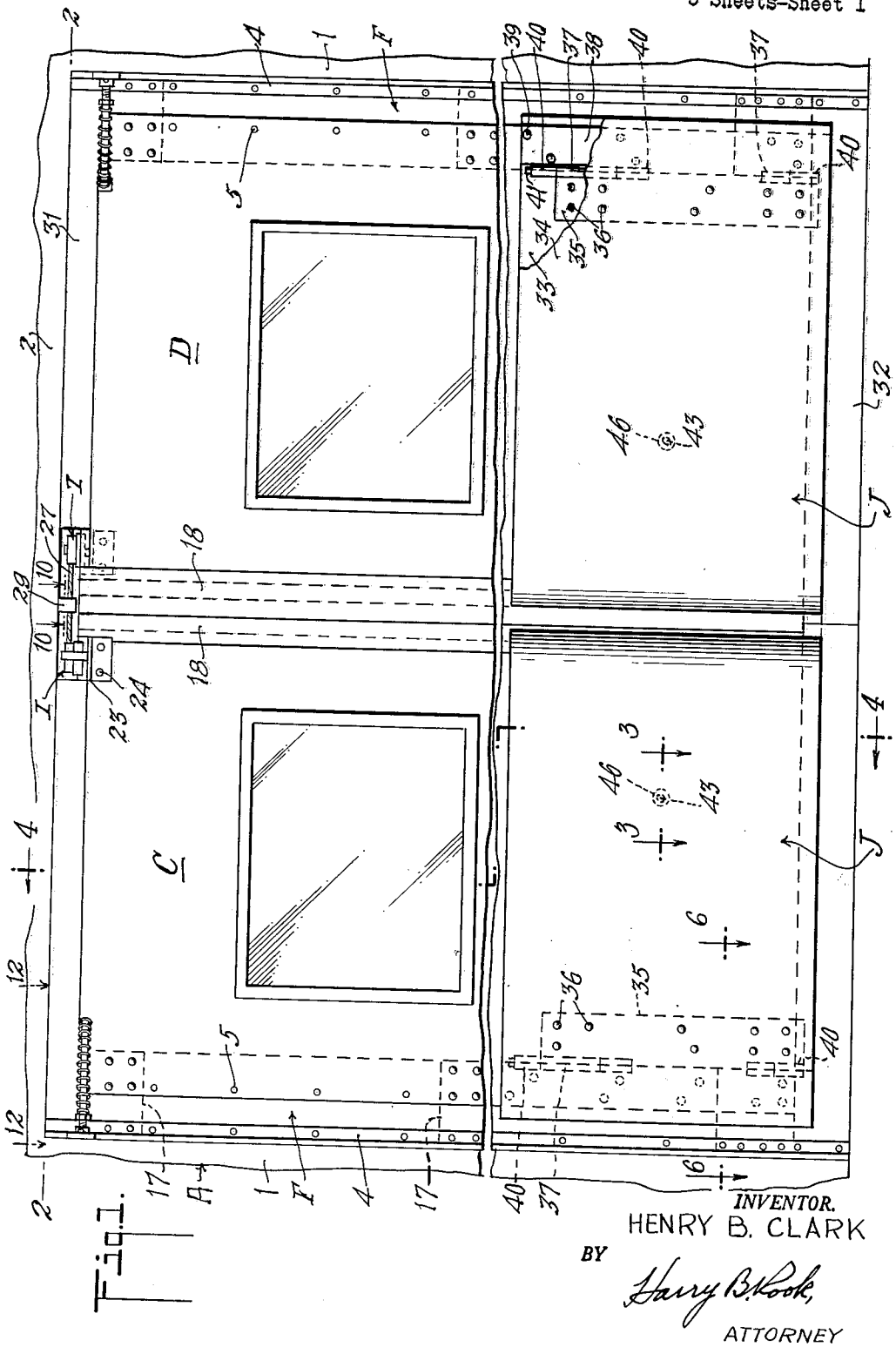


Fig. 1.

INVENTOR.
HENRY B. CLARK
BY
Harry B. Kook,
ATTORNEY

June 4, 1963 H. B. CLARK 3,091,818

SPRING-CLOSED SWINGING SHOCK ABSORBING DOOR

Filed July 13, 1960 5 Sheets-Sheet 2

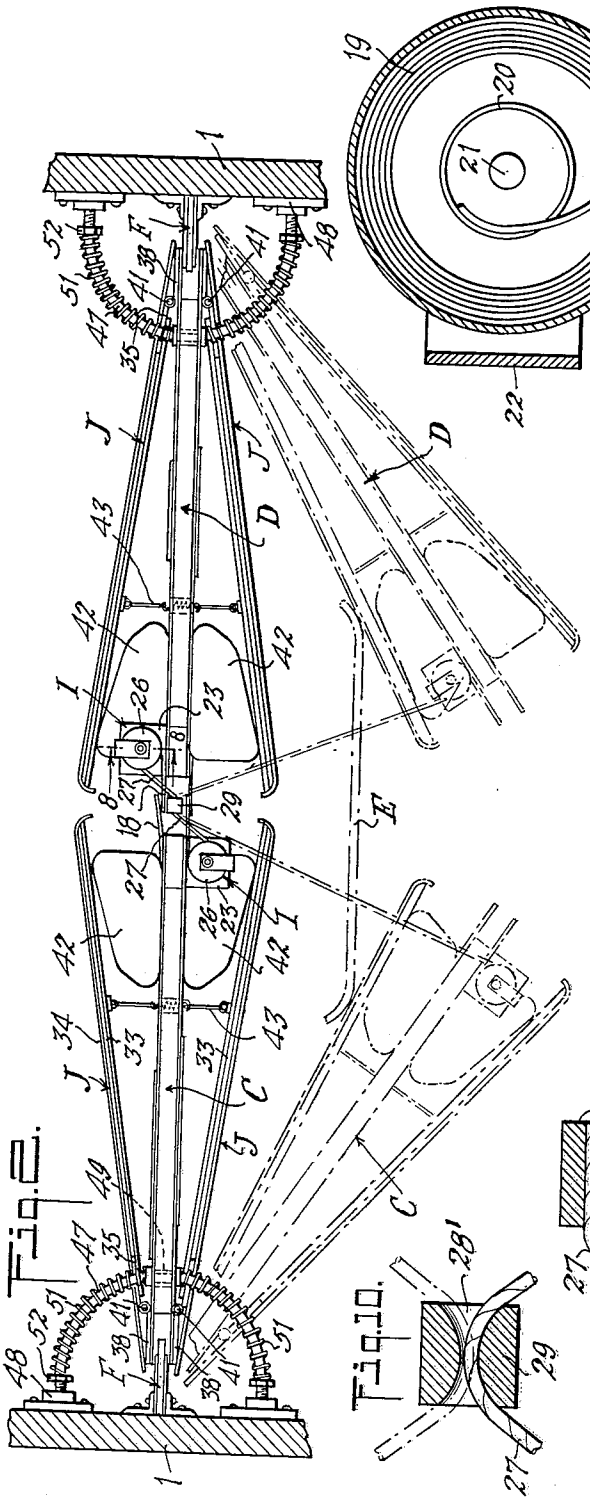


Fig. 2.

Fig. 8.

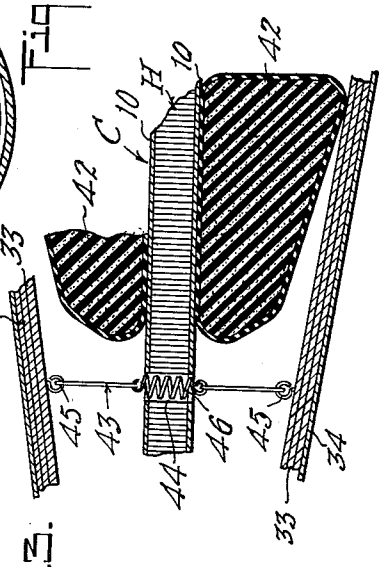


Fig. 7.

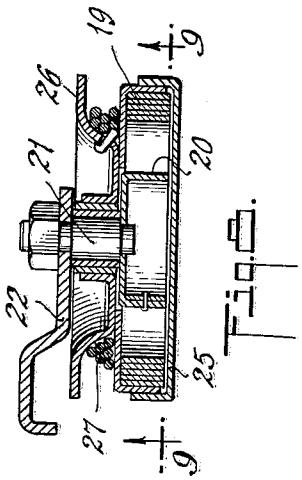


Fig. 9.

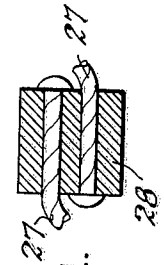


Fig. 11.

Fig. 10.

INVENTOR.
HENRY B. CLARK

BY

Harry B. Clark,
ATTORNEY

June 4, 1963 H. B. CLARK 3,091,818

SPRING-CLOSED SWINGING SHOCK ABSORBING DOOR

Filed July 13, 1960 5 Sheets-Sheet 3

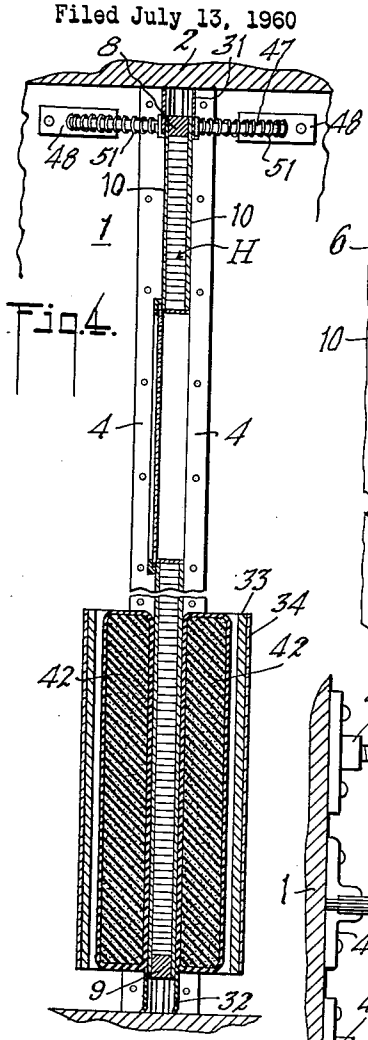


Fig. 4.

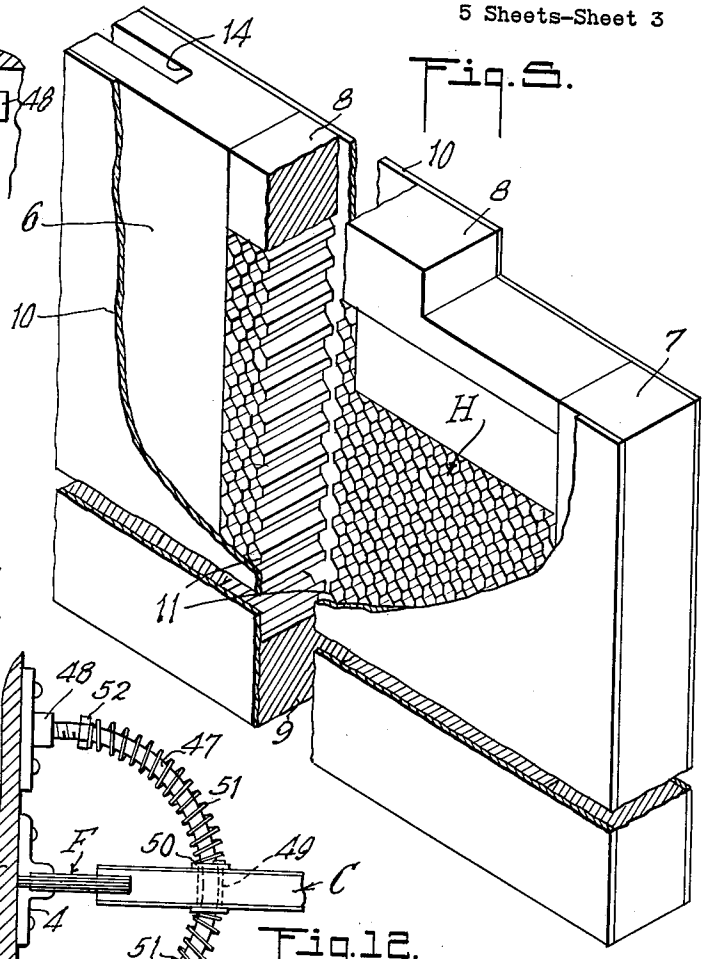


Fig. 5.

Fig. 12.

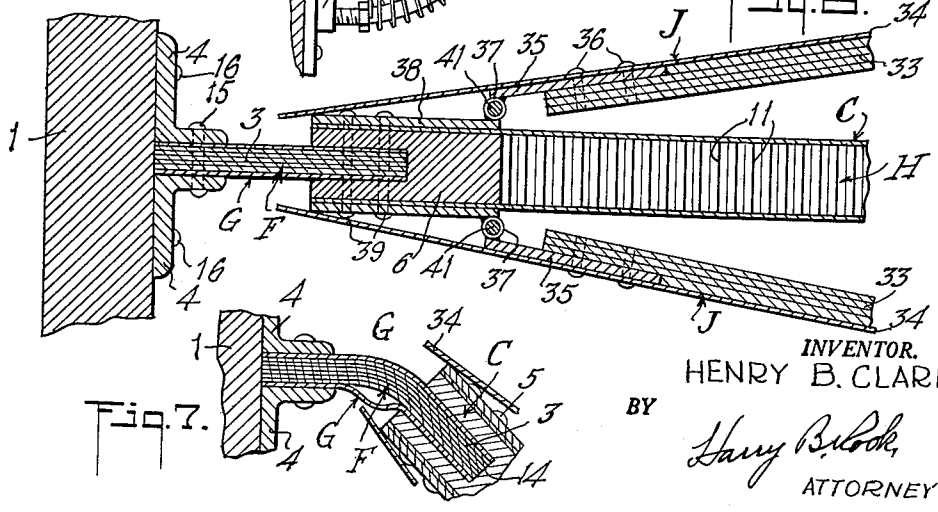


Fig. 6.

Fig. 7.

INVENTOR.
HENRY B. CLARK
BY
Harry B. Clark
ATTORNEY

June 4, 1963 H. B. CLARK 3,091,818

SPRING-CLOSED SWINGING SHOCK ABSORBING DOOR

Filed July 13, 1960 5 Sheets-Sheet 4

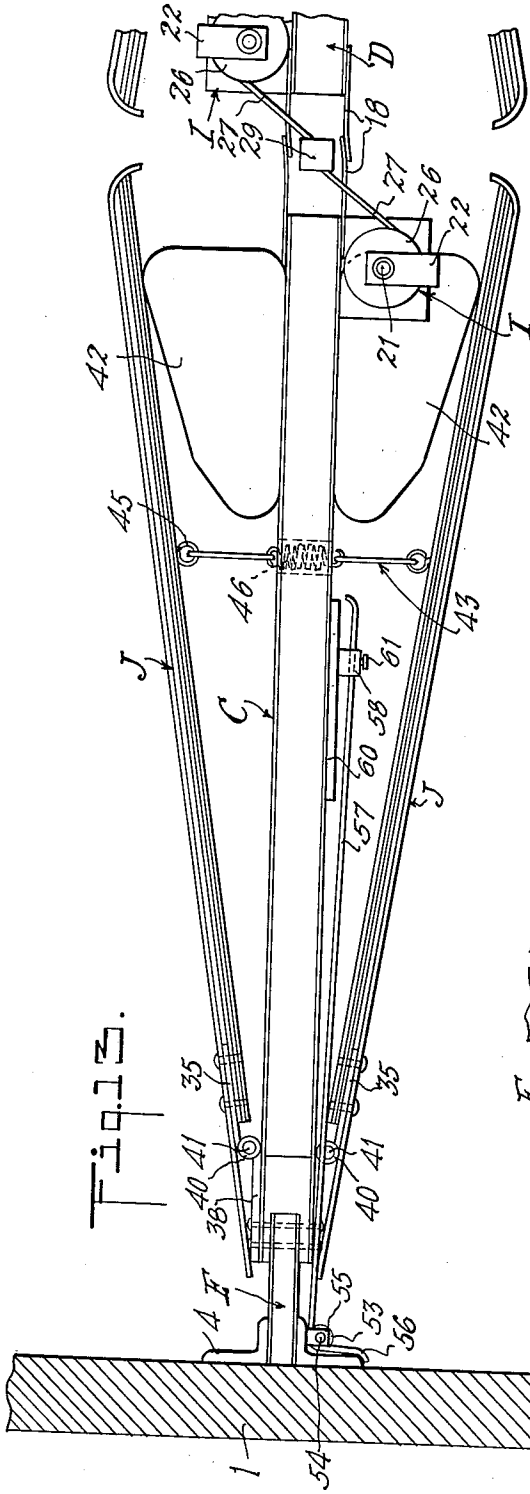


Fig. 13.

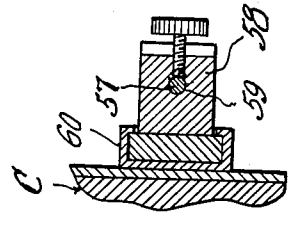


Fig. 15.

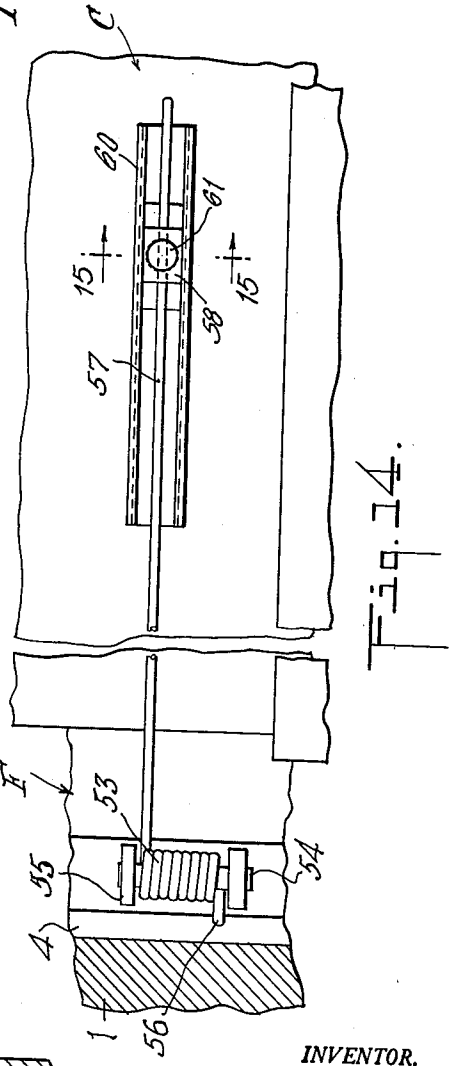


Fig. 14.

INVENTOR.
HENRY B. CLARK
BY
Harry B. Cook,
ATTORNEY

June 4, 1963 H. B. CLARK 3,091,818

SPRING-CLOSED SWINGING SHOCK ABSORBING DOOR

Filed July 13, 1960 5 Sheets-Sheet 5

Fig. 16.

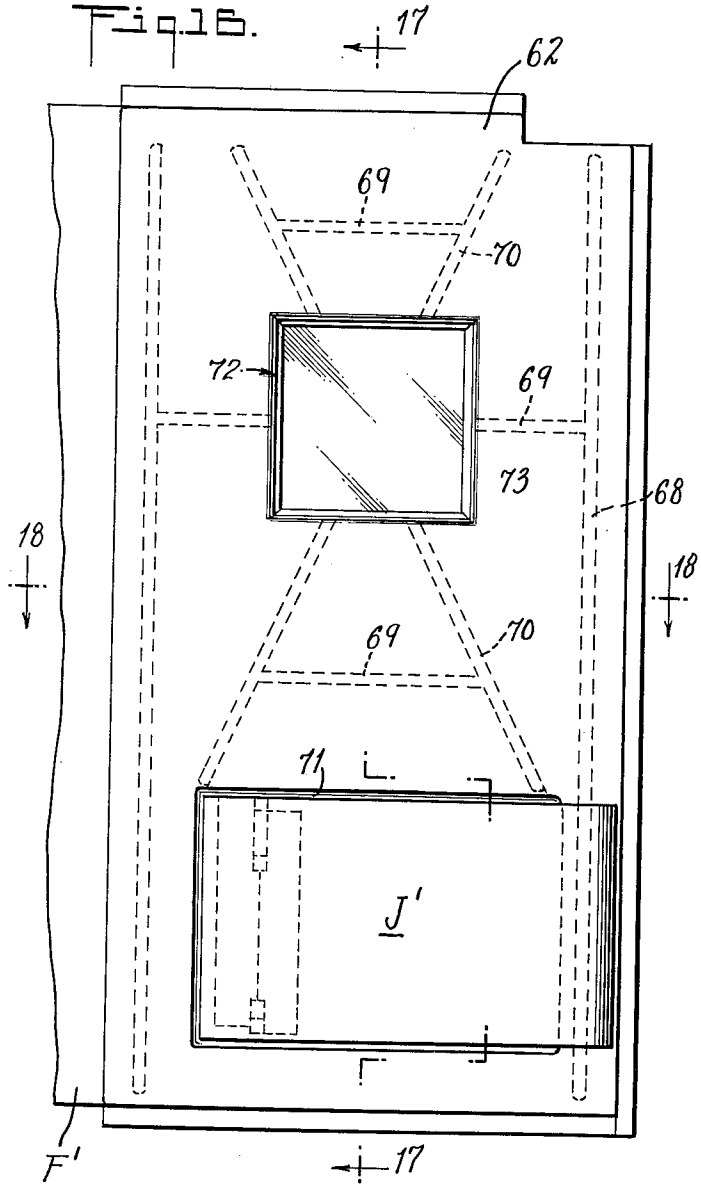


Fig. 17.

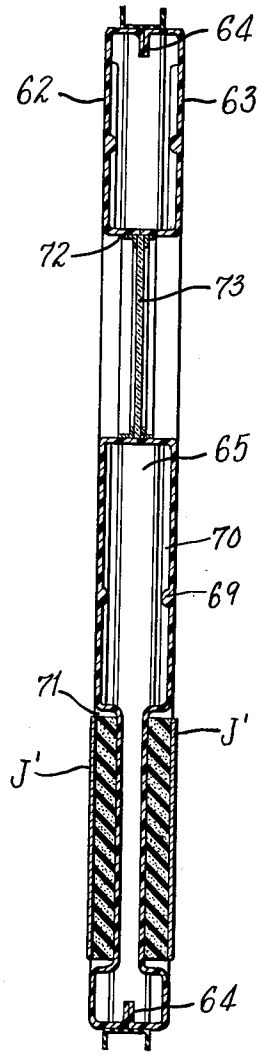
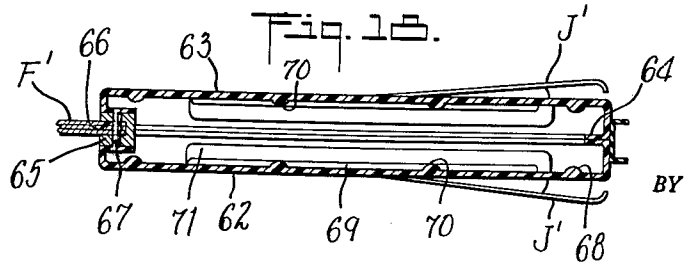


Fig. 18.



INVENTOR.
HENRY B. CLARK

BY

Henry B. Clark

ATTORNEY

United States Patent Office 3,091,818 Patented June 4, 1963

3,091,818
SPRING-CLOSED SWINGING SHOCK ABSORBING DOOR

Henry B. Clark, 1247 Clinton Place, Elizabeth, N.J.

Filed July 13, 1960, Ser. No. 42,664
1 Claim. (Cl. 20—16)

This invention relates in general to swinging doors that are closed by spring mechanisms and may be easily opened by pressure applied against the doors from either side thereof; and this application is a continuation-in-part of my co-pending application Serial No. 776,851, filed November 28, 1958, now abandoned.

A primary object of the invention is to provide a novel and improved spring-closed door of this type that shall be especially adapted for use in cooler rooms and rooms in warehouses, factories, and the like, which can be easily opened in either direction by the pressure of a wheeled truck against the door and shall be automatically closed by a spring mechanism.

Another object of the invention is to provide a pair of doors each of which is hingedly connected at one vertical edge to a door frame so that the doors may swing into a common plane transversely of the door opening to close the latter, and novel and improved spring mechnism to provide selectively for either individual or simultaneous opening and closing of the doors.

Still another object of the invention is to provide a spring-closed, swinging, shock-absorbing door which shall include a novel and improved construction and combination of a door, an elongated strip of flexible strain-resistant material extending from the top edge to the bottom edge of the door, or a plurality of strips spaced apart along the vertical edge of the door and fast-connected at their longitudinal edges to said door and to the door frame or jamb, respectively, for hingingly connecting the door to the frame, a spring mechanism for closing the door including a spring connected at one end to the door and at its other end to the frame, particularly the top margin, of the door opening, and whose force is close to uniform through the extension and extraction of the spring, and a bumper on each side of the door comprising a substantially rigid sheet connected by a pintle hinge to the door adjacent said hinged mounting of the door to swing on a vertical axis, each sheet being of the size and located on the door to be abutted by a wheeled truck to open the door for passage of the truck through the door opening, a flexible normally elastically taut connector passing freely through an opening in the door and connecting together said rigid sheets, and a resilient element interposed between said sheet and said door and normally biasing the corresponding rigid sheet and the other rigid sheet from and toward the door, respectively, to absorb the shock incident to the bumping of a truck against the side of either of said rigid sheets, whereby the door shall open in either direction with substantially uniform low spring resistance and will close under substantially the same spring resistance and when a wheeled truck strikes the door, the door in effect shall "ride with the blow" rather than resist it and the shock of the impact shall be largely absorbed by the resilient elements so that only the steady pressure incident to movement of the truck through the door is transmitted to the door and there is a minimum tendency toward bouncing, whipping or snap action of the door, thereby reducing the shocks and vibrations on the door and the strain and wear on the parts that would be incident to such shocks and vibrations.

Further objects of the invention are to provide in such a combination a novel and improved door which shall be light-weight and at the same time strong and resistant to blows such as might be incident to a moving wheeled truck striking the door, and due to the lightness of the door, the forces and shocks imposed upon the hinges connecting the door to the frame and upon the bumpers and the hinges that connect them to the door, shall be of small magnitude and thus insure long life of the door construction; and thus to provide a door which shall include a rigid frame, for example, a rectangular wooden frame, thin sheet metal sides, such as sheet aluminum, secured to the frame in opposed spaced relation to each other, and a light-weight preferably cellular rigid core such as expanded and cured honeycomb filler made by the Union Bag-Camp Paper Company comprising corrugated strips of resin impregnated paper adhesively secured together, or urethane foam or of one or more plastic sheets having reinforcing ribs and grooves therein rigidly secured, as by adhesive, to the frame and to the metal sheets, the corrugated strips being disposed edgewise with respect to the metal side sheets so that the planes of the strips are perpendicular to the planes of the side sheets, thus serving in effect as struts, or to provide a door formed of two molded, ribbed synthetic plastic shells, such as polystyrene, secured together.

Light-weight hingedly mounted doors when used in the cooler rooms and other places in which currents of air flow through the door opening, have a tendency to swing under the influence of the air currents in the direction of flow of the air currents. Another object of the invention is to provide a door of the character described which shall include novel and improved means for compensating such forces incident to air currents so as to bias the door into its normal closed position.

Other objects, advantages, and results of the invention will be brought out by the following description in conjunction with the accompanying drawings in which:

FIGURE 1 is a front elevation of a pair of swinging doors mounted in a door frame in accordance with the invention, portions of the doors and frame being broken away;

FIGURE 2 is a horizontal sectional view approximately on the plane of the line 2—2 of FIGURE 1 showing the doors in top plan view and illustrating them being swung in one direction into partially open position in broken lines;

FIGURE 3 is a greatly enlarged fragmentary horizontal sectional view approximately on the plane of the line 3—3 of FIGURE 1;

FIGURE 4 is a transverse vertical sectional view approximately on the plane of the line 4—4 of FIGURE 1;

FIGURE 5 is an enlarged fragmentary perspective view of one of the doors with portions broken away and other portions shown in section;

FIGURE 6 is an enlarged fragmentary horizontal sectional view approximately on the plane of the line 6—6 of FIGURE 1, with the door illustrated in normal closed position;

FIGURE 7 is a similar view showing the door swung in partially open position in one direction;

FIGURE 8 is an enlarged fragmentary vertical sectional view approximately on the plane of the line 8—8 of FIGURE 2 with portions omitted;

FIGURE 9 is a horizontal sectional view approximately on the plane of the line 9—9 of FIGURE 8;

FIGURE 10 is an enlarged fragmentary horizontal sectional view on the plane of the line 10—10 of FIGURE 1;

FIGURE 11 is a similar view of another construction;

FIGURE 12 is an enlarged fragmentary plan view on the plane of the line 12—12 of FIGURE 1;

FIGURE 13 is a view similar to FIGURE 2 but show-

ing only one of the doors and a modification of the spring means for compensating the forces imposed on the door by air currents;

FIGURE 14 is a fragmentary side elevation of the construction shown in FIGURE 13;

FIGURE 15 is an enlarged fragmentary transverse vertical sectional view on the plane of the line 15—15 of FIGURE 14;

FIGURE 16 is a detached front elevation of a door embodying a modified construction;

FIGURE 17 is a transverse vertical sectional view approximately on the plane of the line 17—17 of FIGURE 16; and

FIGURE 18 is a horizontal sectional view approximately on the plane of the line 18—18 of FIGURE 16.

It will be understood that the invention may be embodied in either a single door construction or a double door construction, but for the purpose of illustrating the principles of the invention, a pair of swinging doors have been shown in the drawings.

Referring to the drawings, the reference character A generally designates a door frame that includes a jamb 1 and a lintel or header 2 that with the floor B and a building provide a door opening in which are hingedly disposed a pair of doors C and D that are normally arranged in a common plane across the door opening so as to complement each other for closing the door opening as shown in FIGURES 1 and 2. In FIGURE 2, the the two doors are shown in top plan view by solid lines in closed position, and the doors are shown in broken lines as being pushed open by a wheeled truck, the bumper of which is shown in broken lines E.

Each door is connected to the corresponding jamb by a hinge F that, preferably, also serves to seal the gap between the edge of the door and the jamb, although it may be desirable to provide a sealing strip G at each of opposite sides of the hinge extending from the top edge to the bottom edge of the door. The hinge may comprise a strip or piece 3 of flexible, non-stretchable laminated sheet material comprising alternate layers of canvas and neoprene or leather and neoprene, each strip being connected along one edge by angle bars 4 to the corresponding jamb as best shown in FIGURE 6, while the other edge of the strip is secured to the edge of the corresponding door, for example, by rivets or the like 5. Preferably, the door is formed so as to be both light in weight and strong and resistant to blows and vibrations, and the door includes a rectangular wooden frame having side stiles 6 and 7, a top rail 8 and a bottom rail 9. To each of opposite sides of the frame is rigidly secured a face panel or sheet 10 that is preferably formed of material, for example, aluminum, and within the wooden frame and between the face panels is a light-weight core or filler H which in FIGURE 5 is shown as comprising the well-known expanded and cured honeycomb made by the Union Bag-Camp Paper Company and comprising a plurality of corrugated strips 11 of heavy paper that are impregnated with a resinous material and adhesively secured together so as to provide the effect of a honeycomb. As shown in FIGURE 5, the strips are of the order of three-quarters of an inch wide and are disposed edgewise to the face panels 10 or transversely of the plane of the frame, approximately perpendicular to the planes of the face sheets so as to serve in effect as struts.

It will be understood that a light-weight door could be formed in other ways and without a core; for example, the door could be formed of two molded shells of plastic material such as polystyrene secured together as shown in FIGURES 16 through 18 and as will be more fully described hereinafter.

Preferably one stile of the door, in the present instance, the wider stile 6, is provided with a deep groove 14 in its edge extending throughout the height of the door in which one edge of the hinge strip 3 is fitted as

best shown in FIGURE 6, the strip being secured in the groove by the rivets or other fastening members 5. The other edge of the hinge strip may be secured between the corresponding angle bars 4 by suitable fasteners such as bolts or rivets 15 and the angle bars may be secured to the door frame by suitable fasteners such as screws 16. As shown, the hinge strip may extend the full height of the door and may be reinforced at spaced points along the vertical edge of the door by additional flexible hinge pieces 17, or there may be a plurality of hinge strips spaced apart along the vertical edge of the door like the hinge pieces 17. When the strip runs the full length of the door, it may itself seal the space between the door frame and the hinge edge of the door, although when separate hinge pieces are utilized it is necessary to provide the cover strips G to seal the spaces between the spaced hinge strips.

The swinging edges of the door are provided with complemental sealing devices 18 that abut each other when the doors are in closed position as shown in FIGURES 1 and 2; and as shown, each device includes a strip of flexible material such as neoprene or synthetic resin plastic fastened to the edge of the door in the nature of a flap to coact with a corresponding strip on the juxtaposed edge of the other door when the doors are in closed position, as shown in FIGURES 1, 2 and 13.

With the construction so far described, it will be observed that the doors normally will be in a common plane across the door opening to close the opening as shown by solid lines in FIGURES 1 and 2, and that the doors, either individually or at the same time, can be swung about the flexible hinges F into open position as indicated by broken lines in FIGURE 2. The invention provides spring mechanisms for closing the doors of such nature that the doors are opened and closed under substantially uniform spring tension. As shown, there is a power spring device I mounted on one side of each door adjacent the upper and swinging edges thereof, each of which includes a spiral power spring 19 one end of which is fixedly connected through a cup-shaped element 20 to a stud 21 that is non-rotatably mounted on the arm 22 of a bracket 23 that is secured to the door as by screws 24. The other end of the spring is connected to a casing 25 that is rotatably mounted on the stud 21 and has rigidly connected thereto a pulley flange 26 around which is wound a cable 27 one end of which is fixedly connected to the pulley flange and casing. The spring preferably is of the so-called uniform tension type of the general nature described in Patents Nos. 2,833,534, dated May 6, 1958, and 2,609,191, dated September 2, 1952. One suitable device is denoted "Spir'ator" and is made by Hunter Spring Company, of Lansdale, Pennsylvania.

The other ends of the cables 27 may be connected to the header or lintel 2 as by a stud 29 as shown in FIGURE 10, with the said ends of the cables connected together and slidably passing through an opening 28' in a guide element 29 on the header or lintel 2. In other cases, it may be desirable to connect the free ends of the two cables to a stud 28 secured on the lintel as shown in FIGURE 11. The tension of the springs is such as to yield when pressure is applied to the doors so as to permit the doors to be opened, the tension also being adequate to swing the doors into their closed positions from their open positions. Pressure on either door will cause opening of that door and the corresponding spring will close the door. Pressure simultaneously on both doors, as by the bumper E of a wheeled truck, will cause simultaneous opening of the doors and the spring mechanisms will close the doors. When the cables are connected together as shown in FIGURES 1 and 2, the tensions of the two springs will tend to pull the two doors simultaneously into their common plane and the tensions of the two springs oppose each other. With such a construction the tendency to snap action or whipping of the doors as

they swing to their closed positions is practically eliminated.

It will be understood that the spring devices I could be mounted on the header or lintel with the ends of the cables 27 connected to the doors, and it will also be understood that the positions of the spring devices and the studs and elements 29 and 28 may be changed to suit different doors and different conditions.

It is desirable, especially when the doors are used for cooler rooms, to provide sealing means at both the top and bottom edges of the doors. As shown, there is a strip 31 of flexible, wear-resistant material such as neoprene secured to each side of the top edge of each door to wipe against the underside of the lintel, and a flexible resilient sealing flap 32 is attached to the bottom edge of each door to resiliently frictionally engage the doorsill or floor.

Another feature of the invention is a bumper J pivotally connected to each side, that is, each of the front and rear sides of the door, to assume the shocks incident, for example, to the pushing of the doors into open position by a wheeled truck. The bumpers are of such weight and width and are so related to the lower edges of the doors that they may be engaged by the bumper E of a power driven truck approaching the doors from either side thereof. Conveniently, the bumpers may comprise sheets 33 of plywood or other light-weight, force-resisting material having a wear-resisting facing layer 34 of for example a metal such as steel. Each bumper is shown as hingedly connected to the door by a pintle hinge that includes a hinge leaf 35 rigidly secured to one edge of the sheet 33 as by bolts or rivets 36 and having hinge knuckles 37 spaced apart along its other edge which extends parallel to the vertical edge of the door. The hinge leaf 35 cooperates with a complemental hinge leaf 38 that is rigidly secured as by suitable fastening elements 39 to the door and has hinge knuckles 40 disposed in axial alignment with the hinge knuckles 37 when the door is installed. The two hinge leaves are pivotally connected by hinge pintles 41 that extend through the complemental hinge knuckles 37 and 40. The bumper sheets 33 are normally inclined outwardly from the corresponding faces of the doors from the hinges toward the swinging edges of the doors so that the free ends of the bumper sheets may hingedly swing toward and from the corresponding sides of the door. The movements of the bumper sheets toward the corresponding door is limited by resilient elements 42 which may be of any suitable construction and normally bias the corresponding sheets 33 away from the door. Preferably the elements 42 are blocks of polyurethane foam, foam rubber or other suitable resilient material that has a wear-resisting surface or may be enclosed in a wear-resistant casing. As best shown in FIGURE 2, the blocks 42 are roughly triangular in top plan with their thicker ends disposed in closely spaced relation to the swinging edges of the door and the bumper sheets, and their other ends are normally in spaced relation to the bumper sheets so that as the bumper sheets are pressed toward the door, the thicker ends of the resilient blocks 42 are first compressed and then continued pressure is gradually applied by the bumper sheets to the other portions of the blocks as the sheets move toward the door.

In accordance with the invention, the two bumper sheets on each door are normally yieldingly urged or biased toward the corresponding side of the door and into contact with the corresponding resilient cushion block 42; and for this purpose, I have shown a connector generally designated 43 which extends through an opening 44 in the door and has each of its opposite ends pivotally connected at 45 to one of the bumper sheets 31, as best shown in FIGURE 3. Preferably, the connector includes a tension spring 46 that continuously urges the two bumper sheets toward each other and into contact with the resilient cushion blocks 42 which also serve as stops for the

bumper sheets. It will be observed that with this construction, the bumper sheets are normally held in the positions shown in FIGURE 2 with their swinging edges in approximately equidistantly spaced relation to the corresponding sides of the door, and each block normally biases its corresponding bumper sheet away from the door and simultaneously presses the other bumper sheet toward the door, and the spring 46 maintains a normally taut flexible connection between the bumper sheets normally drawing the sheets into contact with respective cushion blocks 42, whereby vibration of the bumper sheets relative to each other and to the corresponding door is reduced to the minimum.

Where the door is used in a door opening through which strong currents of air may pass, such currents of air have a tendency to swing the doors toward their open position in the direction of flow of the air currents. The invention provides means to compensate the forces of such air currents so as to maintain the doors in closed position. As shown in FIGURES 1, 2 and 12, there is an arcuate rod 47 approximately concentric with the axis of the hinge of each door and having its ends secured at 48 to the corresponding door frame and its intermediate portion passing loosely through a hole 49 in the door. Slidably mounted on the rod and in abutment with opposite sides of the door are abutment plates or rings 50 against each of which bears one end of a compression spring 51, the other end of which abuts a nut 52 that is screw threaded on the corresponding end of the rod 47. The compression of the two springs is adjusted so that they complement each other and normally offset or compensate the air pressure on one side of the door so as to hold the door in its normal closed position under the influence of such air pressure but to permit the door to freely swing in either direction to open or close.

Another form of the invention is shown in FIGURES 13–15, inclusive, where there is an helical spring 53 mounted on a pivot pin 54 that is secured in a suitable bracket 55 on one of the angle bars 4, one end of the spring abutting the angle bar or door frame as indicated at 56 and the other end 57 bearing upon one side of the door. The spring is mounted on one side of the door and has such tension that it will resist swinging of the door in one direction under the influence of the air current, and for convenience a suitable means may be provided for adjusting the tension in accordance with the conditions under which the door is intended to operate. For example, the end 57 of the spring may pass through an opening 58 in a block 59 that is relatively slidably mounted in a guide channel 60 secured on the side of the door, the block being slidably adjustable along the end 57 of the spring and being rigidly clamped in adjusted position by a thumb screw 61 screwed into the block 59.

It will be understood by those skilled in the art that means for adjusting the tension of the spring could be used at the other end of the spring, for example, for swinging the end 56 of the spring relative to the door frame so as to vary the tension of the helical coil 53.

It has been found that the spring mechanism I, the flexible hinge strip connecting the door to the frame and the strong light-weight door having the thin flexible face panels and the light cellular but strong core, and the bumpers with their sheets hingedly connected to the door, complement each other in a unique and highly advantageous manner so that the doors can be opened with substantially a uniform force applied thereto and without bouncing or snapping action. In other words, when the doors are pushed open by a power driven truck, the doors in effect "ride with the blow" or hug the bumper of the truck and thus move smoothly and uniformly with the truck, and after the truck has passed, the doors swing smoothly and uniformly into their closed position with practically no whippinng action. The construction and combination of the parts provides a door wherein the shocks incident to impact of, for example, a motor driven

truck, are effectively absorbed with a minimum of relative vibration of the parts.

As hereinbefore indicated, a light-weight door may be formed of synthetic plastic material without a core. One example of such a door is shown in FIGURES 16 through 18 where reference characters **62** and **63** designate two molded shells formed of suitable synthetic plastic material having their edges in abutting relation to each other and secured together as by sealing. Preferably inturned flanges **64** are provided at the top, bottom and one vertical edge of the door that are secured together in abutting relation to insure a firm and rigid connection of the two shells.

The other vertical edge of the door has the hinge F' connected thereto. This connection may be effected by securing a wooden filler strip **65** between the edges of the two shells **62** and **63**, having a groove **66** in which the hinge is secured by pins or other fastener elements **67**.

Each shell is reinforced as by ribs molded into the shells and projecting from the inner surfaces thereof so as to leave the outer surfaces of the shells substantially smooth. Some of the ribs may extend approximately longitudinally of the shell as indicated at **68** while others may extend horizontally as indicated at **69** and others may be formed diagonally as indicated at **70**, to provide adequate reinforcement against collapse under pressure incident to opening of the door by a wheeled truck.

The panels may be molded with recesses **71** in their outer faces in which the bumpers J' are mounted. With this construction, the bumpers do not project as far outwardly from the faces of the doors as do the bumpers J hereinbefore described. The shells may also be molded with a window opening **72** in which may be mounted a pane of glass or other transparency **73**.

The door may be mounted in the same manner as the doors C and with the same spring mechanisms I, and it will be seen that the doors will operate in substantially the same manner as the doors C and D, the molded plastic shells performing the same function as the wooden frame and aluminum panels hereinbefore described, and the reinforcing ribs **69** performing functions similar to those incident to the cellular core H.

It will be understood by those skilled in the art that the now preferred embodiments of the invention have been illustrated primarily for the purpose of explaining the principles of the invention and that many modifications and changes can be made in the construction of the door and the bumpers within the spirit and scope of the invention.

I claim:

A spring-closed shock absorbing door including a door having angularly related edges, means comprising a strip of flexible strain-resistant material having one edge connected to said door and its other edge to be connected to the side margin of a door frame for hingedly connecting the door to a door frame along one of said edges to swing in each of opposite directions between open and closed positions, spring mechanism for closing said door including a bracket mounted on the door, a spiral spring having one end connected to said bracket and its other end connected to a spool rotatably mounted on the bracket, and a cable wound on said spool with one end to be connected to the top margin of the door frame, the force of said spring being close to uniform during extension and contraction of the spring, and a bumper on each side of the door comprising a substantially rigid sheet hingedly connected at one end to the door adjacent said hinged mounting of the door to swing on a vertical axis, each sheet being of a size and located on the door for engagement by a wheeled truck to open the door for passage of the truck through the door opening, a flexible connector passing freely through an opening in the door and connecting together said rigid sheets, and a resilient element interposed between each said sheet and said door and normally biasing the corresponding rigid sheet and the other rigid sheet from and toward the door, respectively, to absorb the shock incident to the bumping of a truck against the side of said rigid sheets, said hinged connection of each rigid sheet to the door comprising leaves rigidly secured respectively to the rigid sheet and the door and having complemental hinge knuckles, and a pintle inserted through said knuckles, and said door comprising a rectangular wooden frame having a thin metal facing sheet rigidly secured to each side thereof, and a light-weight cellular core rigidly secured to said frame and to said sheets.

References Cited in the file of this patent

UNITED STATES PATENTS

1,186,720	Westhoff	June 13, 1916
1,455,967	Pals	May 22, 1923
1,776,005	Miller	Sept. 16, 1930
2,337,716	Hall	Dec. 28, 1943
2,593,403	Bailey	Apr. 22, 1952
2,734,234	Eckel	Feb. 14, 1956
2,797,435	Decker et al.	July 2, 1957
2,827,670	Schwindt	Mar. 25, 1958
2,829,915	Claveau	Apr. 8, 1958

FOREIGN PATENTS

11,012	Great Britain	May 21, 1896