United States Patent [19]

Imhoff

[11] **3,894,356**

[45] **July 15, 1975**

[54] **DOOR COORDINATOR**

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[73] Assignee: **Leigh Products, Inc.**, Coopersville, Mich.

[22] Filed: **Mar. 28, 1974**

[21] Appl. No.: **455,609**

[52] **U.S. Cl.** **49/366**; 16/82; 292/262

[51] **Int. Cl.**[2] **E05C 7/05**

[58] **Field of Search** 49/366, 367, 368, 369; 292/262; 16/82

[56] **References Cited**

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Attorney, Agent, or Firm—DeLio and Montgomery

[57] **ABSTRACT**

A door coordinator for pairs of swinging doors comprising a pair of arms on a common hub pivotally mounted in a bracket on the door frame, a longer arm adapted to move vertically into and out of the path of an active door and a shorter arm provided with a cam surface supplemented or constituted by a roller so located that the inactive door engages the cam surface and/or the roller for controlling the vertical movement of the shorter arm relative to the inactive door and the simultaneous vertical movement of the longer arm into and out of the path of the active door.

5 Claims, 11 Drawing Figures

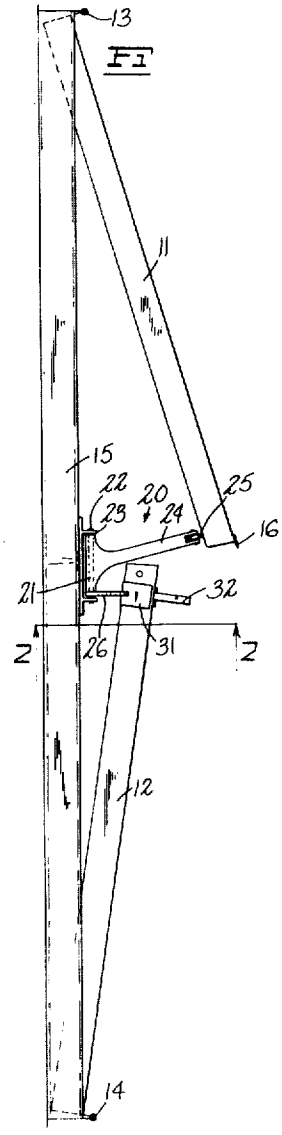


Fig. 1
PRIOR ART

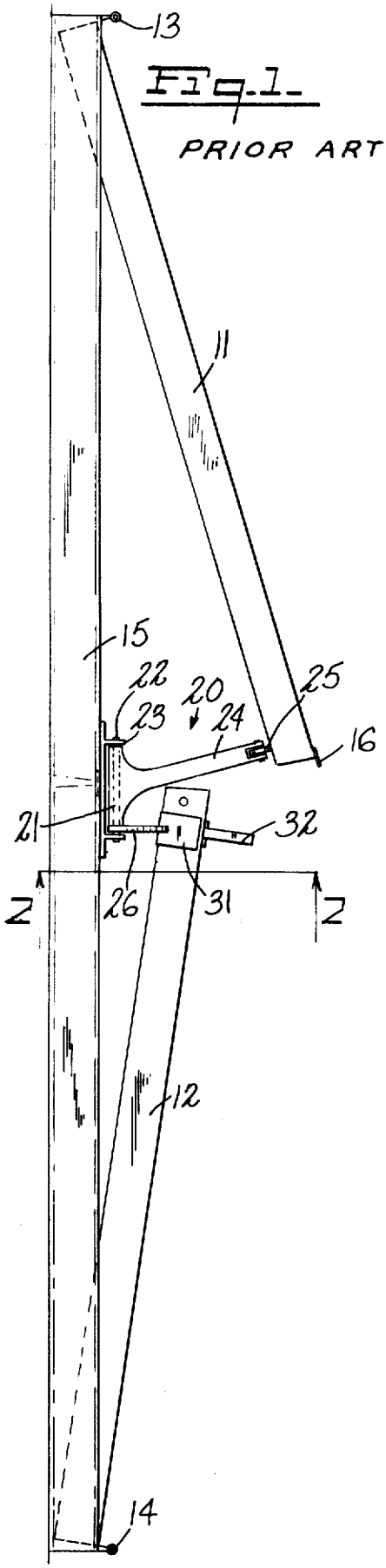


Fig. 2
PRIOR ART

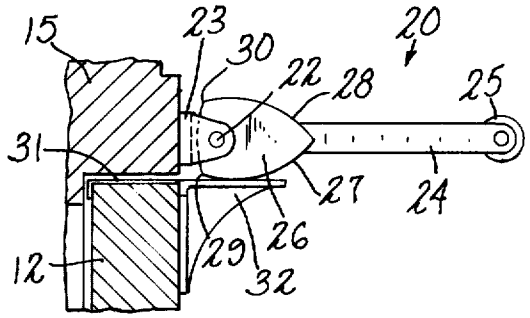


Fig. 3
PRIOR ART

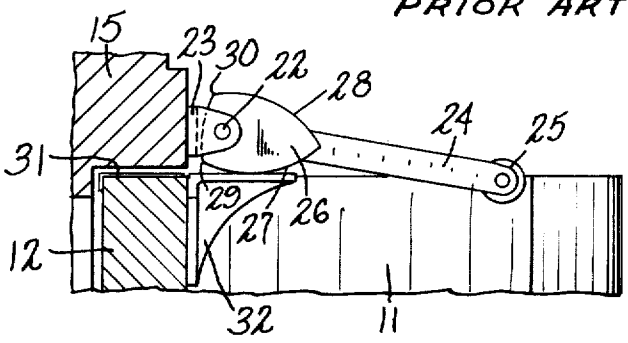


Fig. 4
PRIOR ART

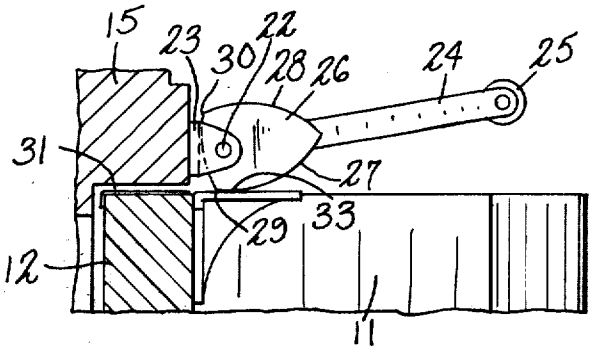


Fig. 5.

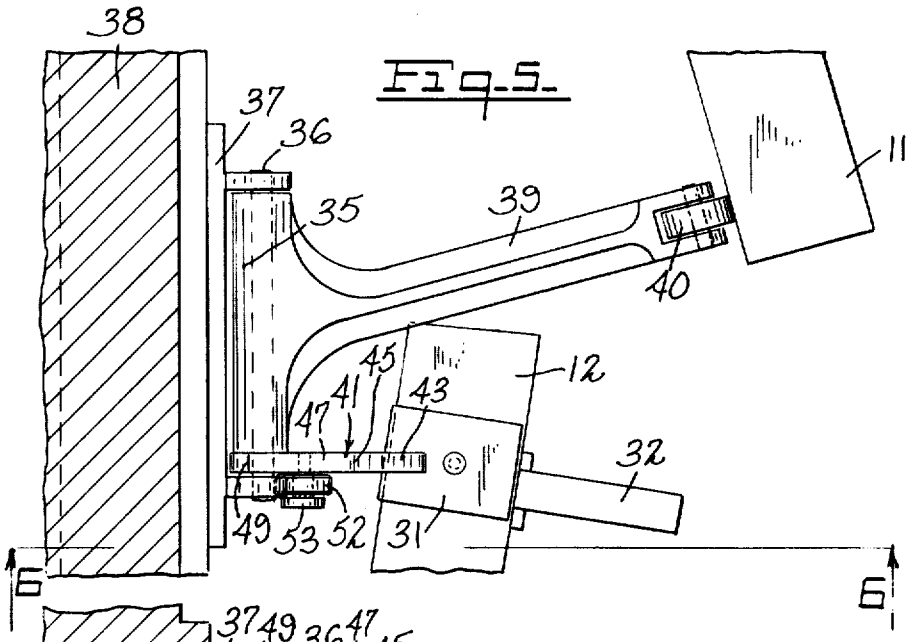


Fig. 6.

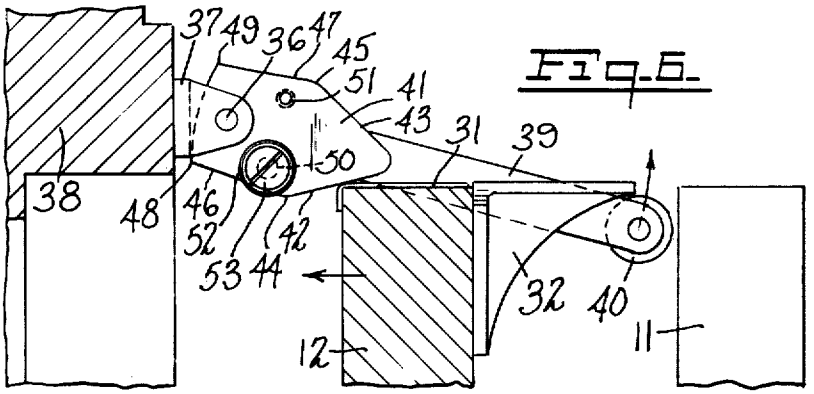


Fig. 7.

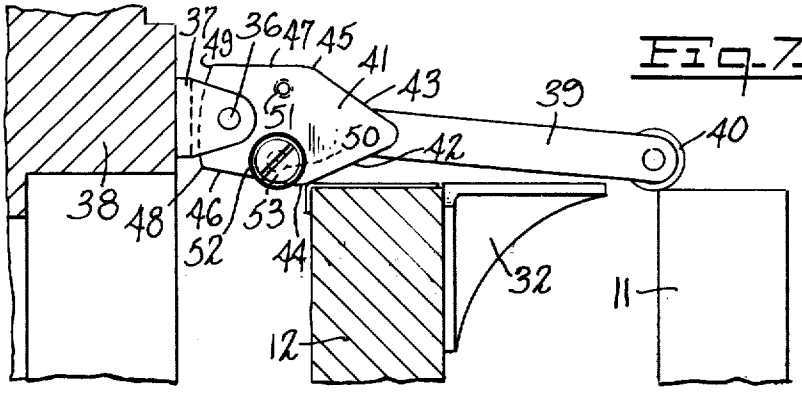


Fig. 8.

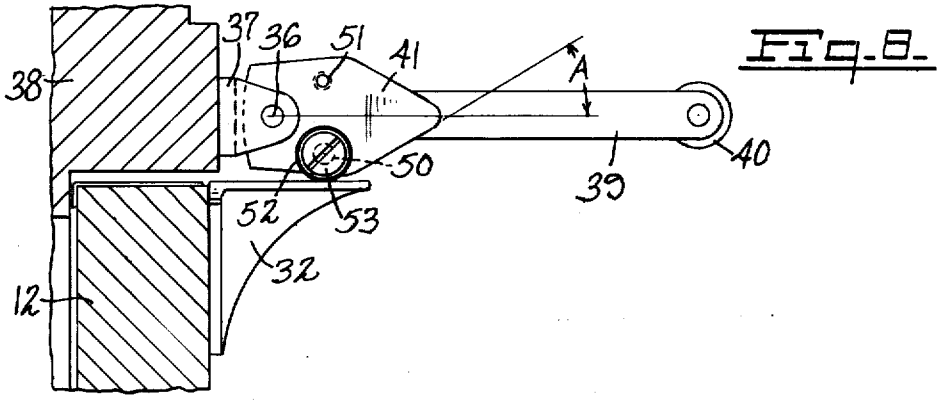


Fig. 9.

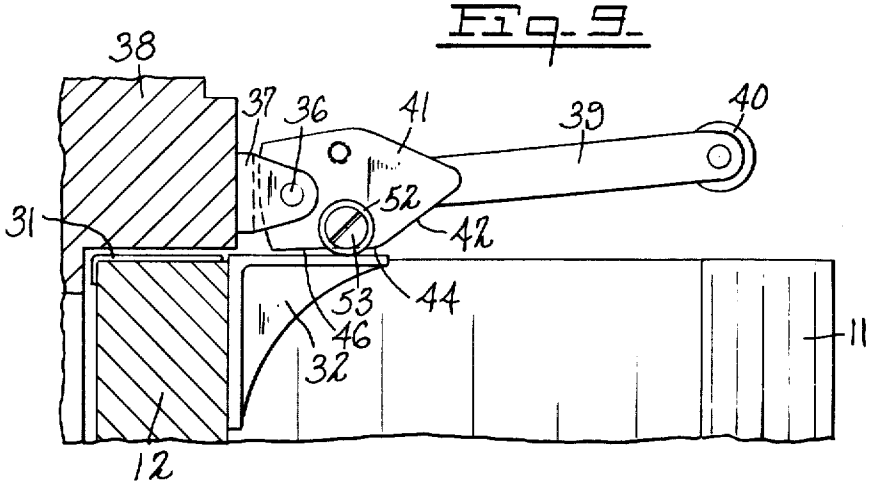


Fig. 10.

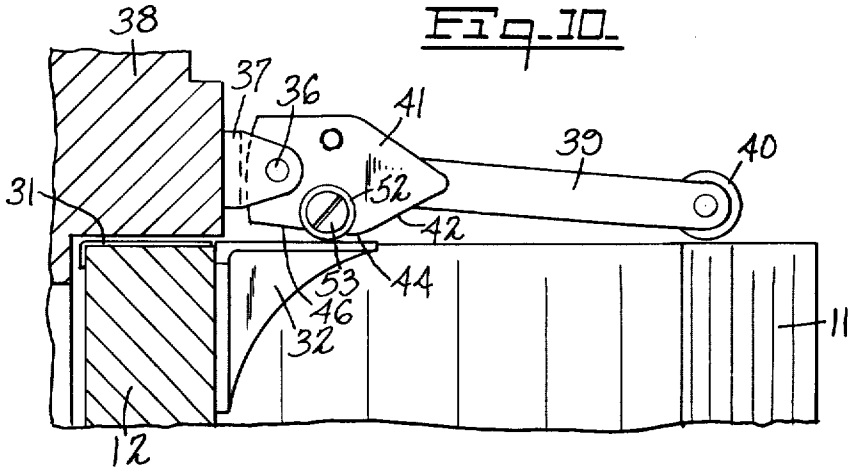
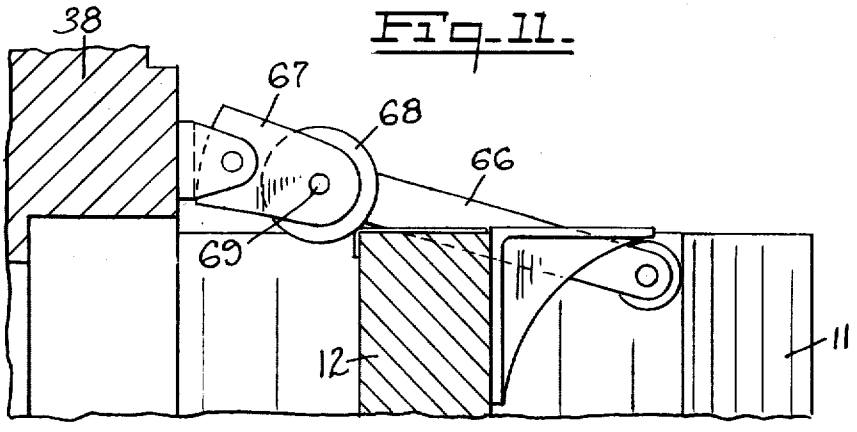


Fig. 11.



DOOR COORDINATOR

This invention relates to a door coordinator for properly controlling the sequential closing of a pair of swinging doors in which one is an active door and the other an inactive door.

In many installations, pairs of doors are utilized which are hinged to a door opening at the outside edges thereof.

The active door, in which the center latch is installed, is normally used to pass through the opening. The inactive door, which contains the strike for the center latch, is normally held closed by top and bottom bolts.

To insure proper clearance of an astragal, which may be mounted on either or both doors, or other hardware devices, a door closing coordinator is required. The coordinator holds the active door open until the inactive door reaches a closing position.

Such door coordinators generally comprise a hub member which is pivotally mounted about an axis above the top edges of the door. Such hub member has a first long arm which extends outwardly and downwardly to engage the active door and hold it until the inactive door reaches a closing position and releases the active door.

Defined on the hub member is a shorter arm which includes a camming surface adapted to be engaged by a strike plate mounted on the top edge of the inactive door to pivot the hub member and longer arm upwardly to insure that the active door is closed after the inactive door.

In a coordinator of the type just described, the distance traversed by the edge of the inactive door, from the point of first contact with the cam to the closed position, is quite short (e.g., about twice the door thickness) so that the cam profile heretofore used has presented a somewhat steeply angled surface to the contacting edge of the inactive door, in order to ensure adequate lifting of the longer member, and the cam surface has been convexly curved to maintain a comparably steep angle of contact as the inactive door approaches its closed position. It has been found that a cam of that shape must be located very precisely, in vertical relation to the top edge of the door. If too high, it will fail to lift the longer member clear of the active door. If too low, it may jam against the top of the inactive door and prevent or impair the latter from opening.

In view of the deficiencies of these present door coordinators the present invention provides a new and improved door coordinator in which criticality of placement of the coordinator is obviated, and the coordinator is more easily operated by the inactive door.

Briefly stated, the invention in one form thereof comprises a hub member as previously described with the stopping arm extending outwardly and downwardly therefrom when in an operative position and a linear camming surface which at all times insures a small contact angle with the active door. Preferably the camming means comprises a shorter arm providing a camming surface adapted to be engaged by the inactive door and a rolling member rotatably mounted behind the camming surface with its periphery extending beyond the camming member so as to be engaged by the strike plate mounted on the upper edge of the inactive door as the inactive door nears its closed position. The addition of the roller makes it possible to dispose the cam surface at a very advantageous angle, and insures proper functioning even when the coordinator is mounted at an incorrect height with reference to the top of the inactive door.

An object of this invention is to provide a new and improved coordinator for a pair of doors.

Another object of this invention is to provide a door coordinator having new and improved camming means adapted to be operated by the inactive door which camming means is relatively unaffected by misalignment of the coordinator mounting.

The features of the invention which are believed to be novel are particularly pointed out and distinctly claimed in the concluding portion of this specification. The invention, however, both as to its operation and organization together with further objects and advantages thereof may best be appreciated by reference to the following drawings wherein:

FIG. **1** is a top plan view of a pair of swinging doors provided with a coordinator according to the prior art where the doors are shown in an almost closed position where the coordinator starts to become operative;

FIG. **2** represents a vertical section seen in the plane of lines **2—2** of FIG. **1** with the doors closed and the coordinator in an inoperative position;

FIG. **3** is a view similar to FIG. **2** but with the coordinator mounted too high;

FIG. **4** is a view similar to FIG. **2** but with the coordinator mounted too low;

FIG. **5** represents a top plan view of the coordinator according to the invention associated with a door head frame and the corners of a pair of swinging doors in a position corresponding to that of FIG. **1**;

FIG. **6** represents a vertical section on the line **6—6** of FIG. **5**;

FIG. **7** represents a vertical section, corresponding to FIG. **6** with the inactive door nearly closed;

FIG. **8** represents a vertical section, corresponding to FIGS. **6** and **7** with both doors closed;

FIG. **9** is a view similar to FIG. **8** but with the coordinator mounted low;

FIG. **10** is a view similar to FIG. **8** but with the coordinator mounted high, and

FIG. **11** is a view similar to FIG. **6** showing another embodiment of the invention.

The disclosure of FIGS. **1** to **4** represents prior art.

As shown in FIG. **1**, swinging doors **11, 12** are hinged at **13, 14** to close beneath a head frame **15.** Each door is normally equipped with a door closer of any suitable type, not shown. The previously described active door **11,** having an astragal **16,** must be prevented from closing until the inactive door **12** has passed it and closely approached the closed position. It is the function of the coordinator **20** to effect this timing. The coordinator comprises a hub **21** pivotally supported by an axle or bearing member **22** in a bracket **23** mounted on the front of the head frame **15.** Extending outwardly and downwardly from the hub is a long arm **24** angled so that its free end carrying a rotatable roller **25** can move into and out of the path of the active door **11.** A shorter arm **26** in the form of a cam extends from hub **21** into the path of the inactive door. The arm **26** has curved lower and upper cam surfaces **27, 28** which are symmetrical with respect to a plane passing through the axis of the axle **22** and the center line of the longer arm **24.** Such symmetry makes the coordinator reversible to cooperate with pairs of doors having either the right-hand door or the left-hand door the active one. The

cam surfaces terminate rearwardly at corners **29, 30** adapted to abut the bracket **23** and to limit the downward rotation of the arms to a predetermined angle, normally approximately **15°** from the horizontal.

When the bracket is installed in its proper relation to the top of the inactive door **12,** the strike plate **31** on that door comes into contact with the cam surface **27,** at an angle of about **22°,** and further movement of the door **12** swings the coordinator upward so that the roller **25** on the arm **24** frees the door **11** from its stopped position and permits it to follow the inactive door to the fully closed position of FIG. **2,** the cam surface **27** then resting on the door bracket **32** and the arms lying in a substantially horizontal position.

In practice, it has been found that vertical deviations in the height of the bracket **23,** amounting to less than one-sixteenth inch either way from the proper position, can render the coordinator inoperative. When the bracket **23** is mounted on the head frame about one-sixteenth inch higher than it should be, the strike plate **31** hits the cam surface **27** closer to the axis of rotation of the cam and the continued closing of the door **12** does not lift the arm **24** high enough to release the active door (FIG. **3**). When the bracket **23** is one-sixteenth inch too low (FIG. **4**) the strike plate **31** hits the cam surface **27** close to the point of the cam, at an angle of about **26°**. The continued closing of the inactive door swings the coordinator upward and brings the point of contact **33** between the cam surface **27** and the door bracket **32** to a position only **0.1** inch forward from the axis of the axle **22.** The weight of the arms with this amount of leverage may cause the door to jam or bind in the vicinity of its closed position or greatly hinder its reopening. From the foregoing it will be recognized that the installation of such a coordinator, with tolerances which must be less than one-sixteenth inch, to cooperate with doors at least **30** inches in width, requires a degree of precision that is difficult to maintain in actual practice, particularly when the door hinges may have a vertical position tolerance.

An improved coordinator in accordance with the invention which overcomes these problems is shown in FIGS. **5** to **8** and comprises a hub **35** pivotally supported by an axle **36** in a bracket **37** mounted on the front of a head frame **38.** The hub has a longer arm **39** with a roller **40** on its free end, and a shorter arm **41** in the form of a cam. In its operative position, as shown in FIGS. **5** and **6,** the arm **39** extends downwardly into the path of the door and outwardly to engage the door substantially perpendicularly as viewed in the plan. Arm **41** is positioned to be engaged by the inactive door. The arm **41** has lower and upper cam surfaces **42,** 43, which are symmetrical with respect to a plane passing through the axis of the axle **36** and the center line of arm **39** as seen in FIG. **8.** Each cam surface is substantially straight and lies at an angle A of about **30°** from said plane. The cam surfaces terminate at points **44, 45,** some distance forward from the axis of the hub, and the cams have straight lower and upper edges **46,** 47, extending rearward from said points to the heel corners **48, 49,** which correspond to the corners **29, 30** in FIG. **2,** and also limit the downward rotation of the arms to approximately **15°** below the horizontal. Rearwardly from the points **44, 45** the cam is provided with holes **50, 51** and the roller **52** rotates on a shoulder screw **53** which is fixed in the hole **50.** The peripheral edge of the roller projects beyond the lower edge **46.**

In the coordinator shown, the hole **51** is nonfunctional. It is provided as an alternative to the hole **50** when reverse installation is required, the roller **52** and the screw **53** being then mounted in the hole **51** and the whole assembly being inverted. The roller **52** may suitably be of nylon or an equivalent durable plastic material.

In FIG. **6** the strike plate **31** of the inactive door **12** is just making contact with the cam surface **42** (at a favorable angle of about **15°**) and the active door **11** has been stopped by the end of the longer arm **39.** FIG. **7** shows the strike plate about to clear the point **44** as the roller **40** is about to clear the top of the door **11.** As soon as the strike plate reaches the roller **52** the resistance to closing of the door **12** becomes minimal and it moves readily to its closed position (FIG. **8**) with the roller riding out on the door bracket **32.** The arm **39** is raised to a horizontal position, and the active door closes in its proper sequence.

The mechanism just described is not only very effective in its operation when properly installed, but also functions adequately even with faulty installation. FIG. **9** shows the position of the improved coordinator when mounted too low. The cam surface **42** would still be disposed at the predetermined favorable angle with respect to the horizontal. In this condition, as the inactive door **12** closes, the strike plate hits the linear surface **42** and pivots the cam and hub counterclockwise (as illustrated) and eventually reaches the roller **52.** The operation is the same as exemplified in FIGS. **6, 7** and **8** except that the active door is released sooner and, upon closing, the plane passing through the center line of the arms may reside at a small angle upwardly from the horizontal. However, the roller **52** rests on the door bracket, and keeps the surfaces **46** and edge **44** above the bracket as shown in FIG. **9.** As a result there will be no binding as between the coordinator cam and the inactive door.

If the coordinator is mounted too high, as shown in FIG. **10,** the longer arm **39** will stop the active door as usual and the strike plate of the inactive door will make contact with cam **41** further back along the surface **42,** nearer the point **44,** but again at the same predetermined desired angle. Further closing of the inactive door produces contact of the door strike plate with roller **52** and further lifts the cam and coordinator. Finally, arm **39** will clear the active door and permit closing as shown in FIG. **10.** The arm is slightly below the horizontal, but its end is high enough to clear the active door. In each of the closing positions immediately described above, FIGS. **9** and **10,** the point of contact between the roller and the strike plate or door bracket is spaced a substantial distance away from the axis of axle **22,** so that the leverage is favorable and there is no tendency to bind the inactive door, even if the roller should fail to roll easily.

Thus a coordinator embodying the invention may be installed within greater tolerances, and also to compensate for tolerances in the positioning of the hinges of the doors.

While the combination of a roller with a straight cam surfaces gives particularly desirable results, it would be possible to obtain some advantages by the use of a single, relatively large, roller without a cam surface as shown in FIG. **11.** In this modification the hub, the longer arm **66,** and the hub mounting are substantially as described above, but the shorter arm **67** is bifurcated

and the relatively larger roller **68** rotates on a journal **69** between the bifurcations. The rim of the roller projects beyond the arm **67** above and below the plane of the arms, so that an arcuate surface is in a position to be contacted by the strike plate of the inactive door within a substantial vertical range of mounting and/or adjustment. The angle between the tangent to the roller and the horizontal at the point of contact with the strike plate varies from **45°** to **60°**, depending on the level of contact, and uniformity of operation is difficult to achieve. The roller **68** is of such dimensions that it may suitably be made of metal, rather than plastic, or of metal with a plastic rim.

Studies have shown that, compared to the prior art, the straight cam and roller coordinator according to the invention when used with typical **36** inch doors with conventional door closers and locks, requires **34%** less force at the initial contact of the strike plate with the cam surface to raise the longer arm and allow the active door to close, and requires only **5%** of the force formerly needed during the final **3** inches of closing of the inactive door. This latter decrease in required closing force is important because the momentum of the inactive door is almost used up in raising the arm to free the active door, so that the final **3** inches of closing has to be effected by means of the remaining force exerted by the door closer.

It may thus be seen that the objects of the invention set forth as well as those made apparent from the foregoing description are efficiently attained. While preferred embodiments of the invention have been set forth for purposes of disclosure, modification to the disclosed embodiments of the invention as well as other embodiments thereof may occur to those skilled in the art. Accordingly, the appended claims are intended to cover all embodiments which do not depart from the spirit and scope of the invention.

What I claim is:

1. A door coordinator adapted to control the closing of a pair of swinging doors constituted by an active door and an inactive door hung to swing into and out of closed position beneath a head frame, the coordinator comprising a hub, means mounting the hub on the head frame for rotation about a horizontal axis higher than the top edges of the doors, a pair of arms of unequal length fixed to and projecting from the hub and having their axes in a plane containing the axis of the hub, means limiting the downward swinging movement of said arms, the longer arm being angled with respect to the hub to cause its free end to lie, when below horizontal, in the swinging path of the active door, the shorter arm having a downwardly facing substantially straight elongated cam surface, the cam surface terminating at a bottom edge lying substantially parallel to said plane, and a roller mounted on said shorter arm with its periphery projecting beyond said bottom edge adjacent to the point of termination of the cam surface, said cam surface, in the lower position of the arms, lying in the swinging path of the upper edge of the inactive door.

2. A door coordinator according to claim **1** wherein the downward swinging movement of said arms is limited to an angle of approximately **15°** below the horizontal.

3. A door coordinator according to claim **1** wherein said straight elongated cam surface is disposed at an angle of approximately **30°** to said plane containing the axis of the hub.

4. A door coordinator according to claim **2** wherein said straight elongated cam surface is disposed at an angle of approximately **30°** to said plane containing the axis of the hub.

5. A door coordinator according to claim **1** wherein the shorter arm has an upwardly facing substantially straight elongated cam surface and upper edge, symmetrical with the downwardly facing cam surface and bottom edge, above and below said plane containing the axis of the hub, and which includes means for mounting a roller on said shorter arm with its periphery projecting beyond said upper edge, whereby said coordinator is reversible.

* * * * *