

D. D. CALL

SENSING SWITCH

3 Sheets-Sheet 1

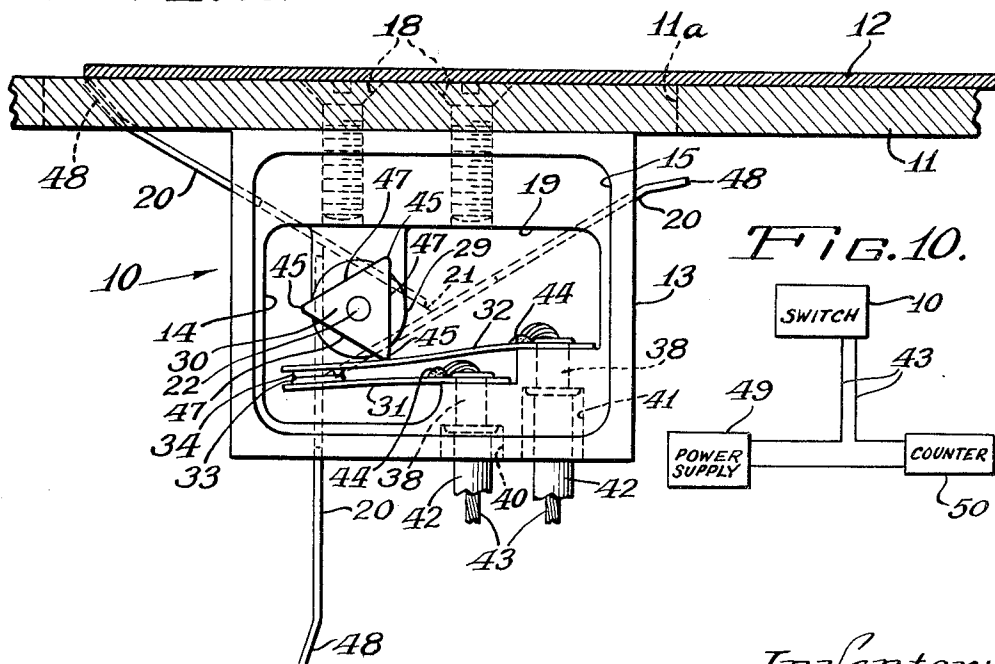


FIG. 10.

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Aug. 24, 1965

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3,202,779

SENSING SWITCH

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3 Sheets-Sheet 2

FIG. 3.

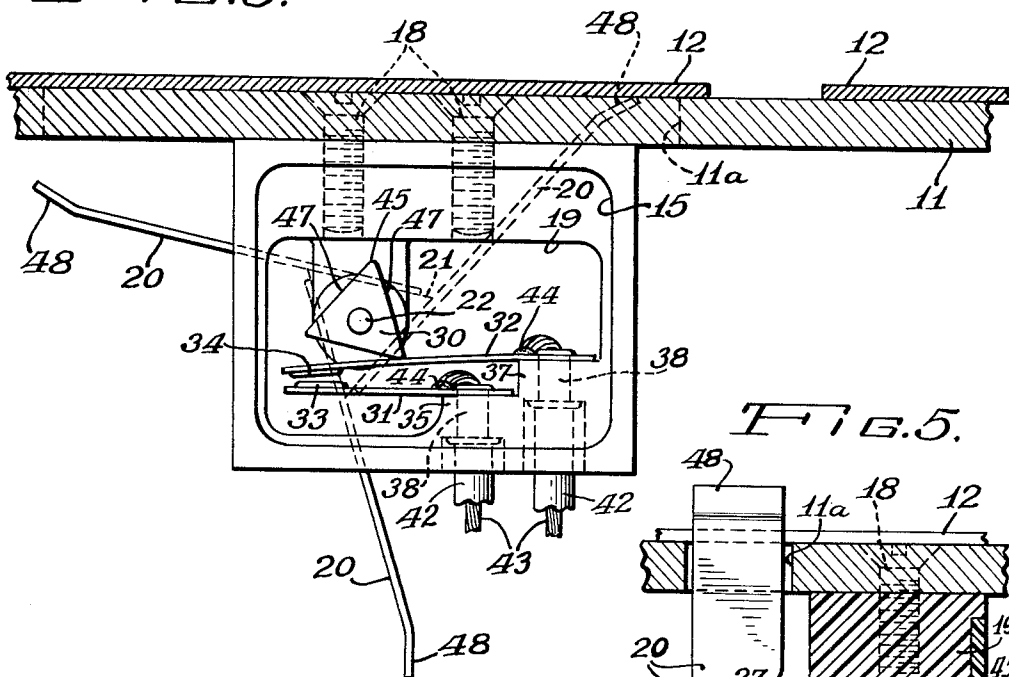


FIG. 4.

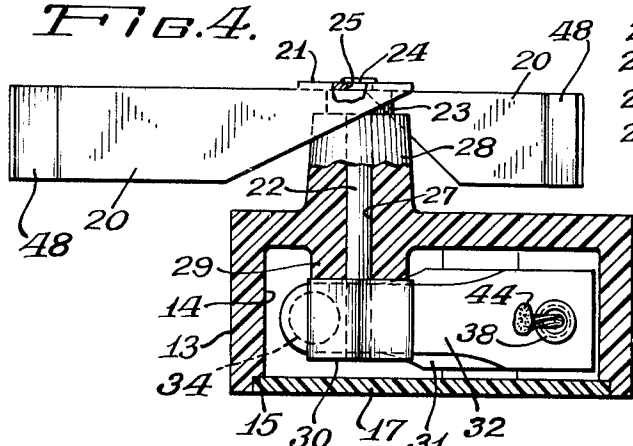


FIG. 5.

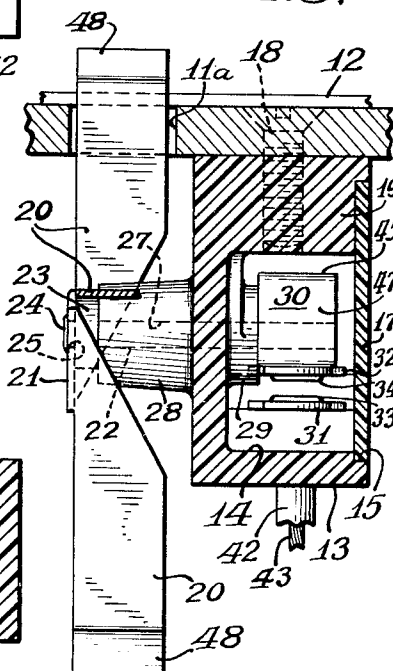
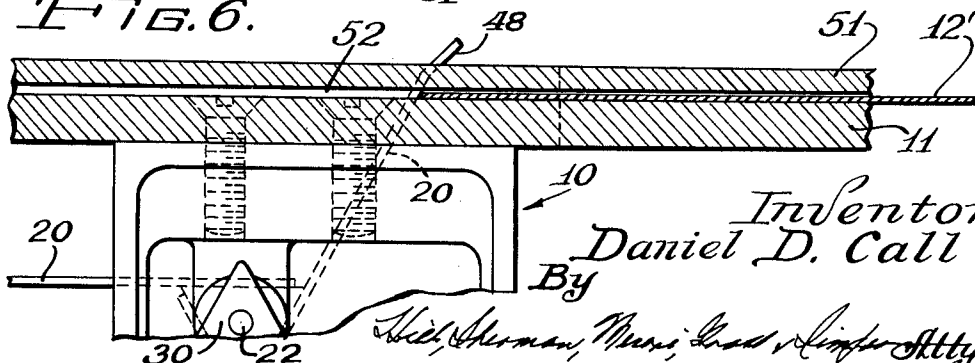


FIG. 6.



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SENSING SWITCH

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FIG. 7.

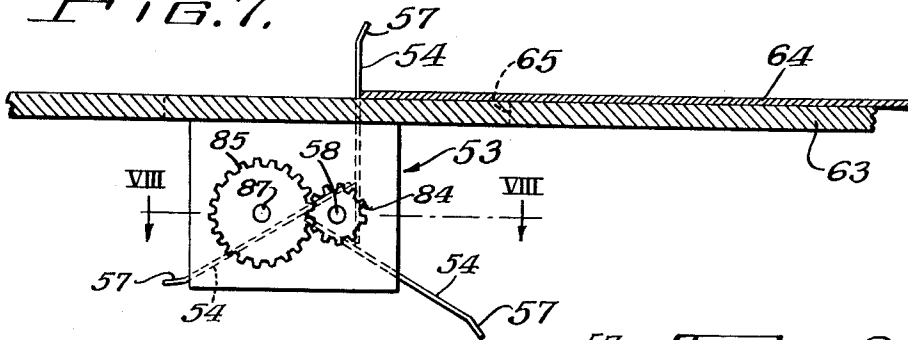


FIG. 8.

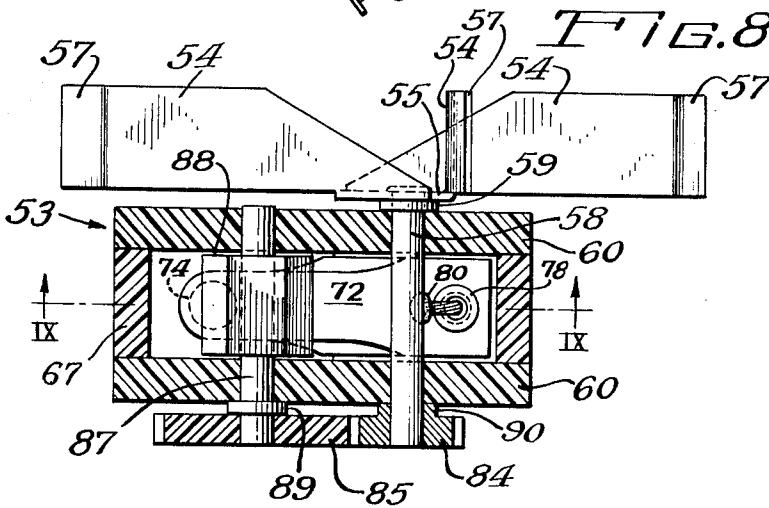
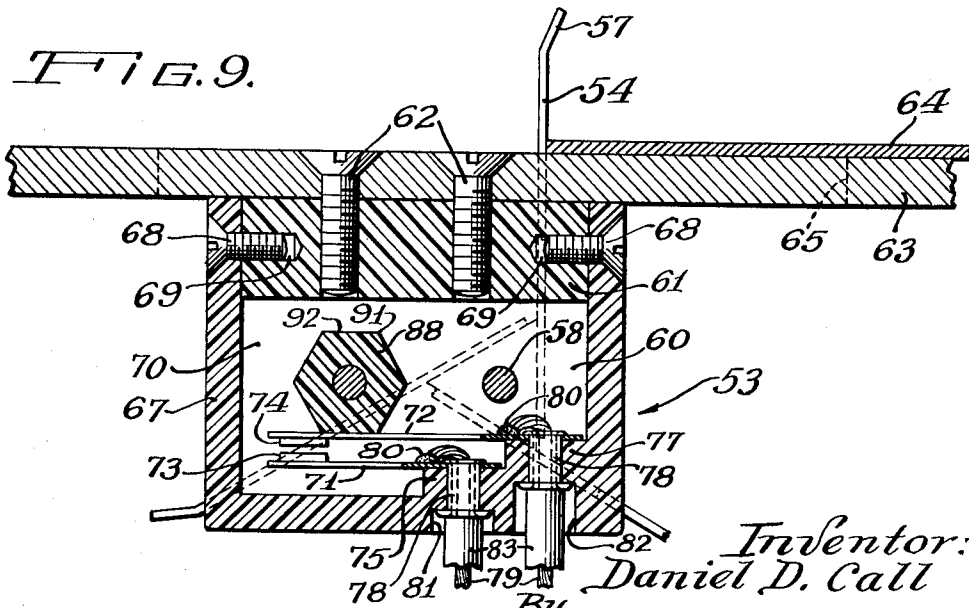


FIG. 9.



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3,202,779

SENSING SWITCH

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Filed June 15, 1962, Ser. No. 202,741
14 Claims. (Cl. 200—61.42)

The present invention relates to improvements in switches of the finger actuated type and more particularly concerns flipper actuated switches generally exemplified in W. B. Karkow, Jr. Patent No. 2,802,914 dated August 13, 1957 and assigned to the same assignee as the present application.

While the switch operating mechanism of the aforesaid patent has functioned with excellent results in check endorsing apparatus for which it was particularly devised, a demand has arisen for a more compact, miniaturized, more simple, faster operating, more directly responsive, more wear free and foolproof version of such mechanism employing the flipper finger or arm principle.

In addition to uses such as in check endorsing apparatus, switches of this sort are well adapted for other electrical control functions where responsiveness to serially moving members is required, and more especially sheet-form members, inclusive of checks, cards, record sheets of various sorts, and the like, which must be accurately individually sensed as they follow a predetermined path. This sensing may be for purposes including actuating a functioning unit such as a check endorser, energizing a counting mechanism, and the like. Additionally, because of substantial advances in mechanical and electrical technology that have been made, greatly increasing the speeds of response of electrical systems and gadgetry, and speeds at which sheet processing machines can operate, more direct and higher speed responsiveness in switch mechanism is desirable than has been possible with systems employing linkages and tripping mechanisms as heretofore.

It is, accordingly, an important object of the present invention to provide a new and improved sensing switch construction which will meet all of the foregoing and other desirable requirements in highly efficient, inexpensive form.

Another object of the invention is to provide a novel sensing switch which, in addition to all of its other attributes, is adapted to be constructed in such small and compact size as to be readily mounted in extremely limited space, whereby to afford distinct advantages in manufacturing design of associated apparatus, in keeping with the modern trend toward compactness and miniaturization of equipment.

A further object of the invention is to provide a new and improved sensing switch construction which although it is rugged and long lived in service can be embodied in an unusually small and lightweight unit.

Still another object of the invention is to provide a novel flipper sensing switch construction especially adapted for substantially capsular unitized form.

Yet another object of the invention is to provide a novel sensing switch construction employing rotary flipper arm motivated means affording positive, high speed step-by-step control.

It is further an object of the invention to provide novel sensing switch apparatus wherein a flipper arm rotated switch actuating member and electrical signal means coact with the dual functions of not only transmitting electrical signals responsive to the rotary movements of the rotatable member, but also of maintaining the rotary member and thereby the associated flipper finger or arm means normally in a predetermined angular sensing disposition.

A yet further object of the invention is to provide a new

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and improved sensing switch construction which lends itself readily to various uses and speed requirements and which functions sensitively in a novel direct manner and with great precision.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a sectional elevational view of a sensing switch according to the present invention showing the same installed for use adjacent the path of serially movable sheet members to be individually sensed and with the relationship at the moment of engagement of one of the flipper arms by an advancing member;

FIGURE 2 is a view similar to FIGURE 1 but showing the relationship of parts after the switch has been actuated by movement of the engaged flipper arm by the advancing member;

FIGURE 3 is another view similar to FIGURES 1 and 2 but showing a third relationship of the parts just before full cycle return of the switch to starting position;

FIGURE 4 is a sectional elevational detail view taken substantially on the line IV—IV of FIGURE 1;

FIGURE 5 is a sectional elevational detail view taken substantially on the line V—V of FIGURE 1;

FIGURE 6 is a sectional elevational detail view disclosing the same switch unit in a slightly modified operating environment;

FIGURE 7 is a sectional elevational view of a modified switch construction showing it in an operating environment;

FIGURE 8 is an enlarged sectional elevational detail view taken substantially on the line VIII—VIII of FIGURE 7;

FIGURE 9 is a sectional elevational detail view taken substantially on the line IX—IX of FIGURE 8; and

FIGURE 10 is a schematic illustration of utility of the switch in controlling a counter.

In an exemplary form of the invention as shown in FIGURES 1–5, a sensing switch structure 10 is constructed and arranged to be mounted on a suitable portion 11 such as a guide track member affording a path of movement for successive members 12 such as documents, cards, record sheets, checks, etc., to be sensed. Although for illustrative purposes all of the structures have been shown on a large scale, in this instance actually in a four to one ratio of an actual practical size especially useful in paper document handling equipment, numerous variations in proportions may be effected to meet other practical requirements.

An extremely simple, compact construction of the sensing switch 10 in the disclosed embodiment includes supporting means comprising a housing body 13 which is desirably molded from a suitable dielectric material such as a synthetic plastic and provided with a switch chamber cavity 14 opening from one face of the housing body. About the open end of the switch chamber cavity 14 is provided a shallow recessed seat 15 receptive of a cover plate 17, desirably made from transparent plastic sheet material to enable inspection of the interior of the chamber. This cover plate 17 has, for convenience in illustration been omitted in FIGURES 1–3, but is shown in FIGURES 4 and 5 and may be permanently secured in place after the switch assembly has been completed.

In order to facilitate attachment of the housing body 13 to the paper pathway guide member 11, as by means of screws 18, a thickened attachment portion 19 is provided along one side of the chamber cavity 14. This enables mounting of the switch unit 10 as close as practicable to the path of movement of the members 12 to be

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sensed, and in the illustrated example alongside a longitudinal slot 11a in the member 11 through which sensing means in the form of a flipper arm 20 of the switch unit is adapted to project across the path of movement of the members 12 to be sensed.

Desirably, although only one flipper arm or finger projects into the path of movement of the members 12 at any one time, three of the flipper finger arms 20 are provided on a hub 21 spaced equidistantly, that is, 120° apart. This hub and the flipper arms are desirably made integrally in one piece from suitable sheet metal such as stainless steel. In a desirable form, the hub 21 is of equilateral triangular outline and the flipper arms 20 extend from the respective sides of the triangle, being bent relative to the hub to be disposed in planes 90° relative to one face of the hub. This provides an arrangement wherein the flipper arms 20 are arranged generally paddle wheel fashion with their broad sides facing in the direction of rotation about the center of the hub 21 and extending tangent to a circle described concentric with the center of the hub within the confines of the proximal end portions of the arms.

For rotatably mounting the flipper wheel on the supporting housing body 13, a shaft 22 made from suitable metal such as stainless steel is provided having adjacent to one end a stabilizing hub and spacer flange 23 of a diameter to be received freely but closely within the confines of the proximal end portions of the flipper arms 20 (FIGS. 1, 4 and 5). Attachment of the shaft hub 23 to the flipper hub 21 is conveniently effected by means of a riveted or peened over central projection 24 on the hub 23 received through a complementary central aperture 25 in the flipper hub 21.

Highly stable, free rotary support for the shaft 22 with its distal end portion within the chamber 14 is afforded by journaling it in a bearing bore 27 extending through the base wall defining the chamber 14 and aligned external and internal respective spacer bosses 28 and 29 on such wall. The length of the spacer boss 28 is sufficient to maintain an adequate spacing of the adjacent edges of the flipper arms 20 from the housing 13 with the opposing face of the attachment and spacer hub flange 23 freely engageably opposing the outer end of the external spacer boss.

Means are provided whereby in the rotation of the shaft 22, as motivated by the flipper arms 20 through the corotative hub attachment described to operate electrical signal effecting means. For this purpose, the distal, or inner end portion of the shaft 22 extends inwardly a sufficient distance beyond the inner end of the inner spacer boss 29 to have corotatively mounted thereon a combination switch operating and detenting member 30 made from a dielectric material such as a suitable moldable plastic. This member is constructed and arranged to operate signal effecting means mounted within the chamber 14 and desirably comprising a pair of opposed leaf spring switch arms 31 and 32 carrying respective opposed electrical contacts 33 and 34. Mounting of the switch arms 31 and 32 is such that one of them, herein the arm 32 is disposed to be operatively engaged by the cam member 30.

In the exemplary sensing switch 10 shown, the switch arms 31 and 32 are mounted in spaced superposed relation to maintain the contacts 33 and 34 in normally separated open switch relation. To this end, the housing body 13 is provided within the chamber 14 on the side thereof opposite to the attachment portion 19 with a pair of stepped lands or platforms 35 and 37 to which the switch arms 31 and 32 are respectively attached cantilever fashion. Attachment is effected by means comprising identical, respective tubular rivets 38 extending through respective bores 39 through the adjacent wall of the housing body 13 which at the outer side is counter-bored as at 40 and 41 to accommodate rivets of as short as practicable length and also to receive end portions of

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insulating sheath 42 of respective lead wires 43 extending through lead inlet passages afforded by the tubular sleeve rivets and attached at their ends as by means of solder 44 to the respective leaf spring arms.

In order to provide for the dual functions of switch operating and detenting action, the member 30 is desirably in the form of a cam having its periphery coactively opposing the signal effecting means and more particularly the spring switch arm 32. Accordingly, the member 30 has its cam periphery provided with a plurality of successive switch arm biasing projections 45 and intervening detent faces 47. In the directly corotatively coupled relationship of the shaft 22 and the cam member 30, the peripheral outline of the cam member is preferably of equilateral triangular form with the projections 45 at the apices of the triangle and the detent faces providing the sides of the triangle. Location of the shaft 22 is adjacent to but spaced from the back of the spring arm 32 but spaced from the free end of the arm in such manner that the respective detent faces 47 can engage the back of the spring arm 32 in its normally contact-open spaced relation to the companion spring arm 31 as shown in FIGURE 1. This holds the shaft 22 and thereby the flipper arm wheel stationary until rotary or torque pressure is applied to one of the flipper arms 20 to effect rotation.

Disposition of the cam member 30 with respect to the flipper arms 20 is such that in the detenting coaction of the spring arm 32 and a face 47 of the cam member one of the respective flipper arms 20 is located across the path of movement of the sheet members 12 to be sensed in travelling past the sensing switch 10, so that the leading edge of the member 12 will engage and swing the flipper arm in the direction of advance of the member 12. Such interengagement is enhanced, and adequate swinging movement of the flipper arm 20 is afforded to actuate the sensing switch, by a normal inclination of this trigger-poised arm toward the advancing edge of the member 12. In addition, each of the arms 20 preferably has a terminal end portion 48 angled to provide a bias toward the advancing edge of the document member 12 and serving as a lead-in and engagement finger for the document edge.

As the sheet member 12 drives against the engaged flipper arm 20 and swings it in the direction of movement of the sheet member, the flipper wheel is turned to rotate the cam member 30 counterclockwise as viewed in FIGURES 1 and 2 and thereby driving the contiguous cam projection 45 toward and against the spring contact arm 32, as best visualized in FIGURE 2. Since the switch arm 32 is of substantial length and thus resiliently flexible it affords only moderate resistance to flexure affording, in a practical unit, yieldability in response to about seven grams force thrust against the triggering flipper arm 20. In order to reduce frictional resistance to a minimum, it will be observed that the tips of the projections 45 are curved on a suitable radius.

During its arc of movement, the switch arm pressing cam projection 45 sufficiently depresses the switch arm 32 to effect firm engagement of the contacts 33 and 34, with the opposing switch arm 31 affording cushioning resilient flexure yieldability, as indicated in FIGURE 2, and pressure relief after the contacts have been closed. Thereby, an electrical circuit through the leads 43 is closed. By way of example, as shown in FIGURE 10, the electrical circuit in which the switch 10 and the leads 43 may be included comprises a suitable power supply 49 and a counter 50 of any preferred electrically energized type commonly employed on machines where a record of the number of operations or number of units handled by a machine is desired. Thus, upon closing of the switch 10 through driving of the switch contacts into closing relation by the cam member 30 an electrical circuit impulse is supplied to the counter 50 to effect recording of the fact that the switch has been actu-

ated by movement thereby of one of the sheet members 12. This is repeated for each of the sheet members and thus affords a count of the number of sheet members handled by the associated machine in any period of operation.

After the flipper arm 20 in triggering position has been swung about 80° from its initial position in FIGURE 1 to the position shown in FIGURE 2; wherein it clears the motivating sheet member 12, the switch arm engaging cam projection 45 moves sufficiently beyond center for the spring load reaction developed in the flexed spring arm 32 to snap the cam member 30 and thereby the flipper arm wheel at an accelerated rate in the rotationally advancing direction so that the succeeding flipper arm 20 swings toward the opposing face of the motivating sheet member 12 until the finger terminal 48 thereof engages the trailing marginal portion of the sheet member as shown in FIGURE 3 to assure instantaneous movement of the terminal end portion of such flipper arm into the gap between the trailing edge of the motivating member 12 and the next succeeding sheet member 12, even though such gap may be quite narrow. Such flipping of the end of the arm 20 against such trailing edge of the motivating sheet member may even be accompanied by a slight deflection of such trailing margin and thus affording further assurance that the finger terminal 48 will enter into sensing position with respect to the advancing edge of the next succeeding sheet member 12. As this action occurs, the points or contacts 33 and 34 separate as shown in FIGURE 3. As soon as the flipper arm 20 leaves the trailing edge of the member 12, the next succeeding detent face 47 of the cam member 30 is snapped by the spring action of the arm 32 into detenting coaction therewith so that overrunning of the flipper wheel is avoided and should there not be a succeeding sheet member 12 or should the gap between such succeeding and the preceding sheet member be unusually wide, the flipper arm 20 that has been moved into triggering position will maintain that position until the leading edge of the succeeding member 12 engages and swings the triggering arm to repeat the sensing cycle.

In the modification of FIGURE 6, the same sensing switch 10 is employed but in order to adequately handle sheet members 12' which are quite thin, a retainer track guide bar or plate structure 51 is mounted in suitably spaced relation to the transporting face of the supporting member 11 to provide a guideway 52 within which the advancing thin sheet member 12' is guided to move in its plane and thus assure adequate coaction of its leading edge with the triggering flipper arm 20 as shown. Otherwise, it will be understood that operation of the sensing switch 10 is identical to that already described.

Where it is desired and practical to have the gap between the contact points of the switch arm substantially closer than provided by the arrangement of the switch 10, a sensing switch structure 53 as shown in FIGURES 7-9 may be employed operating on substantially the same principle but embodying mechanism which reduces the switch arm throw or flexure to effect closing of the contact points. Accordingly, the switch 53 has a flipper wheel structure which is substantially the same as that employed in the sensing switch 10 and includes a plurality, herein three circumferentially equally spaced flipper arms 54 projecting from a triangular hub 55 and each provided with an angular lead-in terminal finger flange 57.

Centrally the hub 55 is secured to the end portion of a shaft 58 by riveting over the end of the shaft to clamp the wheel hub against a spacer flange 59 integral on the shaft. This shaft 58 is rotatably journaled through respective opposite face wall panels 60 of a body member including an integral connecting web portion 61 arranged to provide an attachment base adapted to be secured by

means such as screws 62 to a supporting member 63 affording a guide path for sheet members 64 to be sensed by the arms 54 successively projecting through a clearance slot 65 in the member 63.

Completing the body of the switch member 53 is a generally U-shaped dielectric member 67 fitting snugly between the margins of the wall panels 60 and secured in place by means such as screws 68 threaded into threaded bores 69 in the base member 61. This provides an enclosed housing chamber 70 within the switch body wherein are mounted respective switch arms 71 and 72 having opposed respective closely spaced switch contact points 73 and 74. The switch arm 71 is the shorter of the arms and is mounted cantilever fashion on a stepped offsetting platform portion 75 on the connecting web portion of the housing member 67 opposite the base portion 61, while the longer resiliently flexible switch arm 72 is mounted on an offsetting platform step 77. It will be understood that since the housing portion 67 is made from a dielectric material such as a suitable moldable plastic, it may conveniently be transparent.

Attachment of the switch arms 71 and 72 is effected by means of tubular sleeve rivets 78 similarly as described in connection with the switch 10, accommodating electrical lead wires 79 therethrough electrically connected to the switch arms as by means of solder 80. Respective counterbores 81 and 82 outwardly from the platform offsets 75 and 77 accommodate the end portions of insulating sheaths 83 for the electrical lead wires 79.

In the switch 53, the flipper wheel shaft 58 is mounted adjacent to the mounts for the spring arms 71 and 72, and the end portion of the shaft opposite the flipper wheel projects beyond the housing wall and has corotatively attached thereto a small gear or pinion 84 which meshes with a larger gear 85 corotatively attached to an end portion of a cam shaft 87 also rotatably journaled through the wall panels 60 in suitably spaced parallel relation to the shaft 58 and carrying corotatively fast thereon, within the chamber 70 a switch actuating cam member 88. In the illustrated embodiment, the gear wheel 85 is made from a dielectric material and the shaft 87 has a spacer collar flange 89 thereon between the gear 85 and the adjacent housing wall 60. A spacer hub 90 on the gear 84 serves the same purpose.

In order to accommodate the small gap for closing of the switch contacts 73 and 74, the cam member 88, which is also preferably made from a dielectric material, is provided with twice the number of switch closing projections 91 and detent faces 92 on its periphery as there are flipper arms 54. Thus, in the arrangement shown, there are six of the projections 91 and of the detent faces 92 and it will be understood that these projections and faces coact with the longer resiliently flexible switch arm 72 in the same manner as the corresponding projections 45 and detent faces 47 of the switch 10. However, because the switch actuating projections 91 project to a shorter distance relative to a circle through the centers of the detent faces than is true with respect to the three-projection cam member 30, the projections 91 depress the switch arm 72 a correspondingly shorter distance, but ample to effect full closing of the contacts 73 and 74 during the sweep of each of the projections 91 cyclically against the switch arm 72.

As each of the flipper arms 54 is swung by the advancing document member 64 it rotates the shaft 58 and thus the gear 84 through one-third of a revolution. By having the gear 85 in a 2-to-1 ratio to the gear 84, the gear 85 will be rotated one-sixth of a revolution and effect corresponding revolvment of the cam 88 to advance the same by one projection and one detent face in each sensing cycle of operation of the switch 53.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a sensing switch construction, supporting means adapted to be disposed adjacent to the path of movement of successive members to be sensed as they pass thereby and including attachment structure for securing it in operative position relative to said path,
a shaft rotatably supported by said supporting means, a flipper arm carried by said shaft and of a length to extend beyond said supporting means and to project across said path of movement of the members so as to be engaged thereby to rotate said shaft,
electric signal effecting means carried by said supporting means,
and a member having a periphery opposed to said signal effecting means and rotatably actuated by said shaft to operate said signal-effecting means, said periphery of said member and said signal-effecting means coacting to maintain said rotatably actuated member and thus said shaft and said flipper arm in a normal disposition wherein said arm projects across said path.
2. A sensing switch construction as defined in claim 1 wherein said electrical signal effecting means includes a spring arm, and said rotatably actuated member comprises a cam structure having on said periphery a projection which engages and flexes said spring arm when said flipper arm effects rotation of said shaft, said periphery also having a detent face coacting with said spring arm to maintain said normal disposition.
3. In a sensing switch construction as defined in claim 1, said rotatably actuated member having a shaft rotatably mounted on said supporting means, and a gear train connecting the arm-carrying shaft and said rotatably actuated member shaft for coordinated rotary operation when said arm-carrying shaft is rotated by the flipper arm.
4. In a sensing switch construction, a supporting body defining an enclosed chamber therein, means for mounting said body adjacent to the path of movement of a succession of members to be sensed as they pass thereby,
a shaft rotatably supported by said body,
a flipper wheel carried by said shaft externally of said chamber and having a plurality of circumferentially spaced flipper arms each of a length to extend beyond said supporting body and adapted to project successively into the path of movement of the members to be sensed so as to be engaged by the members to rotate said shaft,
electrical signal effecting means mounted within said chamber,
and means actuated by said shaft in the rotation thereof for operating said signal effecting means.
5. In a sensing switch construction, a supporting body defining an enclosed chamber therein, means for mounting said body adjacent to the path of movement of a succession of members to be sensed as they pass thereby,
a shaft rotatably supported by said body,
a flipper wheel carried by said shaft externally of said chamber and having a plurality of circumferentially spaced flipper arms each of a length to extend beyond said supporting body and adapted to project successively into the path of movement of the members to be sensed so as to be engaged by the members to rotate said shaft,
electrical signal effecting means mounted within said chamber,
said signal effecting means including a spring arm, and a cam member directly engaging said spring arm and operatively connected with said shaft for rotation when the shaft is rotated by said flipper arm for moving said spring arm to operate said signal effecting means.

6. In a sensing switch construction, a supporting body defining an enclosed chamber therein, means for mounting said body adjacent to the path of movement of a succession of members to be sensed as they pass thereby,
a shaft rotatably supported by said body,
a flipper wheel carried by said shaft externally of said chamber and having a plurality of circumferentially spaced flipper arms each of a length to extend beyond said supporting body and adapted to project successively into the path of movement of the members to be sensed so as to be engaged by the members to rotate said shaft,
electrical signal effecting means mounted within said chamber,
said signal effecting means including a spring arm, and a cam member directly engaging said spring arm and operatively connected with said shaft for rotation when the shaft is rotated by said flipper arms for moving said spring arm to operate said signal effecting means,
said cam member having a series of detent faces thereon coactive with said spring arm to maintain the cam and thereby said shaft against overrunning.
7. In a sensing switch construction, a housing defining a switch chamber therein, a pair of opposed switch contacts mounted on said housing within said chamber and one of which is carried by a spring arm attached at one end to the housing and normally biasing said one contact away from the other contact,
a rotary shaft mounted on said housing within said chamber and having a cam member thereon engaging said spring arm,
said cam member being rotatable with the shaft and having a portion thereon acting during rotation of the cam member to flex said spring arm and thereby move said one contact into closing engagement with the other contact,
a portion of the shaft extending out of the housing, and means carried by said portion of the shaft and engageable by an object to be sensed to effect rotation of the shaft.
8. In a sensing switch construction, a housing defining a switch chamber therein, a pair of opposed switch contacts mounted on said housing within said chamber and one of which is carried by a spring arm attached at one end to the housing and normally biasing said one contact away from the other contact,
a rotary shaft mounted on said housing within said chamber and having a cam member thereon engaging said spring arm,
said cam member being rotatable with the shaft and having a portion thereon acting during rotation of the cam member to flex said spring arm and thereby move said one contact into closing engagement with the other contact,
a portion of the shaft extending out of the housing, and a sensing arm carried by said portion of the shaft and projecting beyond the housing to be engaged by a member to be sensed for rotating the shaft and thus rotating the cam to actuate said spring arm and close said contacts.
9. In a sensing switch construction, a dielectric housing having means thereon for securing it to a support adjacent to the path of movement of a succession of members to be sensed on the support,
said housing having a switch chamber therein, a pair of opposed electrical contacts mounted in said switch chamber,
a resiliently flexible spring arm carrying one of said contacts and normally biasing said one contact away from the other contact into switch-open position,

a shaft carried by said housing and extending across said chamber,
 a dielectric cam member carried corotatively by said shaft and having a series of peripheral detent faces and intervening arm biasing projections,
 said detent faces coacting with said arm to maintain the cam and shaft normally stationary,
 and means outside of said chamber and operatively connected with said shaft and arranged to be interposed in said path of movement to be motivated by said members and thereby to rotate the shaft and said cam member and drive said projections to flex said arm to move said one contact into closing relation to the other contact.

10. In a sensing switch as defined in claim 9, said means outside of the chamber for rotating the shaft comprising a plurality of flipper arms mounted on and projecting laterally from the shaft, and said cam having projections and detent faces each corresponding in number to the flipper arms.

11. In a sensing switch construction,
 dielectric means defining a housing having a switch chamber therein,
 relatively offset platforms in said chamber,
 respective resiliently flexible switch arms mounted cantilever fashion on said platforms in spaced relation and having on their distal end portions respective normally spaced contacts which are opposed to one another and normally in spaced relation,
 a shaft mounted on said housing in said chamber in spaced relation to one of said arms adjacent to said contacts,
 a cam corotative with said shaft and engaging said one arm,
 said cam having a detent face coactive with said one arm in the spaced contact disposition of the arms to maintain the cam and shaft in a normal at rest position and having a projection operative in the rotation of the cam to flex said one arm toward the other of said arms to close the contacts,
 said shaft having an end portion externally of said housing,
 and a flipper arm wheel corotative on said end portion and including a flipper arm adapted to be engaged by a moving member to be sensed and swung thereby to rotate said shaft and thereby rotate said cam to drive said projection against said one arm to flex it and close said contacts.

12. In a sensing switch construction,
 a housing defining a switch chamber,
 said switch chamber having mounted therein opposed electrical contacts one of which is carried on an end portion of a spring arm attached cantilever fashion on its opposite end portion to the housing in the chamber and normally biased to open contact position,
 a rotary shaft carried by said housing in said chamber adjacent to said arm and having a portion outside of the chamber,
 a cam on said shaft having its periphery in engagement with said arm,
 a flipper arm wheel carried by said portion of the shaft and having three flipper arms disposed 120° apart circumferentially,
 said cam having a substantially triangular periphery with three projections and three intervening detent faces,
 said projections being successively operable in the rotation of the cam to press against said arm and deflect it to move said one contact into engagement with the remaining contact and said detent faces being successively engageable with said arm in its biased position to retain the cam and shaft and wheel in respective dwell positions,

said detent faces and said switch arms being relatively oriented to maintain the arms in said dwell positions in a predetermined relation to the housing for engagement by a relatively moving member to be sensed and to be swung thereby to rotate the shaft and the cam to drive one of said projections against said switch arm and swing it into contact-closing position,

said projections having surface contours cooperable with said switch arm for reacting to the arm bias after 80° rotation of the shaft with the respective projections in engagement with the arm to snap the cam in rotary direction and move the succeeding detent face rapidly into dwell engagement with the switch arm.

13. In a sensing switch construction,
 means providing a housing having means attaching it to a support with respect to which a succession of members to be sensed move,
 said housing defining a switch chamber,
 means in said chamber supporting a pair of switch contacts and including a spring arm carrying one of the contacts and normally biasing such contact away from the other contact into switch-open position,
 a shaft carried by the housing in said chamber and supporting a corotative cam,
 said cam having a plurality of detent faces and switch arm actuating projections arranged to engage said spring arm successively in the rotation of the cam,
 a second shaft carried by the housing on a rotary axis spaced from the first mentioned shaft and having a portion outside of said chamber,
 a gear train connecting said shafts,
 and a flipper arm wheel carried by said portion of the second shaft and having arms of a length to project into the path of movement of the members to be sensed,
 said cam having twice the number of projections and detent faces as the number of arms.

14. A sensing switch construction including:
 supporting means including means for mounting the same adjacent the path of movement of a succession of members to be counted as they pass thereby,
 a shaft rotatably supported by said supporting means,
 a flipper arm carried by said shaft and of a length adapted to project across the path of movement of the members so as to be engaged thereby to rotate said shaft,
 electrical contact means for connection in a counter-actuating electrical circuit and supported by said supporting means,
 said electrical contact means including a resiliently biased arm normally maintaining said contact means in open circuit relation,
 and a cam member rotatably actuated by said shaft and having a periphery opposed to said biased arm and functioning during rotation of the shaft by the flipper arm to operate said biased arm to close said contact means,
 said periphery having detent means coactive with said biased arm normally to maintain the cam member and thereby the shaft in an at-rest position and to avoid overrunning of the shaft.

References Cited by the Examiner

UNITED STATES PATENTS

2,126,967	8/38	Lyons	235—92
2,278,087	3/42	McLaughlin	235—98
2,802,914	8/57	Karkow	200—61.41
2,940,667	6/60	Hawkes	235—98
2,974,862	3/61	Eichorn	235—98

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