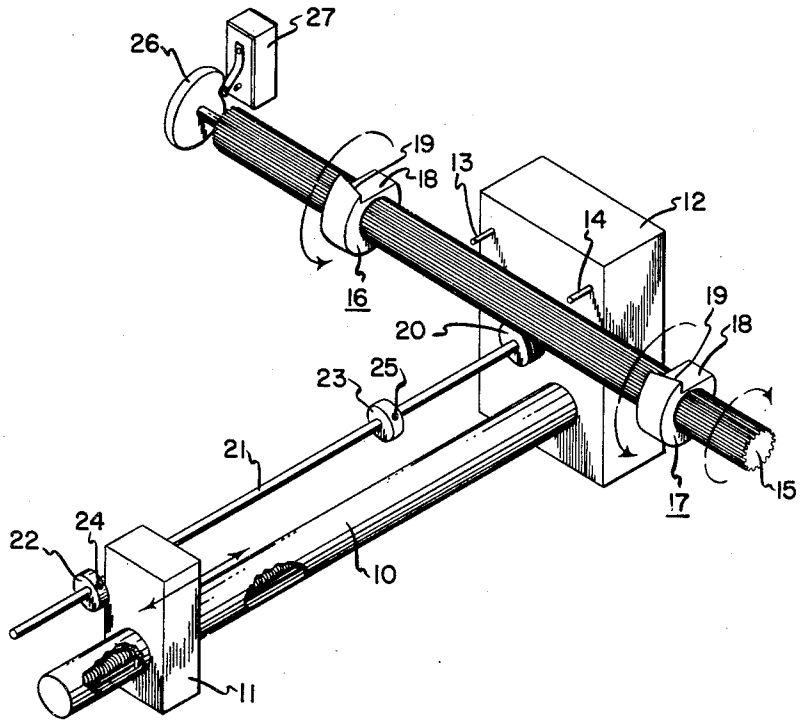
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LIMIT STOP SYSTEM OR THE LIKE

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LIMIT STOP SYSTEM OR THE LIKE

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This invention is related to limit stop systems and more particularly to an improved limit stop system which by incorporating mechanical means and a single switch mechanism or other control means accomplishes the removal of power from an associates system when any of four predetermined limits are reached by the associated system in either of four co-planar directions 90° removed from each other.

For purposes of illustration this invention shall be discussed in terms of adaptability for use in X–Y plotting systems suitable for employment with analog computers of either the electronic or electromechanical variety.

In the past there have been developed many types of limit stop systems suitable for employment with X–Y plotting table apparatus. The purpose of the limit stop system is to render inoperative the electrical driving members associated with the computer plotting table the moment the plotter pen reaches any predetermined limit point in either abscissa or ordinate. Conventional limit stop systems for X–Y plotting tables employ several single-pole double-throw microswitches in order to shut off the plotting table driving motors when any of the predetermined limits are reached by the plotter pen. A disadvantage with the present limit stop systems exists in the fact that the employment of several microswitches accompanies the employment of accompanying electrical circuits and that the several wire leads constituting the same tend to encumber unreasonably the design of the plotting table in general and the movement of the plotter pen and associated apparatus in particular. It would, of course, be highly desirable if but a single microswitch could be employed as an actuating device for breaking the electrical circuits of the driving motors the moment any of the four abscissa and ordinate limits are reached.

Therefore, it is an object of the present invention to provide a new and useful limit stop system which by incorporating mechanical means and a single switch mechanism or other control means accomplishes the removal of power from an associated system when any of four predetermined limits are reached by the associates system in either of four co-planar directions 90° removed from each other.

It is a particular object of the present invention to provide a new and improved limit stop system for incorporation in X–Y plotting tables.

It is a further object of the present invention to provide a limit stop system for use with an X–Y plotting table which will employ but a single microswitch and circuitry associated therewith.

It is an additional object to provide a novel rack and pinion combination suitable for employment in the subject limit stop system.

According to the present invention, a carriage or other device adapted to travel in a first direction is mounted upon an arm adapted to travel in a second direction which is normal to the first direction. First and second limit stops are mounted upon a limit rod which is equidistant from and closely adjacent the aforementioned

arm. The arm is affixed to a carriage having either one or two limit pins which, upon contact with either of two bevel stops mounted upon a pinion rod, rotate the contacted bevel stop, the pinion rod, and a cam associated therewith to actuate a single microswitch or other control device. A circular rack cooperating with the pinion arm is mounted upon a limit rod and, upon contact of the aforementioned device with either of the limit stops, rotates the aforementioned pinion rod and cam mounted thereupon so as to actuate the same single microswitch. The aforementioned cam is designed so that the rotation thereof in either direction will actuate the sole microswitch employed.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawing, in which:

The sole figure is a pictorial representation in perspective of a limit stop system for an X–Y plotting table, according to the present invention.

In the sole figure pen arm **10** is hollow, slit at the bottom, and provided with an appropriate screw shaft which cooperates with pen holder **11** so that by the rotation of the enclosed shaft, the pen holder will be caused to move in one of two opposite directions as shown. Pen arm **10** mounts upon carriage portion **12** which is provided with limit stop pins **13** and **14**. Immediately adjacent carriage portion **12** is pinion rod **15** upon which beveled limit stops **16** and **17** are adjustably disposed. Limit stops **16** and **17** have a flat portion **18** which is substantially parallel to pins **13** and **14** and a beveled portion **19** which is cut so as to cause a rotation of the limit stops as shown upon contact with either pin **13** or pin **14** in their outward translatory movement with carriage portion **12**. Circular rack **20** is mounted upon limit rod **21** which is closely adjacent and parallel to pen arm **10** and is slidably disposed with respect to carriage portion **12**. Upon limit rod **21** are mounted stops **22** and **23** the position of which upon limit rod **21** may be fixed by the tightening of either set screw **24** or set screw **25**. The distance between limit rod **21** and pen arm **10** and the size of stops **22** and **23** are determined so as to effectuate the contact of pen holder **11** with stop **22** or stop **23** at the extremities of travel in the directions shown. Cam **26** is mounted upon pinion rod **15** and is designed to actuate microswitch **27** upon the slight rotation of pinion rod **15** in either direction. Either cam **26**, pinion rod **15**, or limit rod **21** may be spring loaded for returning limit rod **21** to its normal position after actuation of microswitch **27**. In actual practice, limit rod **21** must have a large degree of spring loading in the direction of carriage portion **12** and stop pin **14** must have a small degree of spring loading, or vice versa, in order for the pinion rod to be caused to rotate in the presence of the simultaneous contact of pen holder **11** with stop **22**, and pin **14** with stop **17**.

The limit stop system shown in the sole figure operates as follows. The rotation of the screw shaft enclosed within pen arm **10** as caused by rotation of the motor armature associated therewith (not shown) will be accompanied by the translatory movement of pen holder **11** upon pen arm **10**. The contact of pen holder **11** with stop **22** will, by virtue of the cooperation of circular rack **20** with pinion rod **15**, produce a rotation of pinion rod **15** in a clockwise direction. Hence, cam **26** with rotate in a clockwise direction so as to actuate microswitch **27** and break the electrical circuit associated therewith. The translation of pen holder **11** in the opposite direction will cause pen holder **11** to come into contact with stop **23** and thus move stop **23** and limit rod **21** towards carriage

12. The contact of pen holder 11 with stop 23 will, by the cooperation of circular rack 20 with pinion rod 15, produce a rotation of pinion rod 15 and, hence, of cam 26 in a counterclockwise direction. But the rotation of cam 26 in a counterclockwise direction will also actuate microswitch 27 so as to break the electrical circuit associated therewith and thereby shut off the driving motor source. The translatory motion of carriage portion 12 toward stop 16 will eventually cause pin 13 to come into contact with beveled face 19 of stop 16 and, by virtue of the cut of beveled face 19, will produce a counterclockwise rotation of pinion rod 15 and of cam 26 so as to actuate microswitch 27 and thereby break the electrical circuit associated therewith. The motion of carriage portion 12 in the direction of stop 17 will ultimately produce the contact of pin 14 with beveled face 19 of stop 17 so as to produce a counterclockwise rotation of pinion rod 15 and of cam 26 and thus actuate microswitch 27 and thereby break the electrical circuit associated therewith, thereby shutting off the electrical driving source. It is to be noted that by the unique design of cam 26, as shown in the sole figure, microswitch 27 may be actuated by the rotation of cam 26 in either the clockwise direction or the counterclockwise direction. By such design of cam 26 and indeed of the entire limit stop system, the number of microswitches required for employment is reduced to but one. Hence, the actuation of microswitch 27 will shut off the power supplied to either of the two driving sources (not shown). Since microswitch 27 may be disposed near a wall or partition of an associated plotting table, a preponderance of plotting table area is shown to be unencumbered by the presence of microswitches and electrical circuits associated therewith.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. In combination, a carriage portion, a pen arm mounted upon said carriage portion and translatable in opposite directions normal to said pen arm in accordance with the movement of said carriage portion, a pen holder mounted upon said pen arm and translatable in opposite directions along said pen arm, a microswitch, a cam adapted to engage said microswitch upon rotation of said cam in either direction, a limit rod displaceable along the axis thereof and disposed parallel to and in proximate relation with said pen arm, first and second limit stops adjustably disposed upon said limit rod and adapted to engage said pen holder at predetermined extremes of travel thereof along said pen arm, a first means coupled to said limit rod for rotating said cam upon contact of one of said stops with said pen holder, and a second means including third and fourth limit stops of adjustable disposition actuatable upon said carriage portion reaching predetermined extremes of travel for rotating said cam.

2. Apparatus according to claim 1 in which said first means comprises a circular rack mounted upon said limit rod and a pinion rod cooperating with said circular rack and coupled to said cam.

3. Apparatus according to claim 2 in which said third and fourth limit stops are mounted upon said pinion rod and said second means comprises at least one stop element fixedly disposed with respect to said carriage portion and adapted to engage either of said third and fourth limit stops at extremes of travel of said carriage portion and thereby rotate said cam.

4. Apparatus according to claim 3 in which said third and fourth limit stops each have a beveled face adapted to cooperate with said stop pin upon engagement thereby to rotate said pinion rod and cam.

5. In combination, a first carriage portion, an arm mounted upon said first carriage portion and translatable in opposite directions normal to said arm in accordance with the movement of said first carriage portion, a second carriage portion mounted upon said arm and translatable in opposite directions along said arm, a control device, a cam adapted to engage said control device upon rotation of said cam in either direction, a limit rod displaceable along the axis thereof and disposed parallel to and in proximate relation with said arm, first and second limit stops adjustably disposed upon said limit rod and adapted to engage said second carriage portion at predetermined extremes of travel thereof along said arm, a first means coupled to said limit rod for rotating said cam upon contact of one of said stops with said second carriage portion, and a second means including third and fourth limit stops of adjustable disposition actuatable upon said first carriage portion reaching predetermined extremes of travel for rotating said cam.

6. Apparatus according to claim 5 in which said first means comprises a circular rack mounted upon said limit rod and a pinion rod cooperating with said circular rack and coupled to said cam.

7. Apparatus according to claim 6 in which said third and fourth limit stops are mounted upon said pinion rod and said second means comprises at least one stop element fixedly disposed with respect to said first carriage portion and adapted to engage either of said third and fourth limit stops at extremes of travel of said first carriage portion and thereby rotate said cam.

8. Apparatus according to claim 7 in which said third and fourth limit stops each have a bevel face adapted to cooperate with said stop pin upon engagement thereby to rotate said pinion rod and cam.

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