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**2,628,780**

## ZERO STOP MECHANISM

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**FIG. 1**

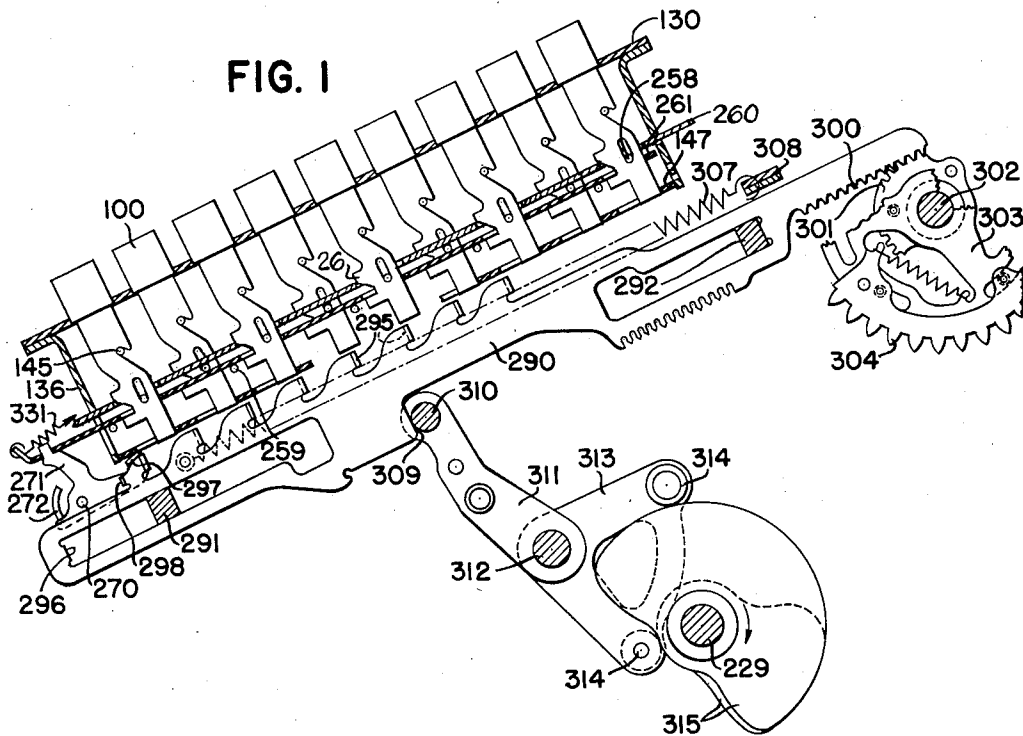
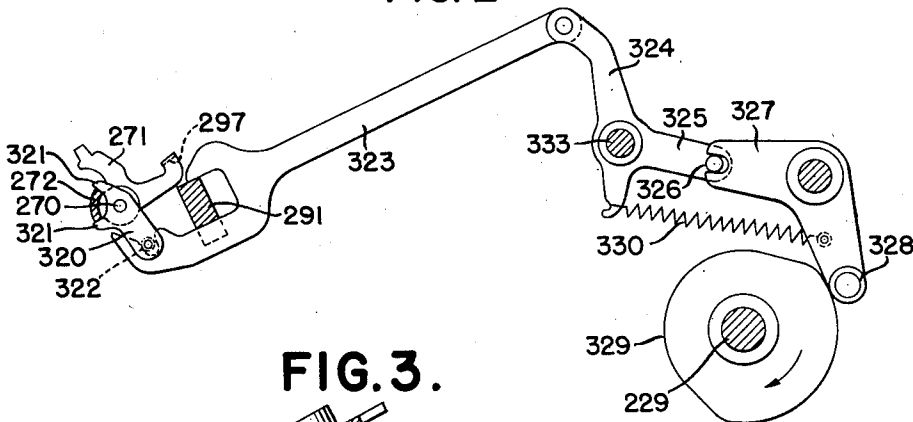
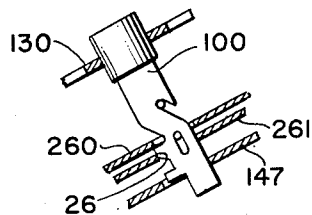


FIG. 2



**FIG.3.**



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## ZERO STOP MECHANISM

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18 Claims. (Cl. 235-145)

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This application is a divisional application of application Serial No. 39,278, filed July 17, 1948, now Patent No. 2,616,638, issued on November 4, 1952.

This invention relates to improvements in zero stop means for differential mechanisms for accounting machines.

The object of the invention is to provide a novel zero stop mechanism for amount differentials in which the zero stop elements are normally in ineffective positions but are moved into effective positions by mechanism operated from the main shaft.

Another specific object of the invention is to provide a machine in which the keys on the keyboard have a minimum load to provide a light touch for the keys.

With these and incidental objects in view, the invention includes certain novel features of construction and combinations of parts, a preferred form or embodiment of which is hereinafter described with reference to the drawing which accompanies and forms a part of this specification.

In the drawing,

Fig. 1 is a side elevational view of the amount differential rack, one bank of amount keys, and a zero stop pawl for controlling the differential movements of the amount differential rack.

Fig. 2 is a side elevational view of the zero stop operating mechanism.

Fig. 3 is a detail view showing an amount key in depressed position.

## GENERAL DESCRIPTION

The machine in which the present invention is shown applied is described in detail in the above-mentioned parent case. One of the features of said machine is an easy key action for the keys of the keyboard, so that a minimum of pressure is required to depress the keys. One means of accomplishing this object is the provision of a novel zero stop means for arresting the amount differential actuator in zero position. This novel mechanism comprises a zero stop pawl which is normally in ineffective position, so that, when a key is depressed, the zero stop pawl need not be moved thereby. When no key is depressed, the zero stop pawl is moved into effective position by a mechanism operated from the main shaft of the machine at the beginning of a machine operation. Depression of an amount key blocks movement of the zero stop pawl during an operation of the machine, so that, in an operation during which a key is depressed, the zero stop pawl is held in its normal position, to permit the

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depressed key to control the movement of the differential actuator.

## DETAILED DESCRIPTION

*Amount key banks*

The machine is provided with the usual plurality of amount banks. Each bank of amount keys includes a full complement of nine keys 100, as illustrated in the parent case. As fully described in the parent case, coacting with each bank of amount keys are four control members including a flexible detent, a zero stop actuating plate 261, a locking detent 260, and an interlocking plate that provides a means for preventing the release of the machine by the depression of certain control keys after an amount key has been depressed.

In assembling each key bank, the four control members, including the zero stop actuating plate 261 are first inserted into the keyboard frame by being inserted through suitable openings in the front plate 136 and over a row of rods 259, which extend across the entire keyboard, on which rods the actuator plate 261 slides. The actuator plate 261 is provided with a slot in line with each key shank 100. After the plate is inserted into the keyboard frame, the keys 100 are inserted through suitable openings in the top plate 130 of the keyboard, then through the slots in the actuator plate 261, and through appropriate slots in the bottom plate 147 of the keyboard frame. By reference to Fig. 1, it will be observed that the key shanks of the keys 100 are in staggered alinement, and the slots in the keyboard frame and the control members are arranged to register with the key shanks when the keys are inserted into the key frame. After the keys 100 for each digit are assembled into the keyboard frame, a rod 258 is inserted through the keyboard frames and through slots provided in the keys.

The rear end of each key is notched, as shown in Fig. 1, to receive the spring 145, which spring stretches across the keyboard frame from right to left, as viewed from the front of the machine. The rods 258 limit the upward and downward movements of the keys 100.

Mounted on ears, formed near the front of the keyboard frame, is a zero stop control shaft 270, on which the zero stops 271, one for each amount bank, are pivotally mounted. The upper end of each zero stop pawl 271 has a finger projecting into a slot of its associated zero control plate 261. Also pivotally carried by the shaft 270 is a yoke 272, which normally engages the tails on the for-

ward extensions of the zero stop pawls 271, by which the zero stop pawls are controlled, in the manner described hereinafter.

#### AMOUNT DIFFERENTIAL MECHANISM

Located beneath each bank of keys 100 (see Fig. 1) in a position midway between the staggered keys, and so as to be controlled thereby, is a differential actuator slide 290. Each actuator slide is suitably slotted to be supported by, and slide on, two cross bars 291 and 292, supported in the machine framework. The slide 290 is provided with eight projections along its top edge, having flanges 295 bent at right angles thereto, and alternately to the right and left, into alignment with the shanks of the keys 100. The flanges 295 are so located on the slide 290 that they are controlled by the digit keys 1 to 8, respectively. The slide 290 is provided with a stop surface 296 near its front end, which engages the cross bar 291 to arrest the slide 290 in its "9" position. When no amount key is depressed, a flange 297 on the zero stop pawl 271 moves into the path of a flange 298 on the slide 290 to arrest the slide 290 in zero position, which zero position is one step from the home position of the slide. Thus the flanges 295 and 296 and the surface 296 provide means to selectively and differentially arrest the slide 290 in any one of ten positions out of its home position, the position to which the slide 290 is moved depending upon whether or not a key has been depressed, or which key has been depressed. Thus it is clear that the differential slide 290 is capable of assuming any one of eleven positions; that is, a home position and ten positions of adjustment.

The slide 290 is provided near its rear end with teeth 300, meshing with a differential segment 301, rotatably mounted on a shaft 302 supported by the framework of the machine. Secured to the segment 301 is an actuator supporting member 303. Slidably mounted on the actuator supporting member 303 are a plurality of totalizer actuator racks 304, only one of which is shown herein.

As fully described in the parent case, the locking slide 260 maintains the depressed amount key in depressed position.

Upon operation of the machine with an amount key 100 depressed, the actuator slide 290 moves a distance commensurate with the value of the depressed key and, through the teeth 300, rocks the segment 301 and the actuator supporting member 303 a like distance. This sets the actuator racks 304 an extent representing the value of the depressed key. After the actuators have thus been set, one or more of the totalizers (not shown) are engaged therewith, and the slide 290 is thereafter returned to its home position. In returning to home position, the segment 301 and the actuators 304 are rotated backwardly a number of steps corresponding to the value of the depressed key, thus entering said amount in whichever totalizer or totalizers have been engaged therewith. After the amount has been entered therein, the totalizers are disengaged from the actuators.

The timing of movement of the differential slide 290 is controlled by a leading frame including a universal rod 310. A spring 307, secured to the slide 290 at one end, and to a cross plate 308 at its other end, supported by the machine framework, normally maintains a shoulder 309 of the differential slide 290 against the universal rod 310. The rod 310 is supported by four arms

311 (only one being shown herein) secured to a shaft 312. Also secured to the shaft 312 are two cam follower arms 313, each having two rollers 314 coacting with a pair of plate cams 315 secured on the main cam shaft 229.

During the operation of the machine, the cam plates 315 rotate clockwise (Fig. 1) to rock the arms 313 first clockwise and then counter-clockwise to move the rod 310 first to the right (Fig. 1) and then back to the left. When the rod 310 moves toward the right, the spring 307 moves the differential slide 290 toward the right until the slide is arrested by a flange 295 thereon coming into contact with a depressed key 1 to 8, or the surface 296 engages the cross bar 291 in the "9" position, or the zero stop pawl 271 arrests the slide in zero position, whereupon the rod 310 completes its rearward movement. Near the end of the machine operation, when the rod 310 is restored to its home position by the cams 315, the rod 310 picks up the differential slide 290 and restores it to its home position, which position is one step beyond its zero position. During this return, or movement toward home position, the differential slide 290, through the connections described above, rocks the actuator racks 304 backwardly a number of steps commensurate with the value of the depressed key, thus entering the amount into the totalizer wheels which were engaged therewith.

#### ZERO STOP MECHANISM

A zero stop pawl 271 is provided for each amount differential to arrest the differential slide 290 in the zero position, in the event no amount key is depressed. This zero stop pawl 271 is normally in an ineffective position; that is, the flange 297 thereon is normally out of the path of the flange 298 of the differential slide. The yoke 272, mounted on the shaft 270, normally maintains the pawl 271 in said ineffective position by engaging a forwardly-extending toe on the zero stop pawl 271. The yoke 272 is maintained in its normal position by an arm 320 (Fig. 2) loosely mounted on the shaft 270 and having two toes 321 straddling the yoke 272 near its center. The lower end of the arm 320 has mounted thereon a stud 322, which projects into a notch in the forward end of a slide 323 bifurcated to engage and slide on the cross bar 291. The rear end of the slide 323 is pivoted to a bell crank 324 pivoted on a shaft 323, said bell crank having a rearwardly-projecting arm 325 carrying a stud 326 projecting into a notch in the forward end of a lever 327. The lever 327 is provided with a roller 328, which is normally held in engagement with a cam 329 by a spring 330 stretched between one arm of the bell crank 324 and a stud on the lever 327. The cam 329 is secured to the main cam shaft 229.

Near the beginning of the operation of the machine, when the main cam shaft 229 and the cam 329 rotate clockwise, the spring 330 rocks the lever 327 clockwise. This movement of the lever 327, through the bell crank 324, shifts the slide 323 to the left, thus rocking the arm 320 and the yoke 272 clockwise. Clockwise movement of the yoke 272 permits the zero stop pawl 271 to be rocked by a spring 331, to position its flange 297 into the path of the flange 298 on the differential slide 290. The spring 331 is stretched between one end of the zero stop control plate 261 and the keyboard front plate 136. When no key is depressed, the plate 261 is free to move in the manner described later. When the differential slide 290 is released by movement of the universal rod 310, the flange 297, having been

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moved into the path of the flange 298, arrests the differential slide 290 in zero position. The timing of this mechanism is such that the cam 315 starts the slide 290 moving immediately the zero stop pawl is positioned in its effective position.

During an operation of the machine with an amount key depressed, the zero stop control plate 261, coacting with a shoulder 26 of the depressed key, prevents the control plate 261, from moving. The control plate in turn prevents the zero stop pawl 271 from moving into its effective position at the time the yoke 272 is actuated.

By reference to Fig. 1, it can be observed that the slot in the zero stop slide 261, through which the amount key 100 projects, is long enough to permit free movement of the key 100 therein, without affecting any movement of the zero stop control plate 261. However, when a key 100 is depressed, the upper shoulder 26 on the depressed key 100 moves into position to engage the left wall of the slot in the control plate 261 to prevent any movement of the zero stop control plate 261. The upper end of the zero stop pawl 271 has a toe projecting into a notch in the zero stop control plate 261, and therefore the zero stop pawl cannot move when released by the yoke 272 whenever a key 100 is depressed and blocks movement of the plate 261. Therefore, when an amount key is depressed and the plate 261 cannot move, the zero stop pawl 271 is maintained in its ineffective position at the time the yoke 272 is moved by its cam 329. Under these conditions, the yoke 272 rocks back and forth idly in the space between the toe on the zero stop pawl 271 and its upstanding arm.

When no key is depressed in the amount bank, the zero stop control plate 261, not being blocked by a shoulder 26 of any key, is free to move to the right when the yoke 272 is rocked. Clockwise rocking movement of the yoke 272 permits the plate 261 to be so moved by the spring 331 connected to one end of the slide. Since the plate 261 can now be moved by the spring 331, the zero stop pawl 271 is rocked clockwise at the beginning of the machine operation to lower its flange 297 into the path of the flange 298 on the differential slide 290.

From the above it is clear that the zero stop pawl 271 is normally in its upper, or ineffective, position and is lowered into an effective position to arrest the differential slide 290 only when no key is depressed. Depression of the key 100 prevents movement of the plate 261 and therefore prevents the zero stop pawl 271 from moving into its effective position, thus permitting the differential slide to be moved under control of the depressed key.

The above arrangement is novel in that it places a minimum load on the amount keys. By moving the zero stop pawl by power supplied by the motor, the extra load usually required to move the zero stop pawl by depression of the amount keys is eliminated.

While the form of mechanism shown and described herein is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to the one form or embodiment disclosed herein, for it is susceptible of embodiment in various other forms.

What is claimed is:

1. In a machine of the class described, the combination of manipulative devices; a differential means controlled by the manipulative devices; a zero stop pawl normally in an ineffective position

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and movable into an effective position to arrest the differential means in zero position; means to normally maintain the zero stop pawl in its ineffective position; power-operated means to move the last-named means to release the zero stop pawl to move into its effective position upon initial operation of the machine when no manipulative device is operated; and means controlled by an operated manipulative device to maintain the zero stop pawl in normal ineffective position to permit the differential means to be controlled by an operated manipulative device during an operation of the machine.

2. In a machine of the class described, the combination of manipulative devices; a differential means controlled by the manipulative devices; a zero stop means to arrest the differential means in zero position; means to normally maintain the zero stop means in an ineffective position; a main shaft; connections between the main shaft and the last-named means to operate the last-named means to release the zero stop means to move into a position to arrest the differential means in zero position; and means coacting with an operated manipulative device and the zero stop means to maintain the zero stop means in normal ineffective position.

3. In a machine of the class described, the combination of manipulative devices; a differential means controlled to be set differentially under control of the manipulative devices; a spring-actuated zero stop pawl movable from a normal ineffective position into effective position to arrest the differential means in zero position; means to restrain the zero stop pawl in normal ineffective position when the machine is at rest; power-operated means to move the restraining means during the initial operation of the machine to release the zero stop pawl to move into effective position to arrest the differential means in zero position; and a control device connected to the zero stop pawl, normally free to operate when the power-operated means is operated, said manipulative devices movable into the normal path of movement of said control device when the manipulative devices are manipulated to arrest the movement of the control device and thereby maintain the zero stop pawl in its normal ineffective position when the power-operated means is operated.

4. In a machine of the class described, the combination of manipulative devices; a differential means controlled to be set differentially under control of the manipulative devices; a spring-actuated zero stop pawl movable from a normal ineffective position into effective position to arrest the differential means in zero position; means to restrain the zero stop pawl in ineffective position when the machine is at rest; power-operated means to move the restraining means during initial operation of the machine to release the zero stop pawl to move into effective position to arrest the differential means in zero position; a control device connected to the zero stop pawl normally free to operate when the power-operated means is operated; a series of stop surfaces on the control device; and a projection on each manipulative device movable into the path of one of said stop surfaces when the manipulative device is operated to arrest movement of the control device to maintain the zero stop pawl in normal ineffective position when the power-operated means is operated after a manipulative device has been operated.

5. In a machine of the class described, the

combination of manipulative devices; a differential means controlled to be set differentially under control of the manipulative devices; a spring-actuated zero stop pawl movable from a normal ineffective position into an effective position to arrest the differential means in zero position; means to restrain the zero stop pawl in ineffective position when the machine is at rest; power-operated means to move the restraining means during the initial operation of the machine to release the zero stop pawl to move into effective position to arrest the differential means in zero position; a control device connected to the zero stop pawl normally free to operate when the power-operated means is operated, said control device having a series of openings in which the manipulative devices are located and operated; and a projection on each manipulative device movable into engagement with a wall of the opening in said control device when operated to arrest movement of the control device and the zero stop pawl when the power-operated means is operated.

6. In a machine of the class described, the combination of manipulative devices; a differential means controlled to be set differentially under control of the manipulative devices; a spring-actuated zero stop pawl movable from a normal ineffective position into an effective position to arrest the differential means in zero position; a toe on the zero stop pawl; a bail normally engaging the toe to restrain the zero stop pawl in its ineffective position; power-operated means to rock the bail upon initial operation of the machine to release the zero stop pawl to move into its effective position; and means coacting with the zero stop pawl and an operated manipulative device to restrain the zero stop pawl in ineffective position during machine operation in which a manipulative device has been operated.

7. In a machine of the class described, the combination of manipulative devices; a differential means controlled to be set differentially under control of the manipulative devices; a spring-actuated zero stop pawl movable from a normal ineffective position into an effective position to arrest the differential means in zero position; a toe on the zero stop pawl; a bail normally engaging the toe to restrain the zero stop pawl in its ineffective position; power-operated means to rock the bail upon initial operation of the machine; and a control device connected to the zero stop pawl normally free to operate when the power-operated means is operated, said manipulative devices movable into the normal path of movement of said control device when the manipulative devices are manipulated, to arrest the movement of the control device to thereby maintain the zero stop pawl in its ineffective position when the power-operated means is operated after a manipulative device is operated.

8. In a machine of the class described, the combination of manipulative devices; a differential means controlled to be set differentially under control of the manipulative devices; a spring-actuated zero stop pawl having a normal ineffective position and movable into an effective position to arrest the differential means in zero position; a toe on the zero stop pawl; a bail normally engaging the toe to restrain the zero stop pawl in its ineffective position; power-operated means to rock the bail upon initial operation of the machine; a control device connected to the zero stop pawl; normally free to operate when the power-operated means is operated; a series of

stop surfaces on the control device; and a projection on each manipulative device movable into the path of said stop surfaces when the manipulative device is operated to arrest movement of the control device to maintain the zero stop pawl in normal ineffective position when the power-operated means is operated after the manipulative device has been operated.

9. In a machine of the class described, the combination of manipulative devices; a differential means controlled to be set differentially under control of the manipulative devices; a spring-actuated zero stop pawl having a normal ineffective position and movable into an effective position to arrest the differential means in zero position; a toe on the zero stop pawl; a bail normally engaging the toe to restrain the zero stop pawl in its ineffective position; power-operated means to rock the bail upon initial operation of the machine, said control device having a series of openings in which the manipulative devices are located and operated; and a projection on each manipulative device movable into engagement with a wall of the opening in said control device when operated to arrest movement of the control device and the zero stop pawl when the power-operated means is operated.

10. In a machine of the class described, a plurality of manipulative devices; a differential actuator controlled thereby; a zero stop device having an ineffective position and an effective position for arresting the differential actuator in zero position; and means operable during a machine operation in which a manipulative device is in operated position for maintaining the zero stop device in its ineffective position and operable to move the zero stop device into effective position during machine operations in which no manipulative device is in operated position.

11. In a machine of the class described, a plurality of manipulative devices; a differential actuator controlled thereby; a normally ineffective zero stop device for arresting the differential actuator in zero position; means operable to move the zero stop device into effective position during machine operations in which no manipulative device is in operated position; and means controlled by the operation of a manipulative device to render the last-named means ineffective.

12. In a machine of the class described, the combination of manipulative devices; a differential actuator controlled thereby; a normally ineffective zero stop device for arresting the differential actuator in zero position; a spring to move the zero stop device into effective position; means normally maintaining the zero stop device in ineffective position; and power-operated means to actuate the last-named means to release the zero stop device to the action of the spring, to cause the zero stop device to move into effective position in machine operations in which no manipulative device is in operated position, said the last-named means being held in normal position by an operated manipulative device during operations in which a manipulative device is in operated position.

13. In a machine of the class described, the combination of manipulative devices; a differential actuator controlled thereby; a normally ineffective zero stop device for arresting the differential actuator in zero position; a spring to move the zero stop device into effective position; means to normally maintain the zero stop device in ineffective position; a power-operated means to actuate the last-named means to release the zero

stop device to the action of the spring to cause the zero stop device to move into effective position; and means on each manipulative device to block movement of the zero stop device when the manipulative device is operated to maintain the zero stop device in normal ineffective position when the power-operated means actuates the first-named means.

14. In a machine of the class described, the combination of manipulative devices; a differential actuator controlled thereby; a normally ineffective zero stop device for arresting the differential actuator in zero position; a spring to move the zero stop device into effective position; means normally maintaining the zero stop device in ineffective position; a power-operated means to actuate the last-named means to release the zero stop pawl to the action of the spring to cause the zero stop pawl to move into effective position; a slide connected to the zero stop pawl and disposed in the plane of all of said manipulative devices so as to be controlled thereby; and means on each manipulative device, each movable into the path of said slide to block movement of the zero stop device when the manipulative device is operated to maintain the zero stop device in normal ineffective position when the power-operated means actuates said last-named means.

15. In a machine of the class described, the combination of a plurality of banks of manipulative devices; a differential actuator controlled by each bank of manipulative devices; a zero stop device for each bank of manipulative devices and differential actuator; a common yoke member coacting with the zero stop devices to normally maintain all of the zero stop devices in ineffective position; a power-operated means to move said yoke to release all zero stop devices in machine operations in which no manipulative devices are operated; and resilient means to move the released zero stop devices into effective positions, said resilient means rendered ineffective to move the zero stop devices by the operation of the manipulative devices.

16. In a machine of the class described, the combination of a plurality of banks of manipulative devices; a differential actuator controlled by each bank of manipulative devices; a zero stop device for each bank of manipulative devices and differential actuator; a common yoke member coacting with each zero stop device to normally maintain all of the zero stop devices in ineffective positions; a power-operated means to move said

yoke to release all the zero stop devices; resilient means to move the released zero stop device into effective positions; and means controlled by the manipulative devices to block movement of the zero stop devices for those banks of manipulative devices in which a manipulative device has been operated.

17. In a machine of the class described, the combination of a plurality of banks of manipulative devices; a differential actuator controlled by each bank of manipulative devices; a zero stop device for each bank of manipulative devices and differential actuator; a common yoke member coacting with the zero stop devices to normally maintain all of the zero stop devices in ineffective positions; a power-operated means to move said yoke to release all the zero stop devices; resilient means to move the released zero stop devices into effective positions; and a slide connected to each zero stop device and coacting with the manipulative devices of each bank of manipulative devices to block movement of the zero stop devices for those banks of manipulative devices in which a manipulative device has been operated.

18. In a machine of the class described, the combination of a plurality of banks of manipulative devices; a differential actuator controlled by each bank of manipulative devices; a zero stop device for each bank of manipulative devices and differential actuators; a common yoke member coacting with the zero stop devices to normally maintain all of the zero stop devices in ineffective positions; a power-operated means to move said yoke to release all zero stop devices; resilient means to move the released zero stop devices into effective positions; a slide connected to each zero stop device; and a lug on each manipulative device movable into contact with the slide associated with its respective bank of manipulative devices to block movement of the zero stop devices for those banks of manipulative devices in which a manipulative device has been operated.

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