

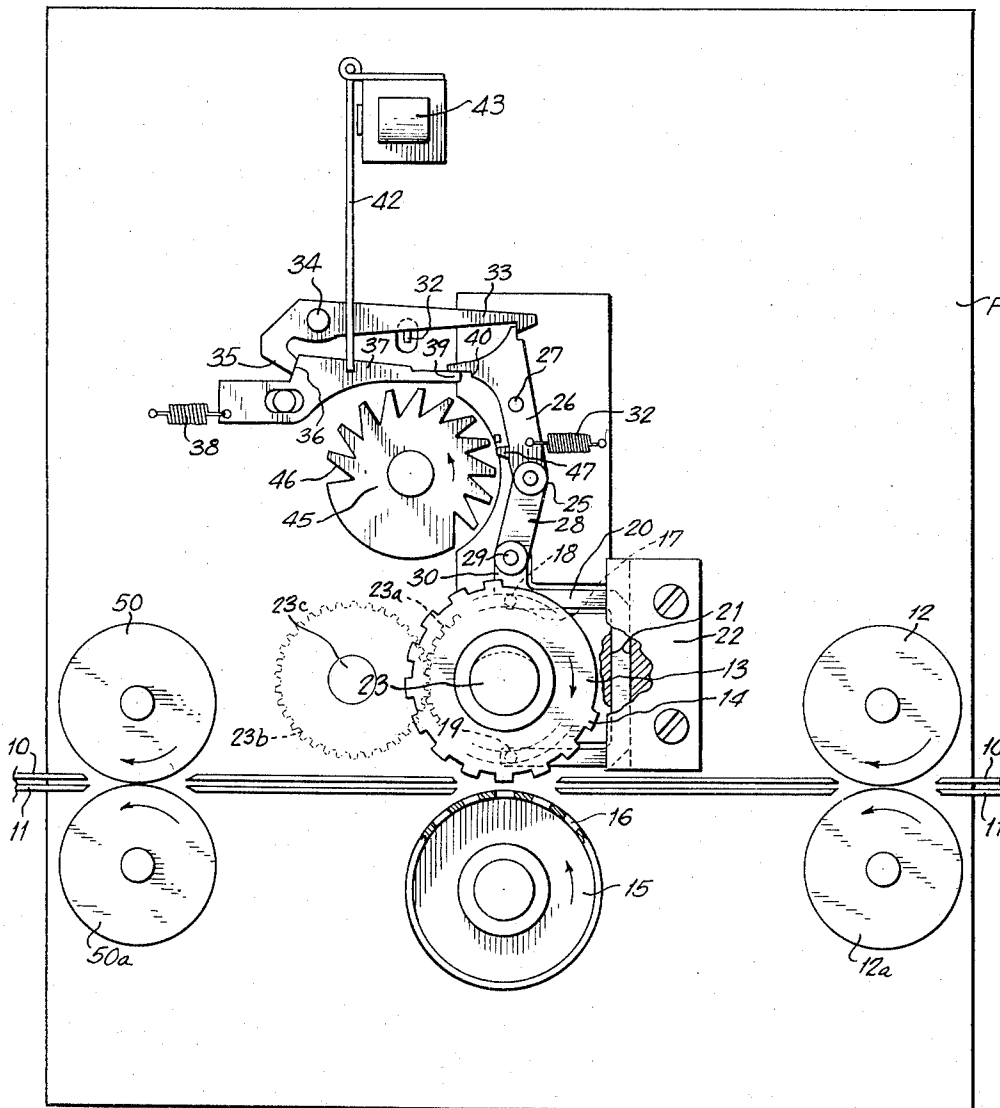
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ROTARY DIE PUNCH

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ROTARY DIE PUNCH

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This invention relates to card punching machines, and particularly to such machines which punch or perforate accurately registered index points of the card as it moves through the machine.

In present day calculating, tabulating and the like business machines, data is conventionally recorded on punched statistical cards for later transcription. Card punching may be accomplished by moving the card through the card punching machine intermittently one index point position at a time, the card movement being arrested while each punching operation is performed. A machine of this character is disclosed in the George F. Daly Patent No. 2,448,781. This type of punch machine operation somewhat limits the maximum rate at which successive cards may be punched.

It is proposed in the Clair D. Lake et al. Patent No. 2,451,752 that higher card punching rates be attained by use of a machine wherein the cards are punched while continuing to move at constant velocity past the punching station. To this end, the punch and its associated die are pivoted to oscillate at card velocity and an interposer is selectably controlled to interconnect the punch and a pivoted oscillatory drive member throughout each punching cycle. Accurate index registration of the card at the punch position is prearranged by the use of relatively critically positioned and operating card hopper plate, picker knife, positioning stops, and temporary lateral guides, and certain feeding roll tension adjustments. While this type of card punching machine effects substantial improvement in card handling capacity, it would nevertheless be desirable and beneficial to increase the card handling rate to an even greater extent than is readily feasible with a machine having the construction described.

It is an object of the present invention, therefore, to provide a new and improved card punching machine which possesses a substantially higher card handling rate than heretofore readily possible.

It is a further object of the invention to provide a card punching machine of simplified and improved construction with resultant lowered initial and maintenance costs and enhanced reliability of operation.

It is an additional object of the invention to provide a card punching machine which enhances the rate of card handling capacity by utilizing only rotary motions or very limited reciprocatory motions throughout.

A card punching machine embodying the invention includes opposed rotary punch and die members mechanically connected for rotation in unison at a circumferential velocity corresponding to the linear velocity of moving cards to be perforated, employs a toggle linkage for providing relative movement of the punch and die members between punching and non-punching positions thereof, has an actuator for moving the toggle linkage to initiate a punch cycle of operation, and includes a toothed member rotating in unison with the punch and die members for reverse actuating the toggle linkage to insure

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positive accurate termination of each cycle of punch operation.

Other objects and advantages of the invention will appear as the detailed description thereof proceeds in the light of the drawing forming a part of this application and in which the singular figure thereof illustrates in elevational cross-sectional view a card punching machine embodying the present invention in a particular form.

Referring now more particularly to the drawing, the card punching machine here illustrated may be one component of a more extensive machine such as that disclosed in the George F. Daly patent to which reference has been made above. The machine includes card guides 10, 11 which receive cards from a card source, not shown, such as a card hopper from which cards are supplied by a reciprocating card picker, and guides the cards through the punching machine. The cards to be punched are conventionally of rectangular configuration passing through the machine with their long axes perpendicular to the guides 10, 11 and conventionally have several hundred index points arranged in 12 rows of 80 columns, the columns running lengthwise of the card. Accordingly, it will be understood that the punch machine shown in Fig. 1 is merely one of some 80 such machines positioned in side-by-side relation with the drive and driven members of the machines aligned normal to the guides 10, 11 and supported on drive shafts individual to moving elements of the same type.

A pair of feed rolls 12, 12a move the cards along the guides 10, 11 to the punch station which includes a rotary punch wheel 13 having circumferentially positioned spaced punch elements 14. A rotary die wheel 15 is geared for movement in unison with the punch wheel 13 and includes die apertures 16 corresponding in number, cross-section, and mating relationship with the punch elements 14. The number of punch elements 14 and die apertures 16 corresponds to the number of rows of index points provided on the card to be punched, and the spacing between the first and last punch element and die aperture of the wheels 13 and 15 corresponds to the spacing interval between successive cards fed to the punch station.

The die wheel 15 is conveniently journaled in fixed bearings provided on a side plate P and an opposing side plate (not shown) of the machine, while the punch wheel 13 is arranged for limited movement in a direction normal to the card guides 10, 11 and between punching and non-punching positions. To this end, one face of the punch wheel 13 is provided with a concentric groove 17 which is engaged by pins 18 and 19 provided on the ends of the arms of a U-shaped yoke 20 supported for reciprocatory movement by guideways 21 provided in a guide member 22. While the shaft 23 supporting the punch wheel 13 may be correspondingly journaled for limited movement with the wheel 13, in practice the movement of the latter amounts to only a few thousandths of an inch and accordingly the wheel 13 may conveniently be provided with an oversize shaft bore allowing it to have a slight amount of radial movement on the shaft 23. This construction is desirable from the standpoint that it minimizes the mass and resulting inertia of the moving parts between punching and non-punching positions, thus enhancing the maximum card punching rate. The punching wheel 13 is somewhat loose on the shaft 23 and has connected or riveted to the back side a gear 23a which meshes with and is driven by a drive gear 23b which in turn is geared to a suitable drive motor, not shown. Gears 23b, 23a and the punch wheel 13 all move in synchronism with the die wheel 15 to maintain punching registration.

A toggle linkage 25 has one arm 26 pivoted at 27 and its other arm 28 connected by a pivot 29 to a pro-

jection 36 provided at the end of one arm of the yoke 20. The toggle linkage 25 is normally biased to a relaxed position by a spring 32. The end of the toggle arm 26 has a latch point engaged by a latch member 33 which is pivoted at 34, is normally biased to unlatched position by a spring 32, and is provided with a re-entrant arm 35 engaging a cam surface 36 provided on a reciprocating arm 37. The latter is spring-biased to a rest position by a spring 38. The forward end 39 of the arm 37 engages a notch 40 provided on the toggle arm 26 above the pivot point 27 and straightens the toggle linkage upon actuation of the arm 37 by the extended end of the armature 42 of an electromagnet 43 in response to a pulse of current supplied to the latter.

A reamer shaft 45 is longitudinally grooved to provide circumferentially spaced teeth 46 which engage a projection 47 provided on the toggle arm 26 whenever the toggle linkage 25 has been straightened in the manner earlier explained. The reamer shaft 45 rotates in unison with the punch wheel 13, and the number and circumferential spacing of its teeth 46 are equal to the number and spacing of the punch elements 14 of the wheel 13. The timing of the reamer shaft 45 is such that a reamer tooth 46 strikes the projection 47 of the toggle linkage 25 at or immediately following the completion of the movement of the punch wheel 13 to its full punch position.

It will be understood that the punch and die wheels 13, 15 and the reamer shaft 45, together with the respective input and output feed rolls 12, 12a and 50, 50a are mechanically connected for rotation in unison as by suitable gearing to a common drive shaft 23c. In this connection, and as mentioned above, the circumferential velocity of the feed rolls 12, 12a and 50, 50a and the punch and die wheels 13, 15 is equal to the linear velocity of the cards moving through the punch station, whereas the angular velocity of the reamer shaft 45 is the same as that of the punch and die wheels 13, 15.

It is believed that the operation of the punching station will be apparent from the foregoing description. Briefly considered, a punching cycle of operation is initiated by applying a pulse of current to the electromagnet 43 to move the arm 37 against the arm 26 of the toggle linkage 25. As the arm 37 moves toward the toggle arm 26, the spring 32 causes the end 35 of the latch arm 33 to follow the cam surface 36 of the arm 37 and the latch arm 33 thereupon moves to unlatched position with respect to the toggle arm 26. This occurs just prior to the moment when the end 39 of the actuating arm 37 engages the notch 40 of the toggle arm 26. The shape of the projection 47 on the toggle arm 26 and the shape of the teeth 46 of the reamer shaft 45 are so selected that the toggle linkage 25 can be moved to its aligned position under actuation of the arm 37 only at such times as a punch element 14 is positioned directly above a die aperture 16 of the die wheel 15. The punch stroke is accordingly precisely timed by the teeth 46 of the reamer shaft 45 so that the energizing pulse of current applied to the electromagnet 43 only secondarily determines the punch stroke timing. Thus as the arm 37 moves the toggle linkage 25 toward its aligned position, the projection 47 on the toggle arm 26 may engage the flattened end portion of a tooth 46 of the reamer shaft 45 and thereby retard the completion of the punch stroke until the moment when the punch and die wheels 13 and 15 are correctly positioned in direct opposing punch relation. At this time further rotation of the reamer shaft 45 permits the projection 47 to ride off the end of a tooth 46 and the linkage mechanism 25 thereupon moves to its completely aligned position and drives the punch wheel 13 downward forcing one of the punch elements 14 through the card and into a die aperture 16 of the die wheel 15. Immediately thereafter, the next succeeding tooth 46 of the reamer shaft 45 strikes the projection 47 of the toggle arm 26 and initiates movement of the toggle linkage 25 toward relaxed position. This move-

ment is sufficient to disengage a punch element 14 from the card, and the toggle linkage 25 thereafter is moved by the spring 32 to its completely relaxed position to effect complete withdrawal of the punch wheel 13 from its punch position.

During all of the punch interval last described, it will be understood that the card being punched continues to move through the punch station and while in this station its movement is followed by the equal circumferential movement of the punch and die wheels 13, 15 due to the rotary motion of these elements. Depending upon the selective actuation of the electromagnet 43, any of the punch elements 14 successively from the first to the last may punch any selected index point in the 12 rows of points provided on the card, each punch operation proceeding in the manner described above. Continued rotation of the punch and die wheels 13 and 15 positions the first punch elements 14 above the first index point of the succeeding card to be punched.

It will be apparent from the foregoing description of the invention that a card punching machine embodying the invention is of simple yet sturdy construction, is reliable in operation, and is capable of a high rate of card handling capacity. The major elements of the machine have only rotary motion, and other moving elements are of light weight and are restricted to limited ranges of motion so that the actuating forces required and the inertia of these moving parts are held to a minimum. The card punching operation is accurately and concisely timed by the action of the reamer shaft teeth in their precise positive control over the movement of the toggle linkage mechanism. This insures high accuracy in the registration of index point perforation.

What is claimed is:

1. A card punching machine comprising, perforating means supported for movement and driven to move in unison with the movement of a card which is transported through the machine and is to be perforated in transit therethrough and including toggle linkage means for actuating said perforating means between perforating and non-perforating positions, means for selectably actuating said toggle linkage means to initiate a perforation cycle of operation, and means moved in timed relation to said first-mentioned movement of said perforating means for automatically reverse actuating said toggle linkage means positively and abruptly to terminate said cycle of operation.

2. A card punching machine comprising, perforating means supported for movement and driven to move in unison with the movement of a card which is transported through the machine and is to be perforated in transit therethrough and including toggle linkage means for actuating said perforating means between perforating and non-perforating positions, means for normally restraining said perforating means in non-perforating position, means for selectably actuating said toggle linkage means and for concurrently releasing said restraining means to initiate a perforation cycle of operation, and means moved in timed relation to said first-mentioned movement of said perforating means for automatically reverse actuating said toggle linkage means positively and abruptly to terminate said cycle of operation.

3. A card punching machine comprising, perforating punch and die members supported for movement and driven to move in unison with each other and in unison with cards which are transported through the machine and are to be perforated in transit therethrough, toggle linkage means for moving at least one of said members between perforating and non-perforating positions, means for selectably actuating said toggle linkage means to initiate a perforation cycle of operation, and means moved in timed relation to said first-mentioned movement of said perforating members for automatically reverse actuating said toggle linkage means positively and abruptly to terminate said cycle of operation.

4. A card punching machine comprising, opposing rotary punch and die perforating members mechanically connected for rotation and rotatably driven in unison at a circumferential velocity corresponding to the linear velocity of moving cards to be perforated, toggle linkage means for moving at least one of said members toward the other to a perforating position and apart to a non-perforating position, means for selectably actuating said toggle linkage means to initiate a perforation cycle of operation, and means moved in timed relation to said rotary movement of said perforating members for automatically reverse actuating said toggle linkage means positively to terminate said cycle of operation.

5. A card punching machine comprising, perforating punch and die members supported for movement and driven to move in unison with each other and in unison with cards which are transported through the machine and are to be perforated in transit therethrough, a toggle linkage having one toggle arm pivoted and the other arm restrained at its remote end for linear movement and connected to one of said members to effect relative movement of said members between perforating and non-perforating positions, means for selectably moving said one toggle arm about its pivot to align said arms and move said one member to perforating position, and means moved in timed relation to said first-mentioned movement of said members for initiating movement of said toggle arms abruptly out of alignment to move said one member to said non-perforating position thereof.

6. A card punching machine comprising, perforating means supported for movement and driven to move in unison with the movement of a card which is transported through the machine and is to be perforated in transit therethrough and including toggle linkage means for actuating said perforating means between perforating and non-perforating positions, means for selectably actuating said toggle linkage means to initiate a perforation cycle of operation, and a toothed member moved in timed relation to said first-mentioned movement of said perforating means for impulse-reverse-actuating said toggle linkage means abruptly to terminate each cycle of operation.

7. A die perforating mechanism for effecting precisely positioned selectively intermittent perforation of moving cards comprising, perforation punch and die members supported for movement and driven to move in unison with each other and in unison with said cards, means including a toggle linkage for imparting additional relative motion between said members in a direction transverse the direction of card movement and into perforation engagement and disengagement positions thereof, means for selectively actuating said toggle linkage to move said members to said perforation engagement position to effect perforation of said cards, and means moved in unison with the first mentioned movement of said members for effecting subsequent movement control actuation of said

toggle linkage to restore said members to said disengaged position thereof.

8. A card punching machine comprising, card punch and die members having multiple card perforation elements successively presented by rotary motion of said members in unison with moving cards to be punched and at least one thereof having a second motion between punching and non-punching position, a punch actuator including a toggle linkage coupled to said one member for moving said one member between said punching and non-punching positions thereof, and means moving in timed relation to said rotary motion of said members for providing precise mechanical timing of the initiation of each forward and reverse movement of said toggle linkage in effecting movement of said one member to said punching and non-punching positions thereof.

9. A card punching machine comprising, card punch and die members having a rotary motion in unison with moving cards to be punched and at least one thereof having a second motion between punching and non-punching positions, a toggle linkage coupled to said one member for moving said one member between said punching and non-punching positions thereof, an actuator for straightening said toggle linkage to initiate a punch cycle of operation by moving said one member to said punching position thereof, and a toothed member moving in unison with said rotary motion of said members for releasing said toggle linkage after each punch operation to initiate return of said one member toward said non-punching position to complete a punching cycle of operation.

10. A card punching machine comprising, perforating means supported for movement and driven to move in unison with the movement of a card which is transported through the machine and is to be perforated in transit therethrough and including toggle linkage means for actuating said perforating means between perforating and non-perforating positions, means moved in timed relation to said first-mentioned movement of said perforating means for providing precise mechanical timing of the actuation of said toggle linkage means to initiate a perforation cycle of operation, and means moved in timed relation to said first-mentioned movement of said perforating means for providing precise mechanical timing and automatic reverse actuation of said toggle linkage means positively and abruptly to terminate said cycle of operation.

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