

July 13, 1965

H. PALTER
PUNCH PRESS HAVING CAM MEANS DIRECTLY
DRIVING ROTARY WORK-FEED MEANS

3,194,099

Filed Sept. 11, 1961

2 Sheets-Sheet 1

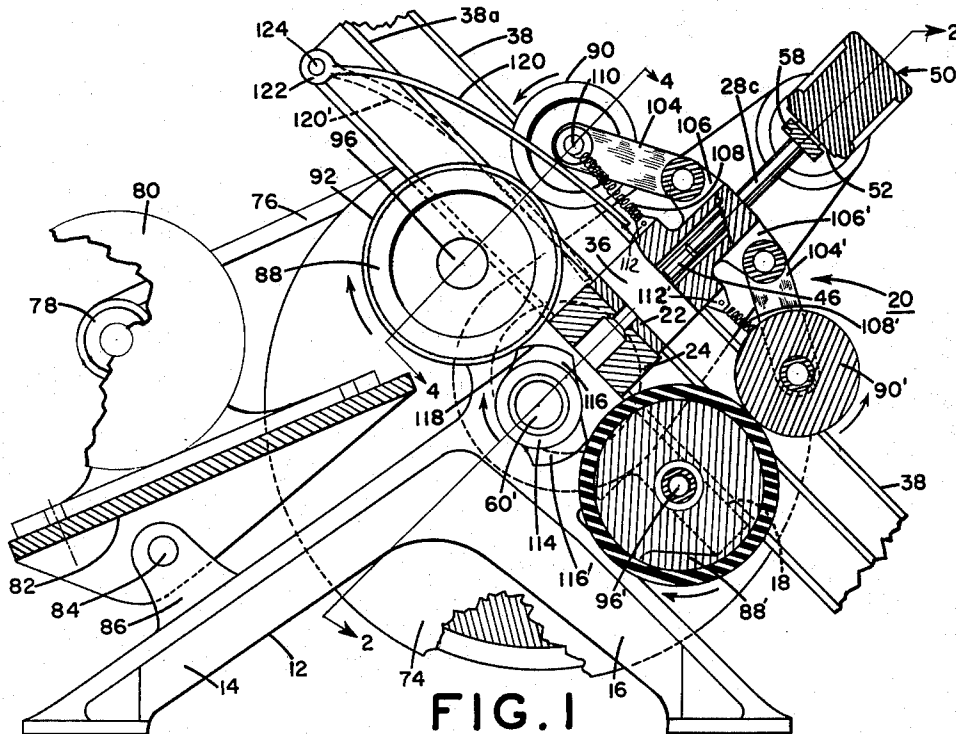


FIG. 1

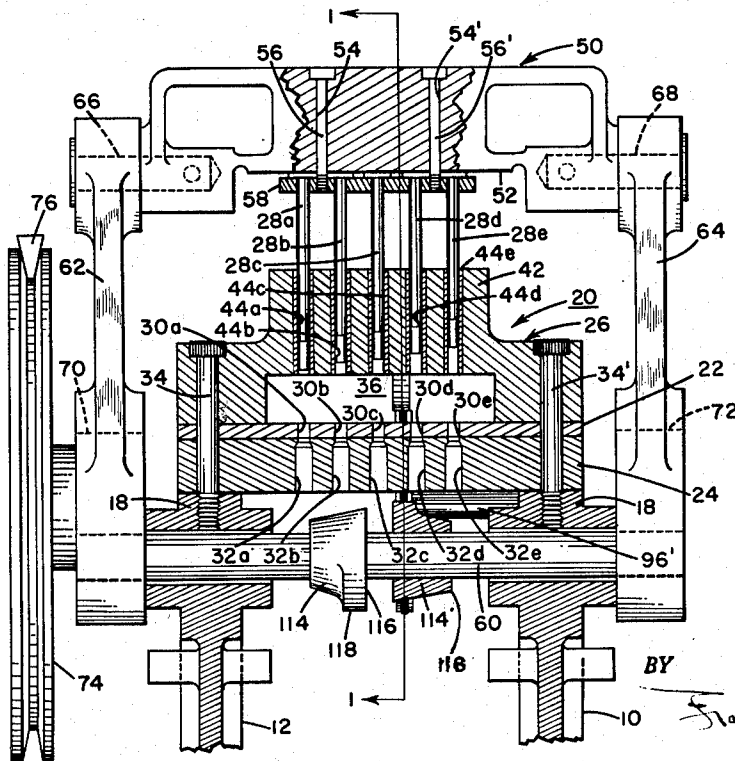


FIG. 2

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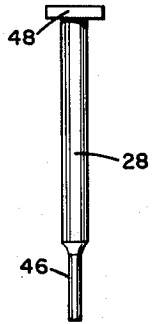


FIG. 3

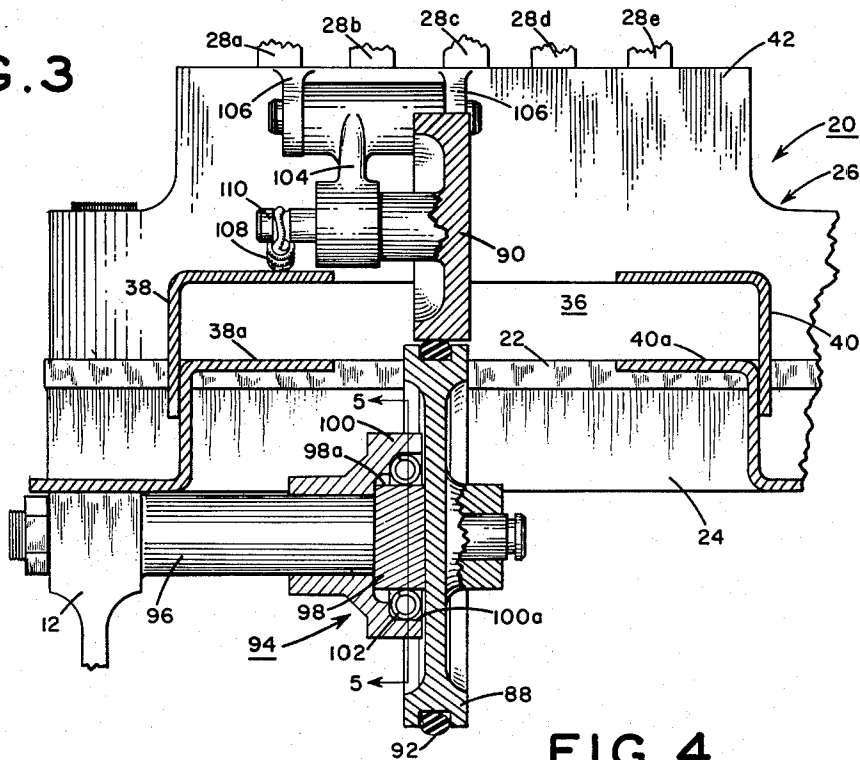


FIG. 4

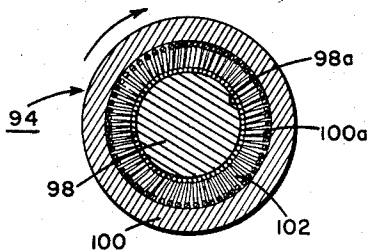


FIG. 5

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PUNCH PRESS HAVING CAM MEANS DIRECTLY DRIVING ROTARY WORK-FEED MEANS

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6 Claims. (Cl. 83—156)

This invention relates to apparatus for incrementally advancing and stopping a work piece at successive equispaced positions and performing a punching operation at such positions.

The invention will be described in conjunction with and as applied to a punch press particularly adapted to the cancellation by perforation of booklets containing so-called "trading stamps." While this is contemplated at present to be the primary field of utilization of the invention, it is to be understood that various other applications are possible and will occur to those skilled in the art.

In recent years, the distribution, accumulation and redemption of trading stamps has attained unprecedented volume. It is the usual, if not universal, practice among trading stamp companies to require that stamps for redemption to be pasted in booklets provided for that purpose. The pages of the booklet are marked and proportioned to receive a predetermined number of stamps in a fixed arrangement. One well known trading stamp booklet is arranged to receive 30 stamps per page: 5 stamps across and 6 stamps to the vertical column. Stamps are pasted on both sides of each leaf, giving the full book (1,200 stamps) considerable bulk and 20 thickness of paper.

As is well known, complete or partially filled booklets are turned in for redemption either to retailers or at redemption centers. In any case, the redeemed booklets eventually arrive in great numbers at some point where they create a serious handling problem. The books and stamps must either be destroyed, mutilated or cancelled in such a way as to render re-use impossible.

The cancellation system employed must be rapid and continuously operative or readily available for operation because, until cancelled, the books must be protected against theft, and, because of their bulk, safe storage in quantity, even for short periods, is a problem. Destruction by fire is not feasible because large and highly effective incinerators are required; as is well known large stacks of booklets burn slowly and incompletely without forced combustion. Furthermore, most trading stamp companies disdain combustion at the redemption point as total destruction of the booklets makes it impossible for the home office to audit branch operations.

Cancellation of the stamps with a cancelling stamp is a slow, tedious, hand operation requiring the turning of each page of the booklet. With increased volume, this method soon became entirely unfeasible and resort was taken to various procedures for invalidating full books of stamps on a volume basis. Among the most prominent of these is cancellation by punching for which a variety of special punch-presses are currently available; all, however, suffer from one or more of the shortcomings discussed hereinbelow. Basically these shortcomings derive from the failure of any known press available heretofore to fulfill the many, unique and often conflicting requirements and desiderata of this particular field of utilization.

While there are many desiderata which are almost uniformly applicable to all mechanical apparatus, e.g., low cost, dependability, ease of service, etc., there are few installations which impose the severe requirements extant relative to trading stamp cancellation presses from

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the standpoint of number, degree and/or conflicting nature.

These are best appreciated from a consideration of the fact that routine procedures of trading stamp companies involve cancellation at the branch redemption store in order to avoid the storage problem and enable the books to be shipped back to the home office at bulk paper rates, or to be field audited and disposed of in the field. At the redemption store, books are cancelled immediately upon presentation by the patron. Consequently, the cancelling press is customarily installed as part of or as an adjunct to a desk, counter or showcase over which patrons are served. The press, therefore, must be compact, of reasonably attractive appearance, quiet in operation, substantially free of vibration, and available for immediate, albeit sporadic, use. Moreover, the press should be capable of accepting and cancelling books as rapidly as it is possible for the operator to feed them.

The need for rapid operation may, at first blush, appear to be of minor importance but this is not the case. If the operator can feed the books, say, twice as fast as the machine can cancel them, one half of the operator's time is spent in idle waiting. The patrons presenting books are likewise kept waiting or, as an undesirable alternative, the books are set aside, creating the need for after-hours cancellation and increasing the possibility of pilferage, all aside from the unrelieved inefficiency in utilization of the time of the operator at whatever time the task of cancellation is performed.

The inherent conflict in some of the requirements alluded to above is exemplified by one form of prior art press which, in an effort to obtain rapid operation employs a punch head carrying a group of punches corresponding in number and location to the stamps on a page so as to effect cancellation in one stroke; thus speed is sought at the expense of quietness and low vibration and attained at a high price in bearing loads and mechanical stresses.

With the foregoing state of the art in view, it is the fundamental object of the present invention to provide a novel punch press which overcomes entirely, or at least mitigates to a large degree, the disadvantages, defects or undesirable features of comparable prior art devices.

Another general object is the provision of an improved device which fulfills to a high degree all or most of the desiderata of punch presses employed for trading stamp cancellation.

A specific object is the provision of a novel punch press as characterized in the preceding objects which is susceptible of easy, low-cost maintenance and service.

Another particular object is the provision of an improved punch press having a uniquely simple and reliable feed mechanism.

A further object is the provision of a novel punch press in which the arrangement of parts is such that the line of application of the punching force is nearly colinear with the line of action of the punches whereby side forces are minimized.

A still further object is the provision of an improved punch press in which the punches are positionally interchangeable and quickly removed for sharpening and/or replacement.

Another object is the provision of a novel punch press which is easily and quickly adaptable to any particular work piece by changing the number, size and/or spacing of the punches.

These and additional objects are accomplished by a punch press which, in accordance with the present invention, comprises guide means defining a plane of travel for a work piece through the press and a punching station

extending transversely of the plane of travel and including a punching die below the plane and a linear series of punches mounted above the plane of travel for reciprocatory movement normal to the plane. A primary actuating shaft is rotatably mounted below the plane of work piece travel and is drivingly connected to reciprocate the series of punches. Unidirectionally operative work piece feed means are located ahead of and following the punching station and cam means are mounted on and rotatable with the actuating shaft to selectively operate the feed means to advance a work piece by increments past the punching station.

Additional objects of the invention, its advantages, scope and the manner in which it may be practiced will be more fully apparent to persons conversant with the art from the following description of an exemplary embodiment thereof, to be read in conjunction with the subjoined claims and the annexed drawings in which like reference characters denote like parts throughout the several views and:

FIGURE 1 is a longitudinal section through a punch press embodying the present invention, taken generally on line 1—1 of FIGURE 2, with certain parts being shown in elevation or broken away to enhance clarity;

FIGURE 2 is a cross-sectional view taken on line 2—2 of FIGURE 1 looking in the direction of the arrows;

FIGURE 3 is an elevational view on an enlarged scale of one punch member of the form used in the FIGURE 1 and 2 embodiment of the invention;

FIGURE 4 is a cross-sectional view on line 4—4 of FIGURE 1 looking in the direction of the arrows; and

FIGURE 5 is a sectional view on line 5—5 of FIGURE 4 looking in the direction of the arrows.

Referring now to the drawing and initially to FIGURES 1 and 2 in particular, the punch press contemplated by the invention comprises as its principal structural component a frame made up of two generally parallel, A-shaped side members 10, 12 integrated by suitable cross-braces, not shown, bolted or otherwise secured to the side members, as well as by other elements having different primary functions as will become apparent as this description proceeds. While the orientation of the apparatus is by no means critical, the apparatus is adapted for mounting in a cabinet (not shown) or similar enclosure in the position best apparent from FIGURE 1, i.e., with the legs 14, 16 of respective side members 10, 12 extending at about 45 degrees to a horizontal mounting surface and at substantially right angles to each other. This arrangement provides a stable, broad-based, four-point mounting.

On each side frame member, extending substantially parallel to one of the legs (16) and, therefore, substantially perpendicular to the other (14), is a mounting pad or boss 18 on which is disposed a punching station assembly, designated generally by reference numeral 20, bridging between side frame members 10, 12 as best appears in FIGURE 2.

Punching station assembly 20 consists of a die plate 22, a die plate support block 24, a punch guide member 26, and a plurality of punches 28a, 28b, 28c, 28d, 28e. Die plate 22 contains a line of punch holes 30a . . . 30e, corresponding in number to punches 28a . . . 28e and coaxially registering with respective, somewhat larger holes 32a . . . 32e in support plate 24, on which it is superposed.

Die plate 22, its support block 24, and punch guide member 26, in the order named, are superimposed upon each other and the assembly disposed transversely between side frame members 10, 12 with its respective ends secured to mounting bosses 18 to which they are fastened by a pair of cap screws 34, 34' threading into suitable tapped holes in the bosses.

As best appears in FIGURE 2, punch guide member 26 is shaped to define, in conjunction with die plate 22, an opening 36 of rectangular cross-section intermediate its ends. A pair of channel members 38, 40 (FIGURE 4),

mounted in confronting relation on respective side frame members 10, 12 and in alignment with opening 36, coact therewith to form an axially-slotted guide defining a path of travel over die plate 22, for a work piece passing through the press.

Above opening 36, member 26 is formed with a punch-guide boss 42 through which extend a series of parallel, bearing-material-lined punch-guide bores 44a, 44b, 44c, 44d, 44e, each coaxially aligned with a respective hole 30a . . . 30e in die plate 22 and slidably receiving a respective punch 28a . . . 28e.

Punches 28a . . . 28e, are substantially identical except for length; as will be seen from the single representative punch 28, shown in FIGURE 3, each punch has a reduced diameter portion 46 at its lower end adapted to be received and operate in a respective die plate hole 30a . . . 30e to perform the punching operation. The upper ends of the punches are provided with discoid heads or buttons 48, not unlike the heads of common nails, which enable mounting of the punches to a cross-head ram member 50 as will now be described.

The underside of ram member 50 is provided with a flat 52 overlying and extending laterally beyond punch guide boss 42. Extending through ram member 50, perpendicular to flat 52 are a pair of screw holes 54, 54' adapted to receive machine screws 56, 56', preferably of the hollow-head variety and countersunk as shown in FIGURE 2.

A retainer plate 58 containing a series of holes only very slightly larger than the shanks of punches 28a . . . 28e and with centers spaced at intervals corresponding to the spacing between punch guide bores 44a . . . 44e are tapped to threadedly receive the ends of machine screws 56, 56'. Thus, the punches are mounted on cross-head ram member 50 simply by dropping them into the holes of retainer plate 58, placing the plate beneath the ram member so that punch heads 48 are clamped against flat 52 and inserting and tightening screws 56, 56'.

At this juncture it will be noted that it is a simple matter to remove punches 28a . . . 28e for grinding or replacement; moreover, the number and/or spacing of the punches can be increased or decreased to meet the requirement of the work piece by substituting a different retainer member 58 having the desired number and location of holes. Corresponding changes of guide member 26, die plate 22, and support block 24 are simply and conveniently made by removal of two additional screws only, viz., 34 and 34'.

Cross-head ram member 50 is driven from a prime actuating shaft or power shaft 60, journaled in side frame members 10, 12, by means of connecting rods 62, 64 having their upper ends pivotally attached to trunnion pins 66, 68 on the respective ends of the crosshead. The lower ends of connecting rods 62, 64 are journaled on eccentrics 70, 72 keyed to the respective ends of power shaft 60 to the outside of sideframe members 10, 12. On one end of power shaft 60 is a balanced fly wheel 74 peripherally grooved to receive a V-belt 76 which drivingly couples it to a pulley 78 on the shaft of an electric motor 80.

Motor 80 is fastened by means of bolts or the like to a rocker plate 82, pivotally secured, by pintles 84, to ears 86 (one shown, FIGURE 1) on respective legs 14 of side frames 10, 12. The center of gravity of motor 80, with its rocker plate, is such that the motor tends to pivot counter-clockwise, as viewed in FIGURE 1, about pintles 84, tensioning drive belt 76.

Stamp books, or other workpieces, are automatically fed into punching station 20 by means of a power-driven feed wheel 88 peripherally coacting with an idling pressure wheel 90. Powered feed wheel 88 has a grooved rim containing a rubber O-ring 92 to provide both high friction and a degree of resilience. To this end the groove is of square cross-section, as best appears in FIGURE 4, and its depth is substantially less than the diameter of O-ring

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92 so that an outer circumferential portion of the latter protrudes from the groove.

Powered feed wheel 88 is mounted by means of a one-way clutch assembly 94 (FIGURES 4, 5) to the end of a stub shaft 96 fastened to and projecting inwardly from one of the side frame members 12 in the illustrated embodiment. Shaft 96 is long enough to dispose wheel 88 intermediate channel members 38, 40 although, for reasons which will appear as this description proceeds, the wheel is not precisely centered with respect to these channel members.

The diameter of wheel 88 is sufficiently large that a small segment of its circumference, bearing O-ring 92, projects between and above the lower surfaces 38a, 40a of channel members 38, 40, thus to engage the underside of a work piece (not shown) disposed therein.

Clutch assembly 94 consists of an inner member formed by a hub 98 on wheel 88 and having a cylindrical surface, or race, 98a; an outer member 100 having an inner cylindrical surface 100a concentrically surrounding that of the hub; and, disposed between the concentric cylindrical surfaces, an annular coil spring 102 of the type usually referred to as a "garter" spring. The outer diameter of the helix comprised by the coils of spring 102 is slightly greater than the radial spacing between inner and outer surfaces 98a and 100a; consequently, the coils of the spring are canted in one circumferential direction and rotation of the outer member relative to the inner member in a direction counter to the slant of the coils is prevented by the spring, the coils tending to "bite" into the respective cylindrical surfaces due to the continued tendency of the spring to right (i.e., uncant) itself and wedge into a space too small to accommodate it. Turned in the same direction as the spring coils are canted, outer member 100 simply slips over the coils; there is, however, some drag in the over-riding direction which is desirable as will appear hereinbelow. The spring in clutch assembly 94 is canted so that wheel 88 can turn clockwise (as viewed in FIGURE 1) about the axis of shaft 96 but cannot turn counterclockwise.

Further information and additional details of this and various other forms of clutches operating on the same principle may be had by reference to H. Palter's copending application Serial No. 137,468, filed September 11, 1961, and now abandoned.

Pressure wheel 90, which rides on the O-ring tired rim of powered feed wheel 88, is rotatably journaled on the free end of an arm 104, pivotally secured between a pair of ears 106 on punch guide member 26. A tension spring 108 connecting between a lug 110 on the free end of arm 104 and an anchor point 112 on punch guide member 26 urges the rim of pressure wheel 90 into contact with O-ring tire 92 of powered feed wheel 88.

Feed wheel 88 is intermittently rotated by cam 114 fixed to shaft 60 between side members 10, 12. As shown in FIGURE 1, cam 114 has a single lobe 116 having steep flanks and a concentric active surface 118. Lobe 116 extends over about 60 degrees of rotation from flank to flank but it will be appreciated that lobe duration may be varied as necessary to achieve the desired feed increment per revolution.

The height of cam lobe 116 is such that it engages and rotates powered wheel 88 a fraction of a turn per cam revolution. The angular position of cam lobe 116 on shaft 60 is determined by reference to eccentrics 70, 72 and, in the present embodiment, the leading edge of the lobe leads the axis of symmetry of the eccentrics by about 75 degrees. The manner in which this positioning is arrived at will be described hereinbelow. At present it is sufficient to say that the angular position of the cam lobe is such, with reference to the eccentrics, that a work piece engaged between the powered and idler feed wheels 88 and 90, respectively, is advanced to a predetermined position at the punching station in timed relation to the descent of punches 28a . . . 28e.

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It will be noted that the incremental rotation of feed wheel 88 in response to engagement by cam lobe 116 is in the over-riding direction of clutch assembly 94, clockwise as viewed in FIGURE 1. The drag of the clutch spring in this direction, heretofore alluded to, prevents "coasting" of the feed wheels due to inertia; consequently, wheels 88 and 90 stop dead almost immediately upon disengagement of the cam lobe. As a result, the work piece is accurately positioned with respect to the punching station.

It is also to be noted that, due to clutch 94 which mounts feed wheel 88 on shaft 96, the wheel is precluded from counterclockwise rotation, as viewed in FIGURE 1. This prevents a work-piece which is being fed into the apparatus from backing up in the event that it happens to engage the feed wheels near the end of a period of rotation where the remaining rotary movement is insufficient to draw the leading edge of the work piece beyond the point of tangency between the two wheels.

Continuing with the description of the exemplary apparatus: on the opposite (i.e., exit) side of punching station 20 with respect to feed wheels 88, 90 is a secondary powered feed wheel 88' and a coacting pressure wheel 90' substantially identical to their already-described counterparts 88, 90. Thus, secondary powered feed wheel 88' is peripherally grooved to carry an O-ring 92' and is mounted by means of a unidirectional clutch assembly 94', also substantially identical to its counterpart 94, to the end of a stub shaft 96' fastened to and projecting inwardly from side frame member 10.

Secondary feed wheel 88' is laterally displaced toward the opposite side of the midpoint between channels 38, 40 with respect to the primary feed wheel 88. This permits mounting a secondary feed cam 114' on shaft 60 adjacent to cam 114, and in a position to engage and intermittently drive secondary feed wheel 88'.

Secondary pressure wheel 90' is rotatably journaled on the free end of an arm 104', pivotally secured between trunnions 106' on punch guide member 26. Pressure wheel 90' is positioned to ride on the rim of secondary powered feed wheel 88' and is urged into contact therewith by means of a tension spring 108' connecting between a lug 110' on the free end of arm 104', and a suitable anchor point 112' on punch guide member 26. Secondary feed wheels 88', 90', engage the work piece as it emerges from the punching station and take over the feeding function entirely when the workpiece has advanced to the point that its trailing end passes from between primary feed wheels 88, 90. Consequently, the configuration and angular position of the lobe 116' of cam 114' are such as to produce synchronous operation of the primary and secondary feed wheels. Any deviation from synchronous operation is accommodated by the clutch assemblies 94, 94' which mount the respective powered feed wheels on shafts 96, 96'.

Automatic energization of motor 80 is accomplished upon insertion of a work piece into the primary feed wheels by means of a trip finger 120 displaceably obstructing the feed chute formed by guide channels 38, 40. Trip finger 120 may consist of a short length of fairly heavy wire or light rod stock. It is mounted cantilever fashion to a collar 122 coaxially fixed to a shaft 124, extending between and having its ends journaled in the lower edges of the side walls of channels 38, 40. Trip finger 120 extends upwardly between channels 32, 40, a region where it is necessarily engaged by a work piece inserted into the apparatus. Forward movement of the work piece into the channel causes angular displacement of the trip finger which turns collar 122 and, therefore, shaft 124 on its axis in a clockwise direction as viewed in FIGURE 1. Shaft 124 is connected in any suitable manner (not shown) to an on-off switch (also not shown) for controlling the supply of electric power to motor 80 so that the clockwise movement described moves the switch from "off" to "on" position. The linkage between the on-off

switch and trip finger 120 is spring-biased to establish a normally-off position for the switch with the tip finger normally occupying a position (shown in solid lines) where it obstructs the feed chute and is unavoidably displaced (to the dotted line position, 120') by insertion of a work piece.

As previously mentioned, punches 28a . . . 28e vary in length. Preferably the variation is in the form of even differentials from one side of ram 50 to the other. Consequently, when repeated grinding to sharpen the punches eventually renders one or more of them too short for further use, only the shortest punch need be discarded. Each of the remaining punches is moved over one place toward the short-punch end of the ram and the vacancy thus created at the other end filled with a new, maximum-length punch. This arrangement not only extracts the fullest measure of service life from the punches but requires the stocking of only one size of replacement punch.

The operation of the device is deemed to be discernible from the preceding description but may be reviewed and summarized as follows: The apparatus is normally at rest, i.e., non-operation is the normal state. Upon insertion of a trading stamp booklet, or other work piece, into the feed guide defined by channel members 38, 40 trip lever 120 is depressed from normal position to its dotted line position, 120' rotating shaft 124, thus moving motor switch to its "on" position. In consequence, motor 80 is energized and its rotation transmitted by means of drive belt 76, causing fly wheel 74 to rotate power shaft 60 in a counter clockwise direction as viewed in FIGURE 1. Eccentrics 70, 72 raise cross-head 50 toward its top dead center position and maximum retraction of punches 28a . . . 28e. While the punches are still on the up-stroke, cam lobes 116, 116' engage powered feed wheels 88 and 88', respectively. Wheel 88 is turned clockwise as viewed in FIGURE 1 so that the trading stamp booklet work piece is drawn between feed wheel 88 and pressure roller 90 and advances to an initial position in the punching station. Its advance halts, followed by descent of crosshead 50 with punches 28a . . . 28e. In the order of decreasing length, the extreme ends of punches 28a . . . 28e pass through the work piece into respective holes in die plate 22 as ram 50 reaches bottom center and starts its retract stroke. As the receding punches pull out of the work piece it is freed for a second incremental advance effected by the next rotary movement of wheel 88 at the next pass of the cam lobe 116. The cycle is repeated for each revolution of power shaft 60. When the work piece has advanced sufficiently, its leading edge is engaged by and drawn between secondary feed wheels 88', 90' which are intermittently rotated synchronously with wheels 88, 90 by cam 114'. In this manner, a smooth transition is made from single feed by the primary feed wheels only, to joint feed by both primary and secondary wheels and, finally, transfer entirely to the secondary wheels when the trailing edge of the work piece pulls clear of the primary wheels.

Motor 80 continues in operation as long as trip finger 120 is maintained in its depressed condition and, inasmuch as feed is automatic once the first work piece engages the primary feed wheels, a succession of work pieces can be fed into the chute so that motor operation is substantially continuous. The inertia of flywheel 74 is sufficient to bridge brief interruptions in motor operation and to complete the punching of the final work piece after it clears trip finger 120. This can, of course, be manually depressed if and as necessary or desired.

With reference to the objects of the invention, it will be noted that the punching force exerted by ram 50 is substantially co-linear with the line of action of punches 28a . . . 28e, thus practically eliminating unwanted side forces. Moreover, all impact forces, albeit they are distributed both in time and space by the staggered punch length arrangement, are absorbed as tension in connecting

rods 62, 64 rather than being transmitted as hammer blows to the frame members and ultimately to the base or support on which the press is mounted.

The simplicity of service already alluded to, includes:

- (1) easy removal and replacement of punches, which requires only the removal and re-insertion of two screws (56, 56'); (2) conversion to a greater or lesser number of punches which requires only the additional removal and re-insertion of two bolts 34 and 34', all that is necessary to change die plate 22, support block 24, and punch guide member 26, and retainer plate 58. Service simplicity extends even to the replacement of the O-rings 92, 92' on powered feed wheels 88 and 88' which can be accomplished without tools or disassembly.

While there has been described what at present is believed to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is aimed, therefore, to cover in the appended claims all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed and desired to be secured by United States Letters Patent is:

1. A punch press comprising: guide means defining a planar path of travel for a work piece through the press; a punching station extending transversely of the path of travel and including a punching die below said path and a linear series of punches mounted above the path of travel for reciprocatory movement normal to the plane thereof; a primary actuating shaft rotatably mounted below said path and drivingly connected to reciprocate said punches in unison; irreversible work piece feed wheel means located ahead of and following said punching station as regards the direction of work piece travel; and continuously operating cam means mounted on and rotatable with said shaft to selectively directly engage and operate said feed wheel means to advance a work piece in a series of substantially uniform increments past said punching station.

2. A punch press comprising: guide means defining a planar path of travel for a work piece through the press; a punching station extending transversely of said path of travel, including a punching die plate mounted below and parallel to said path and a linear series of punches mounted above said path for reciprocatory movement normal thereto; a primary actuating shaft rotatably mounted below and parallel to said path and drivingly connected to reciprocate said punches in unison; a work piece feed wheel mounted for unidirectional rotation about an axis substantially parallel to said shaft plane of work piece travel and substantially tangent to said plane; means for urging a work piece into frictional engagement with the periphery of said feed wheel at the point of tangency with said plane of travel; and cam means mounted on and rotatable with said shaft intermittently engaging and incrementally rotating said feed wheel in timed relation to the reciprocatory movement of said punches to advance a work piece by increments between said punches and punching die.

3. A punch press according to claim 2 including a secondary feed wheel mounted on the opposite side of said punching station with respect to said work piece feed wheel for rotation about an axis substantially parallel to the axis of said shaft and of said work piece feed wheel; additional cam means mounted on and rotatable with said shaft intermittently engaging and incrementally rotating said feed wheel substantially synchronously with said first work piece feed wheel; and additional means urging a work piece into frictional engagement with the periphery of said secondary feed wheel.

4. A punch press comprising: guide means defining a planar path of travel for a work piece through the press; a punching station extending transversely of said path of travel and including a punching die disposed beneath and parallel to said path of travel, a cross-head ram member, a linear series of punches mounted on said ram

member, and means guiding said punches for axial movement normal to the plane of said path of travel; an actuating shaft mounted for rotary movement about an axis extending transversely of said path of travel and parallel to the plane thereof; eccentric means mounted on said shaft for rotation therewith; connecting rod means coupling between said ram and said eccentrics to impart reciprocatory movement to said ram in response to rotation of said shaft; irreversible unidirectionally operative work piece feed wheel means mounted adjacent said path of travel; and cam means on said actuating shaft intermittently directly engaging said feed wheel means to pass a work piece along said path of travel into and out of said punching station in a series of small uniform increments in timed relation to the reciprocation of said ram.

5. A punch press comprising: guide means defining a path of travel for a work piece through the press; a punching die plate fixedly mounted beneath and parallel to said path of travel; a ram member having a flat surface confronting said path of travel; a retainer plate detachably secured to said flat surface; a plurality of headed punches extending from said ram toward said dies and having their respective heads clamped between said flat surface and said retainer plate; punch guide means fixedly mounted between said punching die plate and said ram and having a plurality of bores perpendicular to said die plate slidably receiving said punches; an actuating shaft mounted below said path of travel for rotation about an axis parallel to said die plate; eccentric means mounted adjacent the ends of said shaft for rotation therewith; connecting rod means operatively coupling said eccentrics to said ram whereby to cause reciprocatory movement of said ram in response to rotation of said shaft; and means intermittently operative between each reciprocatory movement of said ram to feed work pieces along said path of travel and between

said die plate and punch guide means, said intermittently operative work piece feed means includes a work piece feed wheel mounted for unidirectional rotation about an axis substantially parallel to said shaft plane of work piece travel and substantially tangent to said plane; means for urging a work piece into frictional engagement with the periphery of said feed wheel at the point of tangency with said plane of travel; and cam means mounted on and rotatable with said shaft intermittently engaging and incrementally rotating said feed wheel in timed relation to the reciprocatory movement of said punches to advance a work piece by increments between said punches and punching die.

6. A punch press according to claim 5 including a secondary feed wheel mounted on the opposite side of said punching station with respect to said work piece feed wheel for rotation about an axis substantially parallel to the axis of said shaft and of said work piece feed wheel; additional cam means mounted on and rotatable with said shaft intermittently engaging and incrementally rotating said feed wheel substantially synchronously with said first work piece feed wheel; and additional means urging a work piece into frictional engagement with the periphery of said secondary feed wheel.

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