PRINTING PLATE BENDING AND MOUNTING MACHINE

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This invention relates to printing and, in particular, to printing from curved plates on cylinder presses.

One object of this invention is to provide a printing plate bending and mounting machine for simultaneously curving original engraved printing plates and attaching them to a curved dummy or adapter which in turn is capable of being mounted directly upon a cylinder press and used immediately for rotary printing procedure, as, for example, in high speed newspaper printing presses.

Another object is to provide a machine of the foregoing character having heaters incorporated therewith for heating and consequently softening the plate while it is other parts of the curving of the printing plate in which is heated to a lower temperature to provide differential thermal contraction upon cooling, which securely shrinks the plate to the dummy.

Another object is to provide a machine of the foregoing character having means incorporated therewith for further bending the ends of the plate around the opposite ends of the dummy in order to secure these to one another and lock them solidly together.

Another object is to provide a machine, as set forth in the object immediately preceding, wherein the bending means also includes means for facilitating the insertion of securing fasteners, such as screws, through the bent end of the plate into the aligned threaded holes in the abutting ends of the dummy.

Another object is to provide a machine of the foregoing character having precision stops incorporated therewith for precisely regulating the rotation and consequent travel of the plate-bending cylinder, so that the opposite ends of the dummy will come to a halt immediately over the opposite ends of the plate in order to provide accurate registry thereon prior to securing the opposite ends of the plate to the opposite ends of the dummy.

Another object is to provide a machine of the foregoing character for bending the original printing plate into snugly fitting engagement with a dummy forming a circumferential section of a hollow cylinder, the combined thickness of the plate and dummy being that of the conventional stereotype plates commonly used in high speed newspaper printing presses, the machine also enabling the bending of the opposite ends of the printing plate around the opposite ends of the dummy so as to secure these firmly to one another, thereby performing all precision operations prior to the arrival of the plate at the press room, and eliminating the need for precision setup operations at the printing press itself.

Another object is to provide a machine, as set forth in the object immediately preceding, wherein the grooves or other means for securing the ends of the printing plate in connection with the preparation of the printing plate are also used for accurate lining up of the printing plate with the dummy preparatory to bending the plate around the dummy and securing their opposite ends to one another.

Another object is to provide a process of simultaneously heating, registering, bending and mounting an original engraved plate upon a cylindrical sector-shaped dummy with the result that the printing plate and dummy, thus united to one another, are interchangeable as a unit with the stereotype plates previously used on rotary cylinder presses, such as in high speed newspaper printing.
FIGURE 13 is a fragmentary longitudinal section taken along the line 13—13 in FIGURE 12; FIGURE 14 is a fragmentary longitudinal section taken along the line 14—14 in FIGURE 12; FIGURE 15 is an enlarged fragmentary vertical section taken along the line 15—15 in FIGURE 3; FIGURE 16 is a fragmentary longitudinal section through one end of a hollow cylindrical sector dummy and printing plate attached thereto, according to a modification of the invention; FIGURE 17 is a top plan view, partly in horizontal section, of the modification shown in FIGURE 16; FIGURE 18 is an enlarged fragmentary longitudinal section, through one end of a hollow cylindrical sector dummy and printing plate attached thereto, according to a further modification of the invention; FIGURE 19 is a top plan view of a hollow cylindrical sector dummy and a plurality of printing plates attached thereto, according to a still further modification of the invention; FIGURE 20 is a side elevation of the assembly shown in FIGURE 19; FIGURE 21 is an enlarged fragmentary longitudinal section taken along the line 21—21 in FIGURE 19; FIGURE 22 is a view similar to FIGURE 2, but mainly in elevation, of a modified bending cylinder unit employing a different heating arrangement from that of FIGURE 2; FIGURE 23 is a left-hand end elevation of the unit of FIGURE 22, with one of the end plates of the drum broken away to show the conductor connections; FIGURE 24 is a top plan view partly in horizontal section, of a slightly modified bed plate from that shown in FIGURE 3, employing a somewhat different heating arrangement; FIGURE 25 is a longitudinal vertical section taken along the line 25—25 in FIGURE 24; and FIGURE 26 is a vertical cross-section taken along the line 26—26 in FIGURE 24.

Hitherto, high speed printing of newspapers and other similar printed matter has been accomplished on high speed rotary presses carrying stereotype plates for producing the printed impression upon the paper. These stereotype plates have been cast by bringing molten metal into contact with matrices of specially prepared paper which have previously been pressed into contact with printing materials, such as type, engraving, plastic, and plate, etc. in order to receive an impression from which stereotype plates could be cast. Such stereotype plates resulted in high volume production of newspapers, but the quality of reproduction was considerably inferior to that produced by direct printing from original plates produced by photo-engraving processes. Such original plates, however, previously consumed so much time in preparation that it was impractical to attempt to produce them in the quantities necessary for use in a newspaper printing plant.

Recently, however, improvements in high speed etching processes and color separation techniques have enabled the production of process color engravings with great rapidity, such as the production of a plate every two or three minutes. This procedure for the first time makes it feasible to view at a single point of view to print newspapers directly from engraved plates rather than by stereotype plates cast from paper matrices produced from engraved plates. Ordinary engraved plates, however, are not directly adaptable to high speed rotary printing presses, such as are used for the printing of newspapers, because stereotype plates (as opposed to the wall 76 above the groove 58). The groove 72 in the horizontal clip bar portion 68 also provides a rib 78 which projects upwardly into the groove 58 in the printing plate 60 and interlocks with the rib 74 thereof to provide a printing plate unit, generally designated 80, including the angle clip bars 66, which are secured to the printing plate 60 by fasteners.
82, such as rivets, engaging the ribs 68. The ribs 68 are also drilled at intervals with holes 84 aligned with holes 86 in the thin portion 76 of the plate 60 (FIGURES 13, 14 and 15) through which screws or other fasteners 87 (FIGURE 7) are subsequently inserted, as described below.

The bed plate 52 has depending edge flanges 88 (FIGURE 4) which form a hinter chamber 99 closed by a closure plate 92 secured to the bottom thereof. Secured to depending bosses 94 within the chamber 90 are multi-pluriparallel electrical heating units 98, the opposite ends of which are interconnected by cross conductors 96 to which in turn are connected conductors 100 and 15 residing in (FIGURE 3) leading to an external source of electricity. The bed plate 52 is provided in one of its side portions 90 with a dovetail groove 104 (FIGURES 1 and 3) extending almost to the midportion thereof from one side edge thereof and containing a sliding stop or positioning block 106 of corresponding dovetail cross-section clamped in place by a clamping bolt 108. The stop block 106 engages one of the side edges 89 of the printing plate 60 to accurately locate the printing plate 60 laterally at a predetermined location on the bed plate 52.

The printing plate 60 is bent and secured in the manner set forth below to a curved dummy or adapter, generally designated 114, having beveled side edges 115. In order to bend the thin end portions 76 of the printing plate 60 around the rounded ends and the opposite ends 112 of the hollow cylindrical section 114, to which the printing plate unit 80 is to be secured (FIGURES 10 and 15) and secure the thin portion 76 thereto by suitable fasteners mounted in the threaded screw holes 116, the machine 30 is provided with bending units, generally designated 120, mounted on the machine at the opposite ends of the printing plate 60. Each bending unit 120 is journaled upon flanged disc bearings 122 (FIGURE 3) of flanged cylindrical form which are drilled to receive screws 124 securing their lower portions to threaded holes 126 in the sides of the bed plate end portion 128. The bearings 122 have cylindrical bearing surfaces 130 which engage radii 132 in the hubs 134 of crank arms 136, the ends of which carry laterally-projecting operating handles 138. Extending between the crank arms 136 and secured thereto as by the screws 140 is a bending bar 142.

Each bending bar 142 in its inactive position at the commencement of bending operations is in the vertical position shown in FIGURES 3 and 14, against the flat end surface 143 of the bed plate 52, which it is swing upwardly into the horizontal position of FIGURE 6 during the bending operation, as described below in connection with the operation of the invention. The bending bar 142 is provided with a thickened offset edge portion 145 containing a groove 144 (FIGURE 15) shaped and dimensioned to receive the horizontal portion 68 of the angle bar clip 66 and having bores 146 aligned with the bores 84 and 86 in the clips 66 and printing plate thin portion 76 and of a sufficiently large diameter to pass the heads of screws subsequently inserted in the bores 84 and 86 (FIGURE 15). Thus, the groove 144 in the bending bar 142 provides parallel upstanding ribs 148 and 149 on the bending bar 142, the rib 148 entering the space between the end of the bed plate 52 and the overhanging clip 66, and the somewhat higher rib 149 serving as an abutment against which the vertical portion 70 of the clip 66 rests during bending.

The hollow cylindrical sector dummy or adapter 114 is so designated because it is in the form of a sector of a hollow cylinder of considerable thickness as thicker than the thickness of the printing plate 60. When the printing plate unit 80 it forms an adapter-end-plate assembly, generally designated 150 (FIGURE 10). The outer cylindrical surface 152 of the dummy 114 is adapted to be engaged by the back surface 64 of the printing plate 60 and their combined radial thicknesses when bent in the manner shown in FIGURE 10 by the machine 30 into the assembly 150 substantially equal the thickness of the conventional cast metal side metal stereotype plate which the assembly 150 is intended to replace in the rotary cylindrical printing press, according to the invention. The dummy 114 is thus an adapter or filler of partially hollow cylindrical form intended to fill in the space between the bent printing plate 60 and the outer cylindrical of the press. The rearward cylindrical surface 154 of the dummy or adapter 114 accurately fits the outer cylindrical surface of the rotary press cylinder (not shown). The dummy or adapter 114 adjacent its opposite ends 112 is provided with ribs 156 adapted to receive the bar clip portions 70 after the bending operation has been completed (FIGURES 10 and 15), the edges of the rabat 156 and bar clip portion 70 being correspondingly inclined or beveled.

In order to provide accurate positions for the beginning and ending of the bending operation, stop units, generally designated 158 and 160, are provided near the opposite ends of the bed plate 52 (FIGURES 1 and 2) and of similar construction, hence the parts are designated with the same reference numerals. Each stop unit 158 and 160 consists of an approximately U-shaped support 162 bolted at 164 to the side surface of the adjacent rack bar 42 and bored at its upper end as at 166 to receive a pivot pin or bolt 168. The latter pivotally supports a swinging stop lever 170 having an upper arm 172 provided with a lateral vertical stop edge 174 and a lower arm 176 with a laterally-projecting boss 178 thereon. The hub 178 is provided with a socket 180 (FIGURE 2) in which a pointed plunger 182 is reciprocally mounted and urged into a corresponding recess 184 in the support 162 by a compression spring 186 mounted in the socket 180. The spring 176 encircles a shank 188 attached to the plunger 182 and passes through the suitably drilled end wall 190 of the boss 178, terminating in an operating knob 192. The recess 184 is so located that when the pointed plunger 182 enters it, the vertical stop edge 174 is positioned at the precise location intended for the hailing place of the periphery of the bending cylinder supporting shaft 194 of a bending cylinder unit, generally designated 196.

The bending cylinder unit 196 is supported by a pair of toothed wheels or gears 198, the hollow hubs 199 of which are keyed or otherwise secured (FIGURE 2) to the opposite ends of the shaft 194. The wheels 198 have peripheral teeth 200 adapted to register with the teeth 44 on the rack bars 42, with the result that the toothed wheels 198 roll along the toothed rack bars 42 as on tracks. Retaining bars 202 are secured to the inner surfaces of the rack bars 42 to prevent the toothed wheels 198 from falling off the tracks formed thereby (FIGURE 2). Also keyed as at 204 to the shaft 194 inwardly of the wheels 198 are the hubs 206 at the opposite ends of a bending cylinder 208, the cylindrical peripheral wall 210 of which has opposite sides 211 and a cylindrical surface 212 forming a seat curved to fit the inner cylindrical surface 184 of the dummy or adapter 114 (FIGURE 4). At diametrically opposite locations, the peripheral wall 210 is provided with grooves 214 of arcuate cross-section sufficiently deep to provide clearance for the thickened edge portions 143 of the bending bar 142 during the bending operation upon reaching the bending positions (FIGURES 6 and 7). Projecting radially inward from the inner surfaces of the peripheral wall 210 of the bending cylinder 208 are multiple bosses 216 arranged in two rows in axially-spaced parallel planes (FIGURE 22) adapted to support multiple electrical heating units 210 installed in a bimetallic cage formation and having their opposite ends interconnected by arcuate almost-circular conductor bars 220 and 222 the ends of which are in turn connected to conductors 224 and 226 respectively passing through a bore 228 in the shaft 194 to contact rings 230 and 232 respectively mounted on a
hub or plug 234 of insulating material through which the conductors 224 and 226 pass (FIGURE 2). The heating units 218 are of course suitably insulated from the boxes 216, and the contact rings 230 and 232 are engaged by conductors 224 and 226 respectively. The brackets 236 and 238 are mounted in a hollow housing 240 en-circling the plug 234, which is itself inserted in the end of the bore 228 in the shaft 194, and are connected to conduits 242 and 244 respectively for connection to a source of electric current.

In order to secure the dummy or adapter 114 to the bending cylinder 208 in an accurately predetermined position prior to the plate bending operation (FIGURES 8 and 9), stop blocks 246 with bevelled inner side edges 248 fitting the bevelled side edges 115 of the dummy 114 are bolted or otherwise secured in peripherally-spaced relation to the peripheral cylindrical surface 212 of the bending cylinder 208 and clamped against them by clamping devices, generally designated 250, including movable clamping blocks 252 also with similarly bevelled edges 254. The clamping blocks 252 have base portions 256 of dovetail cross-section fitting into axial slots 258 (FIGURE 1) also of dovetail cross-section in the periphery of the bending cylinder 208 and bored and threaded axially as at 260 (FIGURE 9) to receive the threaded shank 262 of a clamping screw 264, the head 266 of which is pinned or otherwise secured to the outer end of the screw 262 in spaced relationship to an enlargement 268. Rotatably engaging the screw 262 between the enlargement 268 and the inner end of the head 266 is a bracket 270 which is secured as by the fasteners 272 to one of the sides 211 of the bending cylinder 208. Consequently, when the screw 262 is rotated by the knurled head 266, the bracket 270 prevents it from moving axially, hence the clamping block 252 moves back and forth into clamping engagement with the dummy or adapter 114. Prior to the operation of the machine 30 shown in FIGURES 1 to 9 inclusive, the operator rolls the bending cylinder unit 126 to the left on the rack bar rails 42 beyond the position shown in FIGURE 1 in order to position the grooves 214 of accurate cross-section in an approximately horizontal plane in order to present uppermost the clamping devices 250 on the portion of the bending cylinder 208 intended to receive the dummy or adapter 114. The latter is then placed in its intended position with its opposite ends 112 overhanging the grooves 144 (FIGURE 4). While the bending cylinder unit 196 is still retracted to the left of the left-hand bending unit 120, the printing plate unit 80 with its angle bar clips 66 riveted or otherwise secured thereto after the photo-engraving process has been completed, is placed face down upon the upper surface 54 of the bed plate 52 (FIGURES 3 and 4) with the ridges 56 fitting the grooves 58 over approximately half of their widths.

The handles 138 of the bending units 120 are assumed to have been previously placed in the positions shown in FIGURES 1 and 4 in order to position the bending bars 142 against the adjacent end surfaces 143 of the bed plate 52. In this position, the angle bar clips 66 rest in the grooves 144 in the bending bars 142 and the rib 146 extends upward part way into the groove 58 (FIGURE 15). The heaters 96 and 218 in the bed plate chamber 90 and inside the bending cylinder 208 respectively are energized in order to heat the bed plate 52 and bending cylinder 208 and consequently to heat the printing plate 60 and the dummy or adapter 114. The bed plate 52 is heated to a temperature of 250° to 600° F. to soften the material of the alloy printing plate 60, whereas the dummy 114 is heated to 50° to 100° less, so that in cooling the plate 60 shrinks tightly into engagement with the dummy 114. The bending cylinder unit 196 is now rolled to the right until its shaft 194 encounters the stop edge 174 of the left-hand stop unit 158, whereupon the starting end 112 of the dummy or adapter 114 now occupies the position shown in FIGURES 1, 4 and 14.

When the dummy or adapter 114, bed plate 52 and printing plate 60 have become sufficiently heated, the operator swings the handle 138 of the left-hand bending unit 120 and consequently its bending bar 142 in a clock-wise direction, bending the left-hand end portion of thin portion 76 upward from the position shown in FIGURE 6 to that shown in FIGURE 7. This action moves the boxes 146 in the bending bar 142 from the vertical position of FIGURE 15 to the horizontal position of FIGURE 7. The operator then inserts a screw 87 in each bore 146 and by means of a screw driver (not shown) pushes the shank of each screw 87 through the holes 84 and 86 into the mouth of the threaded hole 116 whereby securing the angle bar clip 66 and the adjacent thin end portion 76 of the printing plate 60 to the end 112 of the dummy or adapter 114 (FIGURE 7). The operator now swings the left-hand stop lever 170 out of the path of the shaft 194 by pulling outward on the detent knob 192 (FIGURE 2) and swinging the stop lever 170 in a clockwise direction out of the path of the shaft 194. The operator then rolls the bending cylinder unit 126 from its left-hand position of FIGURE 1 to that shown in FIGURE 282, causing the printing plate 60 to be simultaneously bend and rolled into contact with the curved surface 152 of the dummy or adapter 114 until the shaft 194 arrives against the stop edge 174 of the right-hand bending unit 160, whereupon the opposite edge 112 of the dummy or adapter 114 is now presented above the opposite angle bar clip 66 of the printing plate unit 80. The operator then swings the handle 138 and crank arm 136 in a counterclockwise direction to swing their respective angle bar 142 upward to the left to bend the adjacent thin portion 76 of the printing plate 60 around the corner edge 110 into contact with the adjacent end 112 of the dummy or adapter 114, and consequently bring the screw holes 84 and 86 into alignment with the threaded holes 116, whereupon screws 87 are inserted through the now horizontal bores 146 in the manner described above, and thus securing the printing plate unit 60 completely to the dummy or adapter 114. The bending units 120 are now swung backward to their starting positions of FIGURES 3 and 4, and the plate assembly is removed from the bending cylinder 208 by retracting the clamping devices 250 (FIGURES 8). The assembly 150 is allowed to cool sufficiently for handling, the differential shrinkage causing a tight fit between them. The assembly 150 is then ready to be transferred to the press room for mounting upon the rotary press cylinders in the same manner as the stereotype plates which the assemblies 150 are intended to replace. Printing is then carried out in the usual manner, but by the use of the original printing plate and adapter assemblies 150, instead of by stereotype plates.

Modified printing plate and adapter assembly

A modified printing plate and adapter assembly, generally designated 260, shown in FIGURES 16 and 17 employs a printing plate 282, and an adapter 284 of which is the same as the main portion 63 of the printing plate 60 of FIGURE 11 and it similarly has a front surface 286 with the photo-engraved and etched cut which is to be printed, whereas the rear surface 288 engages the pivotal member 212, and the upper surface 290 of which is that shown in FIGURES 1 to 4 that engages the bending cylinder peripheral surface 212, as before. The end portion 296 of the printing plate 282 differs from that of the printing plate 60 in that it has two relatively narrow grooves 298 and 300 adjacent one
another on the front surface 286 and rear surface 288 respectively. The adapter 292, as before, has a rounded front 300 and also has a rabbit 306 formed in the rear surface 294 thereof. The plate-sealing device 308, however, differs greatly from securing device 66 of FIGURE 11, termed the angle bar clip. The securing device 308 consists of a hollow structural member of approximately rectangular cross-section with a front wall 310, outer end wall 312, rear wall 314 and inner end wall 316. The rear wall 314 has an extension 318 projecting into and flush with the rabbit 306 and secured therein by screws 320. The rear wall 314 and its extension 318 have a cylindrically-curved rear surface 322 which is of the same curvature as the cylindrical rear surface 294 of the adapter 292 so as to merge smoothly therewith. The inner end wall 316 abuts the end surface 304 of the adapter 292 but terminates short of the corner edge 302. The front wall 310 also terminates short of the rounded corner edge 302 of the adapter 292 so as to provide a gap 324 through which the end portion 296 of the printing plate 282 projects into the interior chamber 326 of the device 308, and rests against the inclined or beveled internal portion 328 of the front wall 310.

The rear wall 314 has a flat internal surface 330 (FIGURE 16) which the flat rear surface 332 of a clamping bar 334 slidably engages. The front of the clamping bar 334 has inclined stepped-inclined and rearward surfaces 336 and 338 with a beveled shoulder 340 between them adapted to bite into the side wall of the inner groove 300 while the surfaces 336 and 338 respectively engage the bottom of the groove 300 and the rearward surface 288 of the printing plate 282 adjacent in-apposition. The clamping bar 334 is provided with laterally-spaced threaded holes 342 through which are threaded screws 344, the conical heads of which are seated in flared holes 346 in the end wall 312, whereas their ends engage the inner surface of the inner wall 316 as an abutment. The opposite end of the dummy or adapter 292 is provided with a solid securing device (not shown) similar to the securing device but lacking the take-up screws 346 and having an immovable portion or bevelled shoulder like the shoulder 344 onto which the end of the plate 282 is hooked.

In the operation of securing the plate 282 to the adapter 292, the plate 282 is first bent to the curvature of the adapter 292 in the same bending machine previously described without using the end-bending mechanisms so that it possesses the proper curvature to accurately and snugly fit the outer cylindrical surface 290 of the adapter 292. The printing plate 282, thus curved, is placed against the dummy or adapter 292 without further heating and its opposite end portions 296 slid through the gaps 324 into the chamber 326 where their grooves 300 are hooked onto their respective shoulders 340. The screws 344 of the clamping device 308 are then rotated by a screw driver in order to pull the clamping bar 334 to the left and pull the printing plate 282 tightly against the outer front surface 290 of the dummy or adapter 292.

This arrangement has the advantage of simplicity and ease of application and is useful where there is space available between the head and tail stops of the printing press. Where the maximum number of lines to be printed, however, and such space is not available, the arrangement 150 shown in FIGURE 10 is employed because it has the maximum arcuate length of printing surface in proportion to the overall arcuate length of the assembly 150 between its opposite ends.

Further modified printing plate and adapter assembly

The further modified printing plate and adapter assembly, generally designated 350, shown in FIGURE 18 is generally similar to the assembly 292 of FIGURES 16 and 17 and has the same advantages and limitations thereof, as stated above. Since the assembly 350 is for the most part of similar construction to the assembly 292, duplication of description is unnecessary and is avoided by applying similar reference numerals to corresponding parts. In the assembly 350, the dummy or adapter 292 is additionally provided at its end 304 with a recess or socket 353 and the inner wall 316 of the clamping device 354 is bored and threaded at 356, whereas the bore 358 in the clamping bar 354 is smooth and of smaller diameter than the threaded bore 356.

The hole 360 in the outer wall 312 replaces the flared hole 346 and serves for the insertion of a so-called Allan wrench 362 shown in dotted lines in FIGURE 18. This wrench 362, which is well known in the mechanical arts, is of hexagonal cross-section and snugly fits a recess or socket 364 of hexagonal cross-section in the reduced diameter stem 366 of a headless adjusting screw 368, the enlarged diameter shank 370 of which is threaded through the threaded bore 356 into the socket 358, which has sufficient clearance to receive it. The remainder of the construction is substantially the same as that of FIGURE 16 and similar reference numerals are therefore employed. The printing plate 282 is also of the same construction as the printing plate 282 of FIGURES 16 and 17. A solid or non-adjustable clamping device similar to the adjustable clamping device 354 is also used at the opposite ends of the dummy or adapter 292 of FIGURE 18, so that it is similar to FIGURE 16, the clamping bar 334 thereof being fixed and lacking the adjusting screws 368.

The operation of the further modified assembly 350 as regards the inversion of the printing plate 282 and the clamping of its opposite ends is also substantially the same as that described above in connection with FIGURES 16 and 17. A solid or non-adjustable clamping device similar to the adjustable clamping device 354 is also used at the opposite ends 296 laterally through the respective gaps 324 of the clamping devices 354 into the interior chambers 326 thereof and hooking their internal grooves 300 onto the respective shoulders 340 of their respective clamping bars 334.

Multiple printing plate and single adapter assembly

The multiple printing plate and single adapter assembly, generally designated 380, shown in FIGURES 19, 20 and 21 is for the purpose of enabling two or more printing plates 383 to be mounted in tandem upon a single dummy or adapter 384 so that their combined thicknesses will be substantially the same as the conventional thickness of the curved stereotype plate 430 (not shown) which are applied in the high speed rotary printing press, such as is used in modern newspaper printing plants. The printing plate 382 is similar to the printing plate 60, except for its shorter length, and has a similar main or central portion 383 and grooved end portion 385. The radial thickness of a conventional stereotype plate is approximately 3/8 of an inch, whereas the engraved printing plate 382 has a thickness of approximately 0.05 inch. The dummy or adapter 384, as before, has an inner cylindrical surface 386 of substantially the same curvature as the cylindrical surface of the press cylinder which it is intended to fit. The outer cylindrical surface 388 has circumferentially-spaced laterally-extending parallel recesses or grooves 390 with substantially flat bottom surfaces 392 and arcuately convex cylindrical side wall surfaces 394 (FIGURE 21). Each groove 390 in its bottom wall 396 is provided with laterally-spaced screw holes 398 into which are threaded the threaded lower portions of clamping screws 400, the upper portions of which are smooth and rotatably engage similarly-spaced holes 402 in elongated clamping bars 404. The holes 402 are countersunk at their upper ends to receive the heads of the screws 400 so that they are flush with the upper surfaces 406 of the clamping bars 404. The clamping bars 404 (FIGURE 21) on their opposite sides have stepped arcuately-concave side surfaces 408 and 410 respectively with a shoulder 412 between them adapted to engage one side wall of the groove.
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11 414 in each end portion 383 of the printing plate 382. The clamping bars 404 are of slightly less thickness than the grooves 390 which are intended to receive them.

Before mounting the printing plates 382 upon the dummy or adapter 384, the plates 382 are pre-curved in a conventional bending machine (not shown). They are then placed upon the outer surface 388 of the adapter 384 with their grooved end portions 383 overlapping the grooves or recesses 390 from which the clamping bars 404 have been temporarily removed. The clamping bars 404 are then replaced with their opposite edge portions overlapping the end portions 383 of the plates 382 and the screws 400 inserted in their holes 390 and rotated by means of a screwdriver. The rotation of the screws 400 causes the clamping bar 404 to move downward into its respective groove or recess 390, causing the end portions 383 of the printing plate 382 to be pulled downward against the curved side surfaces 394 of the groove 390, as shown on a large scale in FIGURE 21 and on a small scale in FIGURE 20.

Before tightening the screws 400 in each clamping bar 404, however, the operator engages the clamping bar 404 at the opposite end of the printing plate 382 so that each printing plate 382 is engaged at both ends by a clamping bar 404. Where printing plates 382 are arranged with their end portions adjacent one another, the clamping bar 404 engages both of the adjacent ends 383, as shown in FIGURE 21, and in the central portion 400 of FIGURE 20. Where a recess 390 is temporarily not in use, as shown to the right and left of the top of FIGURE 20, a filler bar 415 of corresponding shape is inserted therein and secured by screws 416. The upper surface 388 of the clamping bar 404 is brought down flush with the upper surface 388 of the dummy or adapter 382 so as to form in effect a continuation thereof spanning the groove or recess 390 not being used for clamping purposes.

Modified bending cylinder and bed plate

The modified bending cylinder unit, generally designated 420, shown in FIGURES 22 and 23 is for the same purpose as the bending cylinder unit 196 of FIGURE 2, except that it is of slightly different construction and has a different heating arrangement. In particular, the bending cylinder 420 consists generally of a hollow drum portion 422 with a hollow cylindrical peripheral portion 424, an integral end portion 426 on one end and a detachable end plate 428 on the other end. The end portion 426 of the drum 422 has a hollow boss 430 which has a bore 432 for receiving the bending cylinder supporting shaft 434, the latter being generally similar to the bending cylinder supporting shaft 194 of FIGURE 2. The drum 422 is preferably made of wrought aluminum and has a cylindrical chamber 436 within the hollow cylindrical peripheral portion 424 and through which the bending cylinder supporting shaft 434 passes, in a manner similar to that shown in FIGURE 2. An insulating disc 438 of suitable heat-insulating material is interposed between the rim 440 of the end plate 428 and the cylindrical portion 424 of the drum 422. The end plate 428 also has a hollow cavity 442 Likewise containing a cup-shaped insulating member or layer 444 of material similar to that of the disc 438 and for the similar purpose of retarding heat conduction and consequently reducing loss of heat.

The cylindrical peripheral portion 424 of the drum 422 is provided with multiple elongated bores or sockets 446 (FIGURE 22) disposed parallel to the axis of the shaft 434 and disposed at peripherally-spaced locations around the cylindrical portions 424, the insulating disc 438 being provided with aligned holes 448. Seated in the bores or sockets 446 and extending axially through the holes 448 are elongated tubular electrical heating units or cartridges 450 of conventional construction, each containing an electrical heating element (not shown), 75 the leads 452 and 454 of which project outward from one end of each unit 450 and are connected respectively to approximately circular conductors 456 and 458 (FIGURE 23) which in turn are connected respectively to radial conductors 460 and 462. The radial conductors 460 and 462 pass radially inward through the chamber 442 and into the shaft bore 464 within the supporting shaft 434, whence they proceed axially to and into the hub or plug 466 in the end of the shaft bore 464. The hub 466, like the hub 234 of FIGURE 2, is of insulating material and has axially-spaced contact rings 468 and 470 embedded therein and connected respectively to the conductors 460 and 462.

The contact rings or split rings 468 and 470 are engaged by brushes 472 and 474 mounted in a hollow casing 476 encircling the hub 466 and connected to conductors 478 and 480 leading to a source of electric current in a manner similar to that described in connection with the conductors 242 and 244 of FIGURE 2. As in FIGURE 2, the hub 484 of a gear 484 is mounted on the shaft 434 at each end of the bending cylinder 420 and has teeth (not shown) similar to the teeth 200 of the gear 198 of FIGURE 2 and similarly meshing with the teeth 44 of the rack bars 42 (FIGURE 1) forming the parallel tracks on which the gears 484 roll. The operation of the modified bending cylinder unit 420 is substantially the same as that of the bending cylinder unit 196 described above in connection with FIGURE 2, hence a repetition of the operation is deemed unnecessary.

The modified bed plate, generally designated 490, shown in FIGURES 24 to 26 inclusive, is also generally similar to the bed plate 52 of FIGURES 3 and 4 and differs principally in the manner of heating the plate. The bed plate 490 is approximately cross-shaped and has an upper unit 492 including an upper wall 494 possessing a substantially flat top surface 496 with parallel upstanding ridges 498 at its opposite ends which are adapted to enter the corresponding grooves 58 in the bottom of the printing plate 60 at the opposite ends thereof in a manner similar to the ridges 56 on the top surface 54 in FIGURE 11. The upper unit 492 of the bed plate 490 has projecting end flanges 50 defining elongated chambers 502 (FIGURES 24 and 26) formed in its opposite sides 504 which are closed by the elongated side wall portions 506 rising from the opposite sides of the base 508 of a base unit, generally designated 510, on opposite sides of an elongated and troughlike recess 512 into which the upper unit 492 fits. The upper wall 496 is provided with spaced parallel bores 514 into which tubular electrical heating units or cartridges 516 are inserted, these being similar to the heating units 450 of FIGURES 22 and 23 and of conventional construction.

Each of the heating units 516 has a heating element (not shown) therein supplied with electricity by twin leads 518 and 530 connected respectively to longitudinal conductors 524 and 526 which in turn are connected to conductors 528 and 530 (FIGURE 25) passing downward through holes 532 and 534 in an insulating plate 536 and in the base 508 respectively. The base unit 510 is bolted as at 538 to the upper unit 492 to hold the parts in assembly. The base unit 510 has laterally-projecting side portions 540 (FIGURE 24) corresponding to the side portions 50 of the bed plate 52 of FIGURE 3, the side portions 540 being provided with threaded holes 542 for receiving the bolts 48 by which the rack bars 42 are secured thereto (FIGURE 3). The bed plate upper unit 49 is conveniently made of wrought aluminum. The operator of the bed plate 492 is substantially the same as that described in connection with the bed plate 52 and hence no duplication of the description is deemed necessary.

What we claim is:

1. A bending machine for bending and securing a flat
original printing plate to a curved adapter for substitution for a curved stereotype in a rotary cylinder printing press, said machine comprising a substantially flat bed adapted to receive the original printing plate and having a longitudinal guideway therefore, a traveling plate-bending structure of approximately cylindrical form disposed above said bed in rolling relationship to said bed and guideway and having an adapter-receiving seat on the periphery thereof, a curved plate adapter body detachably secured to said seat of said plate-bending structure and movable therewithin in close proximity to a printing plate on said bed, and a plate-end bending device mounted at one end of said bed and having a plate end gripper thereon, said plate end bending device being movable from an inoperative retracted position through a plate-bending zone to an advanced position to bend the plate ends gripped thereby around the end edge of said adapter into engagement with the end of said adapter upon arrival of said plate-bending structure and adapter thereon at a location adjacent said plate-end bending device.

2. A bending machine for bending and securing a flat original printing plate to a curved adapter for substitution for a curved stereotype on a rotary cylinder printing press, according to claim 1, wherein means is provided in said bed for heating said printing plate, wherein electrical heating means is also provided in the interior of said travelling plate bending structure for heating said plate and said adapter, and wherein means is also provided for maintaining conduction of electric current to said electrical heating means during rolling travel of said travelling plate bending structure along said bed.

3. A bending machine for bending and securing a flat original printing plate to a curved adapter for substitution for a curved stereotype on a rotary cylinder printing press, according to claim 2, wherein said plate-bending structure has a central shaft with an end projecting therefrom and wherein an upstanding stop device is disposed adjacent said bed and has a stop portion projecting into the path of travel of said end of said shaft in engagement therewith in a position adapted to halt said bending structure in response to the arrival of said end of said adapter adjacent the end of the plate to be bent therearound.

4. A bending machine for bending and securing a flat original printing plate to a curved adapter for substitution for a curved stereotype in a rotary cylinder printing press, according to claim 3, wherein a plate end bending device is mounted at each end of said bed and has a plate end gripper thereon, each plate end bending device being movable from said inoperative retracted position through said bending zone to said advanced position to bend the plate end gripped thereby around the opposite end edges of the adapter into engagement with the opposite ends of the adapter upon arrival of said plate bending structure and adapter thereon at a location adjacent said plate end bending device.

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