Feb. 9, 1954 H. L. McWHORTER 2,668,497

LOCKUP FOR PRINTING PRESSES

Filed Feb. 7, 1950 2 Sheets-Sheet 1

Fig. 1

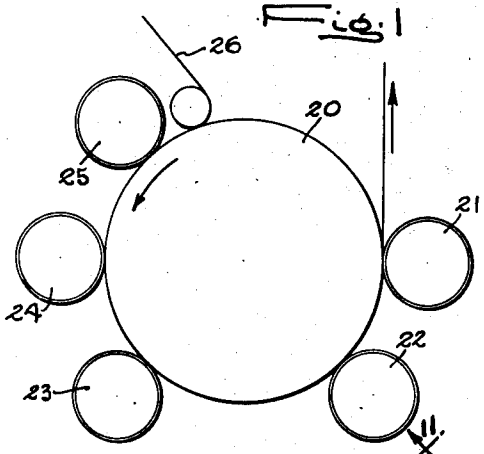


Fig. 2

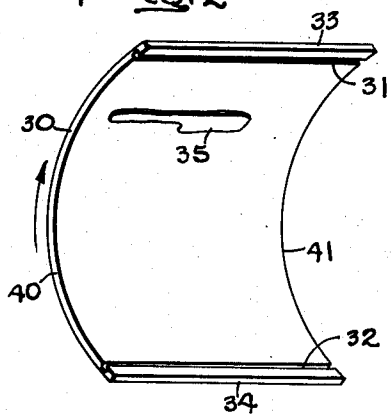


Fig. 3

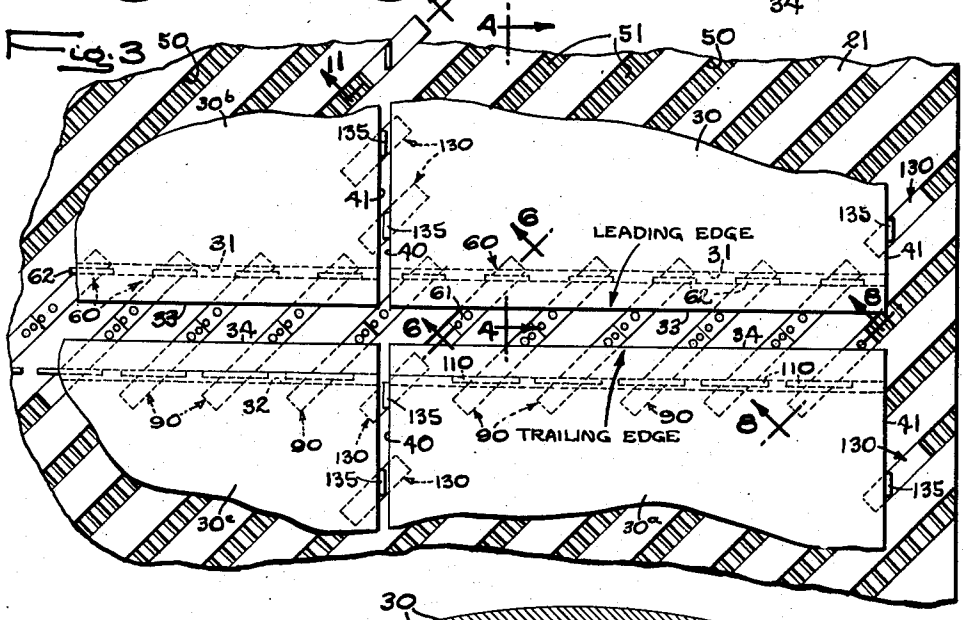
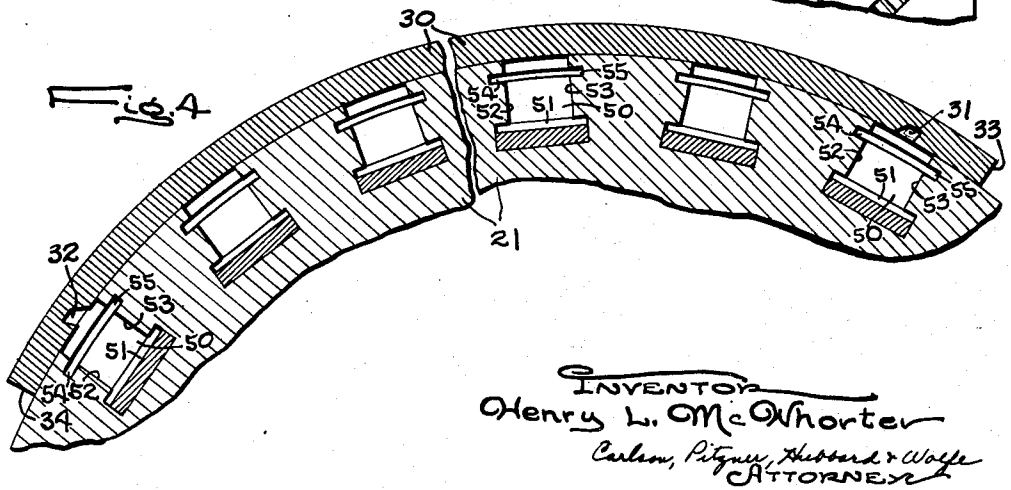


Fig. 4



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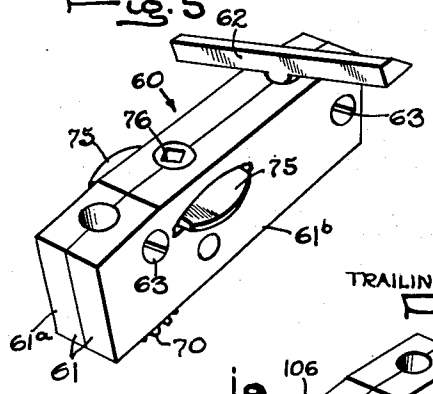
Feb. 9, 1954 H. L. McWHORTER 2,668,497

LOCKUP FOR PRINTING PRESSES

Filed Feb. 7, 1950 2 Sheets-Sheet 2

LEADING EDGE CLAMP

Fig. 5



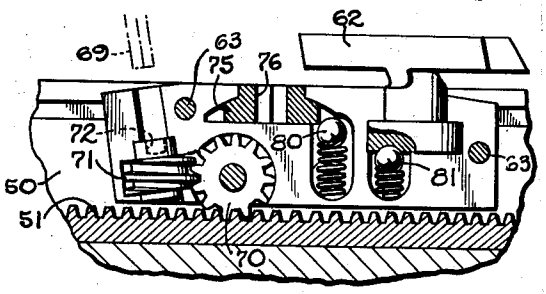
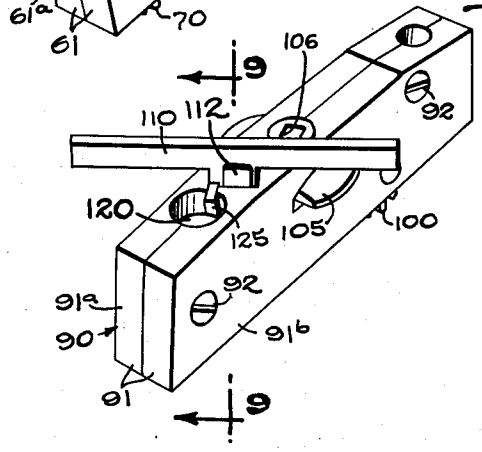


Fig. 6

LEADING EDGE CLAMP

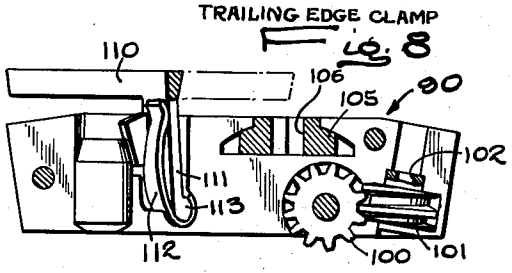
TRAILING EDGE CLAMP

Fig. 7



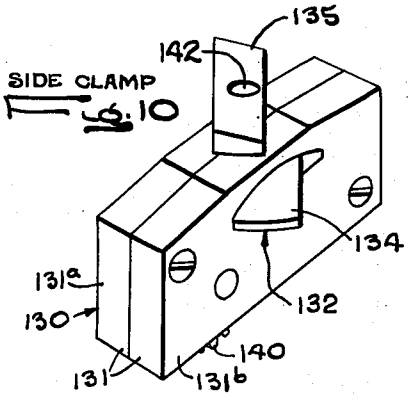
TRAILING EDGE CLAMP

Fig. 8



SIDE CLAMP

Fig. 10



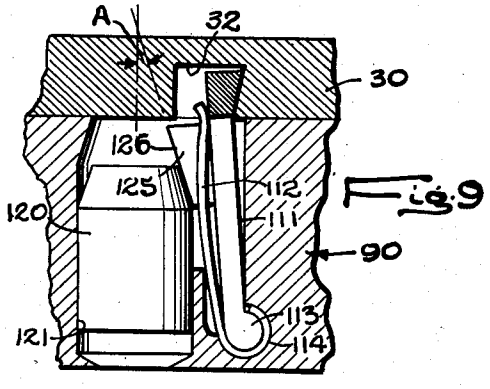
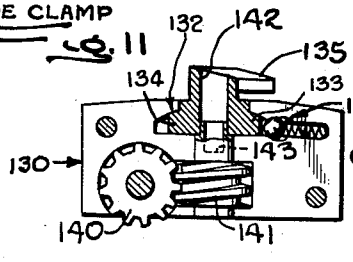


Fig. 9

SIDE CLAMP

Fig. 11



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UNITED STATES PATENT OFFICE

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LOCKUP FOR PRINTING PRESSES

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Application February 7, 1950, Serial No. 142,907

5 Claims. (Cl. 101—378)

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The present invention relates to printing presses and more particularly to tension lockup devices for securing magazine type printing plates to the plate cylinder.

In the printing of high grade color work one of the primary requirements is that all of the printing areas on the plate be at precisely the same height so that an even density of ink is deposited at all points. Experience has shown that this condition can only be established by a trial and adjustment procedure immediately prior to the run, the adjustment being effected by using a plate having a soft lead backing capable of localized bending in response to "make-ready" in the form of small paper shims inserted at the areas of the plate which are found to be low. Another requirement for printing plates for long runs of color work is that the impression remain sharp, that shifting of the plate not occur requiring repeated register adjustment, and that the plate itself not be damaged or fatigued, running the risk that a plate will be "thrown" and necessitating lengthy shutdown and costly repair. Since even temporary shutdowns are costly, it is desirable to eliminate periodic shutdowns which have been required in the past to restore register or to fasten the plate to the cylinder more securely.

By way of comparison the problem is much more severe than in the case of newspaper presses where wide variations in ink density may be permitted and where a soft blanket is used to take up irregularities in the printing surface. Consequently, newspaper plates may be made of relatively hard alloy and much thicker in cross section permitting clamping forces which are many times greater than those which may be permitted in the holding of soft electrotype plates. Satisfactory lockups have been developed for the holding of newspaper printing plates. However, in the case of magazine plates almost none of the above listed requirements have been met on any prior plate lockup of which I am aware. The widely used lockup of the so-called Claybourn type employing catches mounted in helical grooves has a number of serious drawbacks. First of all the plates are clamped in compression so that they are forced inwardly at their marginal edges thus preventing firm and close contact with the cylinder over the entire area of the back surface. Furthermore, the interposition of the usual plate clamp between the beveled edges of adjacent plates makes it impossible to mount plates close to one another for the printing of adjacent bleeds. This has resulted not only in

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wastage of paper but also in a considerable sacrifice in the capacity of the press in addition to complicating the pressman's layout work. Because of the inwardly directed force the plates are likely to become progressively peened at the regions of contact with the clamps which increases the likelihood that a plate will be thrown by centrifugal forces.

Much effort has been expended in an endeavor to overcome these inherent disadvantages and patent applications have been filed on various modifications of the Claybourn lockup intended as improvements. An example is to be found in the Luehrs Patent 2,406,883 which issued on September 3, 1946. While offering considerable promise from a purely theoretical standpoint, such arrangements have suffered from serious inherent disadvantages. First of all there is an assumption that the plates will retain their original dimension after being drawn tight on the cylinder merely because they are clamped in tension. My experience has shown that the plates tend to work loose from a simple tension lockup and the press must be shut down at frequent intervals to take up on the adjustment, particularly in the peripheral direction. It is often necessary to re-register when this is done. Even more important the number of clear impressions which may be made by each of the plates is limited and the plates themselves tend to be destroyed by the fatigue which occurs as a result of repeated rolling impact with the impression cylinder. A further disadvantage of the recent prior art arrangements has to do with the time required to insert the makeready to effect an even printing impression. After an initial or trial run it is necessary to unfasten the plate clamps not only at the trailing edge but also those along the sides of the plate. This is not only a lengthy procedure because of the large number of clamps which are involved in the securing of a single plate, but also tends to destroy the register adjustment so that the plate must be re-registered after the makeready procedure has finally been completed.

Accordingly it is an object of the invention to provide a tension lockup for magazine printing plates which permits a much greater production of clear registered impressions than any available prior art lockup without fatigue or damage to the plates and without necessity for shutting down for effecting periodic takeup of the clamps or for restoring the condition of register. It is another object to provide an improved tension lockup in which the tension on a given plate requires no

careful initial adjustment and in which the tension under operating conditions is automatically and continuously adjusted to the minimum value required to seat the plate securely and safely. It is a related object to provide a tension lockup of the above type in which takeup at the trailing edges of the plate occurs automatically to counteract any circumferential elongation which may occur either initially as a result of conforming the plate to the cylinder or which may occur under running conditions.

It is a further object to provide an improved tension lockup for a magazine printing plate in which the register adjustment may be precisely maintained even where it is necessary to remove the plate repeatedly for the addition of makeready. It is a correlative object to provide means for easily and quickly obtaining axial register and for maintaining it by relatively light clamping pressure in the axial direction.

It is still another object to provide a tension type lockup which is capable of locking the plate into position automatically upon slow rotation of the printing cylinder incident to installation of additional plates and in which the locking force increases in step with the centrifugal force which tends to throw the plate outwardly.

It is a still further object to provide an improved tension lockup which is applicable to magazine presses of conventional design and which permits of cylinder rotation in either the forward or reverse directions. It is a more detailed object to provide a lockup arrangement which is inexpensive to manufacture and which may be applied to existing plate cylinders without the necessity of making any change whatsoever therein and with only minor modification of the printing plates.

Other objects and advantages of the invention will become apparent by a reading of the following detailed description and reference to the drawings, in which:

Figure 1 is a schematic representation of an impression cylinder having a plurality of plate cylinders to which the present invention is applicable.

Fig. 2 shows a printing plate of the type preferably utilized in practicing the invention.

Fig. 3 is a fragmentary plan view showing the adjacent corners of four printing plates secured to a plate cylinder.

Fig. 4 is a sectional view of the plate cylinder taken along the line 4—4 of Fig. 3.

Fig. 5 is a general perspective of one of the leading edge clamps employed in the present invention.

Fig. 6 is a cross section of one of the leading edge clamps taken along the line 6—6 of Fig. 3.

Fig. 7 is a general perspective of one of the trailing edge clamps forming a part of the present invention.

Fig. 8 is a cross section of a trailing edge clamp taken along the line 8—8 of Fig. 3.

Fig. 9 is an enlarged fragment of one of the trailing edge clamps illustrating the function of the sliding weights and showing the angular relationships employed therein.

Fig. 10 is a general perspective of a side clamp forming a part of the present invention.

Fig. 11 is a cross section taken along the line 11—11 of Fig. 3.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail only the preferred embodiment; it is to be understood, however, that I do not thereby intend to limit the invention to the specific form disclosed, but aim to cover all modifications and alternative constructions and uses falling within the spirit and scope of the invention as expressed in the appended claims.

Turning now to the drawings, Figure 1 shows a portion of a magazine press including an impression cylinder 20 and plate cylinders 21—25 distributed about the periphery. Each one of the plate cylinders is supplied with ink of a different color by suitable inking mechanism (not shown) for color printing of a web 26.

Fig. 2 illustrates a plate 30 of one type which may be employed in the present invention. This plate includes undercut grooves 31, 32 which extend uninterruptedly along the leading and trailing edges 33, 34 respectively of the plate. The plate is comprised in the conventional manner of a light electrically deposited shell which is plated with a hard wear-resisting metal to form a printing surface. The shell is then backed with a soft lead alloy to a total thickness of approximately one-quarter inch, the alloy being sufficiently deformable so that an accurate impression level can be established by raising low areas with small shims of paper or "makeready." The manner in which the makeready is applied to the underside of the plate is indicated at 35. For a reason which will later appear the side edges 40, 41 of the plate are made square with respect to the surface of the cylinder. A plurality of such plates are arranged substantially edge to edge on the plate cylinder 21 as shown in Fig. 3. Portions of four plates are shown, corresponding parts of each of the additional plates carrying subscripts *a*, *b*, and *c* respectively.

The plate cylinder 21 is of a conventional type employed in magazine presses. As illustrated in Fig. 3 and in the cross section of Fig. 4, evenly spaced helical grooves 50 are machined in the outer surface. A continuous rack 51 is provided at the bottom of each of the grooves, such rack being normally engaged by suitable pinions included in the clamps employed for securing the plates. The side walls 52, 53 of the grooves are provided with narrow undercut locking grooves 54, 55. These are arranged opposite one another and are bridged by a suitable locking bar in each of the clamps to prevent outward displacement.

In accordance with the present invention a tension lockup is provided comprising means for anchoring the forward end of the plate together with an improved non-retrograde follow-up device for positively anchoring the trailing edge of the plate and without applying any undue stress thereto. Further, in accordance with the invention, side clamps are provided for engaging the squared edges of the plates for preventing axial displacement while permitting removal of the plate for purposes of adjusting the makeready.

Attention will first be given to one of the leading edge clamps indicated at 60 in Fig. 5 which has a body 61 which is formed of two shell-like halves 61*a*, 61*b* held together by suitable cross screws 63. The body of the clamp is dimensioned to fit within one of the grooves 50 and carries at one end a hook 62 for engaging the undercut groove in the leading edge of the plate. As set forth in detail in the cross section of Fig. 6, the leading edge clamp is propelled along the groove by means of a pinion 70 engaging the rack 51. The pinion is turned by a worm 71 which is en-

gaged by a suitable wrench 69 fitted into an upwardly facing socket 72. Because of the mechanical advantage provided by the worm the wrench may be of very light construction and, since the worm provides an irreversible drive, the clamp is automatically locked in position relative to the rack.

For the purpose of maintaining the clamp seated firmly within the groove a double winged lock 75 is provided which is rotated into the bridging or locked position illustrated in Fig. 5 by a suitable wrench inserted in the socket 76 formed centrally therein. A detent 80 is provided in order to signify to the operator by "feel" that the lock is engaged with the registering grooves. As one of the more detailed features of the leading edge clamp, the hook 62, which is mounted for swiveling in the clamp body, is also provided with a detent indicated at 81. This detent is so arranged that with the clamp normally seated in one of the helical grooves the laterally extending portions of the hook 62 will be properly oriented to engage the groove in the leading edge of the plate. This is of advantage since a large number of clamps of the type illustrated are normally employed arranged side by side with all of the hooks in general alinement before the plate may be applied to the cylinder. As shown in Fig. 3 a leading edge clamp may be used in each of the successive grooves.

Turning next to the trailing edge clamp disclosed in Figs. 7, 8 and 9 it will be noted that the appearance is somewhat similar to the leading edge clamp. Thus, the clamp indicated at 90 includes a body 91 having opposed halves 91*a*, 91*b* held together by cross screws 92. The clamp is adjusted along the groove by a pinion 100 driven by a worm 101 rotated by a manually operated wrench inserted at 102. A double winged lock 105 may be rotated around into locking position by means of a wrench inserted in a socket 106. A plurality of such clamps are used in the successive grooves along the trailing edge of each of the plates as illustrated in Fig. 3 with the successive clamps each designated by the numeral 90.

For the purpose of engaging the trailing end of the plate in tension a hook 110 is used which is not freely rotatable as in the clamp previously described but has only limited play so that the hooks of successive clamps are maintained generally in line with one another. In practicing the invention the hook 110 has a limited range of hooking movement and is biased in the plate clamping direction. In the present instance this is accomplished by mounting the hook 110 on a pivot finger 111 and by arranging a light leaf spring 112 so that it presses against the finger. Pivoting is accomplished by providing a shaft-like enlargement at the lower end of the finger as indicated at 113 in Fig. 9 and by forming a suitable receptacle or groove 114 in the body of the clamp. As shown in Fig. 9 the back side of the leaf spring 112 presses against the body of the clamp to urge the hook in the clockwise or clamping direction. The pressure is such as to overcome all frictional forces within the clamp but not so great as to have any noticeable tensioning effect on the plate.

Means are further provided for locking the hook against retrograde movement in response to the action of centrifugal force on a weight which is freely movable in the clamp body. In the embodiment illustrated in Figs. 7, 8 and 9 a weight indicated at 120 is slidable in a bore 121 which extends radially with respect to the plate cylinder

when the clamp is in operating position. The locking effect is obtained by providing a non-reversible wedging surface between the weight and the hook 110 for maintaining the hook wedged in the clamping or clockwise position to which it is moved by the spring 112. In the present instance this is accomplished by a wedge block 125 which is integrally formed on the finger member 111 and which has a wedging surface 126 which directly engages the weight. Preferably the weight is chamfered at its upper end to increase the bearing area presented to the wedge block. While the wedge angle indicated at A should be shallow so as to block the finger member 111 from backing up under the tensile forces in the plate, the actual value is not critical. As a matter of fact the effect of wedge angle will change from a relatively high value which exists when the weight 120 is in the low position illustrated in Fig. 8 to a minimum value when the weight is in its maximum outward position which is approached in Fig. 9. Preferably the effective wedge angle should be less than 30 degrees over the useful range of movement of the weight although the nature of the surfaces at the point of engagement will affect this somewhat with a smooth surface requiring a shallower angle. Any stickiness or corrosion which may develop makes it difficult for return or inward movement of the weight to occur and will merely have the effect of increasing the positiveness of locking.

While the weight may be of any desired high density metal having appropriate resistance against wear, I prefer to employ a pellet of sintered tungsten since this material has a density which is considerably greater than that of lead. In this way the rotation of the printing cylinder will cause the weight 120 to fly forcibly outward into its locking position, thereby overcoming any tendency for the weight to stick in the innermost position illustrated in Fig. 8. Since the effective locking force varies directly with the centrifugal force and, consequently, with the speed of the plate cylinder, such force will be at all times in step with the centrifugal force tending to throw the plate outwardly. While the locking force exerted by the weight varies with the speed of rotation it is to be especially noted that locking is positive and return movement of the plate is prevented at all speeds even down to standstill.

Preparatory to any detailed outlining of the operation of the tension lockup thus far described, reference will be made to the side clamp disclosed in Figs. 10 and 11 a number of which serve to position the plate for axial register. An exemplary clamp indicated at 130 has a body 131 consisting of two halves 131*a*, 131*b*. Included within the clamp is a double winged lock 132 having wings 133, 134 and a T-shaped abutment 135. The latter has a smooth substantially flat face for engaging the square edges (40 or 41) of the plate and for permitting the plate to be withdrawn radially away from the plate cylinder without disturbing the axial register adjustment. Preferably the abutment 135 is alined with the locking wings 133, 134 and is constructed integrally therewith so that when the side clamp is in the position illustrated in Fig. 3 the wings will be positioned in the locking grooves 54, 55. A detent 136 is provided so that with the side clamp in position the abutment automatically assumes a position alined with the edge of the plate making it unnecessary for each of the clamps to be manually alined.

As in the case of the previous clamps, means

are provided for adjusting the clamp in its groove. This function is accomplished by a rack pinion 140 and a worm 141 both of which are suitably journaled in the clamp body. In accordance with one of the more detailed features of the invention the worm 141 is made accessible through the abutment 135. A wrench may be used for this purpose, extending through a bore 142 in the abutment and engaging the socket 143 in the worm. It will be apparent from Fig. 3 that this makes it unnecessary to provide a separate opening in the body for adjusting the clamp and makes it possible to space the adjacent printing plates practically edge to edge.

Résumé of operation

In operation leading and trailing edge clamps 60, 90 are mounted in the plate cylinder in the manner disclosed in Fig. 3 and with the hooks respectively engaging the groove 31 at the leading edge and groove 32 at the trailing edge of a given plate. Side clamps 130 may be positioned at the end portions of the plate or, if desired, at frequent intervals along the sides of the plate, for example in every second groove. The adjusting pinions in the leading edge clamps and side clamps are then adjusted by suitable square head wrenches until a condition of at least approximate register is secured. After this the trailing edge clamps are retracted in their grooves and relative to the edge of the plate until slight resistance is encountered. This indicates to the operator that the hooks "bottomed," in other words, have swung the maximum distance counterclockwise as viewed in Fig. 9. The operator then stops turning the wrench since forceful turning would cause the hook to break. The resistance encountered not only signifies to the operator that the clamp is properly adjusted but insures that the full range of hook movement, preferably on the order of an eighth of an inch, is available to take up elongation of the plate.

At this time the weights 120 in the respective clamps will be in the lowered or at-rest position disclosed in Fig. 8. As the plate is rotated around to the bottom of the cylinder for installation of additional plates, the weight 120 will, of its own accord, fall into the locking position shown in Fig. 9. Because of the undercutting of the groove 32 and the corresponding angling of the face of the hook, the plate will be effectively locked on the plate cylinder. Upon bringing the plate up to speed, centrifugal force causes the weights to have a forceful wedging effect. A trial run can then be made in order to test the evenness of impression and to check the condition of register. Final register adjustments may be made at the leading and side edges of the plate.

To remove the plate for addition of makeready it is merely necessary to insert a wrench into the trailing edge clamps to cause the clamps to walk along their grooves until the hook is disengaged from the undercut portion of the plate. The weights will drop free, whereupon the plate may be lifted off, the makeready installed, and the plate reapplied to the cylinder all without disturbing the register adjustment. The trailing edge clamps are again advanced to the operative position so that the cylinder may be rotated. As before, the first rotation will serve to cause the weights to fall into position so that the plate is immediately locked after which automatic takeup will occur exactly in step with elongation of the plate regardless of the reason for such elongation.

It will be apparent that the automatic takeup feature with its non-retrograde action produces an effect which may be clearly distinguished from tension lockups of the positive type and also from tension lockups in which resilient spring pressures of large magnitude is depended upon to secure the plate. It is a well known fact that the initial seating of the printing plate which occurs during the first few revolutions causes the plate to elongate. Normally it would be necessary to stop the press in order to compensate for such elongation. In the case of the present device, however, this initial elongation is taken up automatically as it occurs. It is to be further noted that the pressure exerted on the plate is at all times that which is required to hold the plate in position and is independent of any decision or judgment on the part of the operator. All it is necessary for the operator to do is to position the trailing edge clamp so that the spring is effective to force the hook into contact with the undercut edge of the plate. The spring is purposely made very weak so that it does not substantially contribute to holding the plate in place. On the contrary the holding effect is due almost exclusively to the wedging engagement of the weight and the wedge block.

Practical tests made employing clamps as shown and described measuring only 3/8" in width and not exceeding 1 3/4" in length show that plates may be securely anchored to a 35-inch circumference plate cylinder at speeds of 1,000 R. P. M., more than three times the usually attained speed of plate cylinders in high speed magazine presses of modern design. Speeds higher than 700 R. P. M. may be maintained for extended periods without any signs of weakening and without necessity for touching any of the clamping adjustments.

My investigations, which were made in an endeavor to explain the surprising and disproportionate results which have been achieved, indicate that the positive holding force developed at the trailing edge clamps is established as an incident to the "rolling out" of the printing plate on the plate cylinder by the impression cylinder. As the impression cylinder is rolled progressively along the plate cylinder two things occur. In the first place there is a slight elastic elongation of the plate which is progressive and which reaches a maximum when the impression cylinder is about to leave the trailing edge of the plate. Secondly, there is a relieving of the stress exerted by the plate against the hooks at the trailing edge. Then, as the impression cylinder leaves the plate there is a tendency for the plate to contract to its original dimension and to reestablish the stress. In tension lockups of the conventional type the cyclical stretching and contracting which occurs at each revolution and the changes in stress which accompany it constitute a "working" of the plate which not only accounts for the wear on the printing surfaces but also results in fatigue of the crystalline structure with the risk of throwing a plate at high speed or after extended periods of operation. In the present construction, it is true, a certain amount of plate elongation occurs. However, because of the immediate follow-up action at the wedging surface, the hooks in the trailing edge of the plate will be repositioned and locked positively in the new position because of the non-retrograde feature. As a result when the impression cylinder leaves the plate cylinder the latter cannot snap back to its original dimension. In spite of cyclical variation in the force

exerted by the plate against the hooks at the trailing edge, fatigue due to repeated straining is substantially eliminated. It is found that the tension in the hooks varies automatically to keep the plate firmly seated on the cylinder and there is no possibility of overstressing the plate due to application of excessive initial clamping pressures. A stable operating condition is established after the first few revolutions and it is unnecessary to stop the press even during the course of long runs to restore register or to make a takeup adjustment.

One of the important results brought about by the present arrangement is that the complete lack of "working" serves to substantially reduce the wear on the printing areas. Tests have shown that 2,000,000 impressions may be made by a plate employing the new lockup without any substantial wear, while plates employing more conventional lockups are useless after running approximately 1,000,000 impressions and, under certain conditions, considerably less.

It will be apparent to one skilled in the art that the present improved lockup is applicable to presses now in operation merely by milling undercut grooves along the leading and trailing edges of the plates and by squaring off the sides. The mechanical elements comprising the clamps are simple and straightforward permitting economical assembly and great strength even in the small sizes in which the clamps must be constructed to fit in the conventional grooves. Because of the extremely small access requirements, the plates may be arranged almost edge to edge in both directions and the printing of bleeds in any and all positions with little waste becomes feasible.

I claim as my invention:

1. In a tension lockup for clamping a printing plate on a printing cylinder, the combination comprising, a leading edge clamp for engaging the leading edge of the plate and positioning the same for peripheral register, a trailing edge clamp having a hook for engaging the trailing edge of the plate, said hook being movable in said clamp, a weight radially movable in said trailing edge clamp under the influence of centrifugal force, and means including a wedging surface between said weight and said hook for urging the hook in a plate tensioning direction upon outward movement of the weight, the angle of said wedging surface being sufficiently shallow to prevent retrograde action whereby the plate is maintained at a constant peripheral dimension so that cyclical working of the plate on the cylinder is obviated.

2. In a tension lockup for clamping a printing plate on a printing cylinder, the combination comprising, a leading edge clamp for engaging the leading edge of the plate and positioning the same for peripheral register, a trailing edge clamp having a hook for engaging the trailing edge of the plate, said hook being movable in said clamp, a weight radially movable in said trailing edge clamp under the influence of centrifugal force, and means including a wedge block on said hook wedgingly engaged by said weight and tending to urge the hook in a plate tensioning direction, said wedging surfaces on said wedge block being so angled as to prevent retrograde movement of the hook so that the plate is maintained positively positioned at a constant peripheral dimension with the result that working of the plate on the cylinder is obviated.

3. In a tension lockup for use with a printing plate having grooves on the underside thereof adjacent the leading and trailing edges respectively, the combination comprising, a leading edge clamp including a hook for engaging the groove at the leading edge of the plate and for positioning the same for peripheral register, a trailing edge clamp having a hook for engaging the groove at the trailing edge of the plate, said hook having a pivoted finger for mounting the same for movement in a peripheral direction, relative to said groove, means for lightly biasing the hook in a direction to clamp the plate in tension so as to effect continuous follow-up of the hook against the groove upon elongation of the plate, said trailing edge clamp including a movable weight mounted to move radially outward under the action of centrifugal force as the plate cylinder is rotated, and a wedge member coupled to said finger and engaged by said weight with the wedging surface so arranged as to be irreversible for locking the finger against retrograde movement during rotation of the plate cylinder.

4. In a tension lockup for clamping a printing plate on a printing cylinder having a plurality of evenly spaced surface grooves around its periphery, the combination comprising leading edge clamps for engaging the leading edge of the plate, said clamps being adjustable in said surface grooves to effect peripheral register, trailing edge clamps having hooks for engaging the trailing edge of the plate, said hooks being movable in said trailing edge clamps, said trailing edge clamps being adjustable in said surface grooves to lockup the plate, respective weights radially movable in said trailing edge clamps under the influence of centrifugal force, and means including respective wedging surfaces between said weights and said hooks for urging the hooks in a plate tensioning direction upon outward movement of the weights, the angle of said wedging surfaces being sufficiently shallow to prevent retrograde action.

5. In a tension lockup for clamping a printing plate on a printing cylinder, the combination comprising a plate tensioning hook for engaging an axially oriented edge of the plate; means carrying said hook for circumferential movement, a weight movable radially under the influence of centrifugal force, and means including a wedging surface between said weight and said hook for urging the hook in a plate tensioning direction upon outward movement of the weight, the angle of said wedging surface being sufficiently shallow to prevent retrograde action.

HENRY L. McWHORTER.

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