ROTARY PHOTOGRAVURE PRINTING APPARATUS

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This invention relates to improvements connected with rotary photogravure printing apparatus and more specifically is directed to a rotary photogravure printing apparatus of the kind disclosed in the complete specification of British Letters Patent No. 586,986 wherein the printing cylinder is supported in a cradle which is fulcrummed on the frame of the apparatus and wherein the cradle can be raised or lowered by means of a pneumatic or hydraulic operated ram means in order to effect the contact of the printing cylinder with the co-acting impression cylinder with the requisite pressure.

Experience has shown that in contrast to the relatively large pressures employed between the printing and impression cylinders for printing normal materials, when printing upon very thin materials such as for example aluminium foil, cellulose film or polythene film light printing pressures are desirable. Accordingly in processing such thin materials in the aforesaid kind of printing apparatus the pressure is reduced in the supply line to the ram or rams, by for example a reducing valve, in order to reduce the pressure which is in turn applied by the rams to the cradle and cylinders. It is found in practice that such a procedure may give rise to large variations in the printing pressure due to relatively small variations in the supply line pressure since for example a fall in pressure of say 1 lb. per square inch from 4 to 3 lbs. per square inch represents a fall in pressure of say 25% alla lation in the printing pressure. Such a variation in the printing pressure can seriously affect the register between the colours in a multi-colour printing press.

This invention has for its object to overcome the aforesaid difficulty by the incorporation in the printing machine, in addition to the ram or rams for providing a relatively heavy printing pressure, of a further ram or rams which is or are adapted to provide a relatively light printing pressure when energised by the relatively high pressure of the supply line which energises the "heavy" ram or rams when it will be appreciated that a fall in pressure of say 40 lbs. per square inch in the supply line pressure of say 40 lbs. per square inch will represent a relatively insignificant pressure variation in the "light" printing pressure.

Accordingly the invention consists of rotary photogravure printing apparatus of the kind wherein the printing cylinder is supported in a pivotally mounted cradle which can be rocked by fluid operated ram means to determine the printing pressure, characterised in that said ram means comprises at least one pair of rams adapted to exert relatively light and heavy printing pressures when energised from a common relatively high pressure fluid supply line. The pair of rams may be adapted to exert relatively low and high printing pressures by virtue of the different cross-sectional areas of the rams, by virtue of the different leverages exerted by the rams in relation to the fulcrum of the cradle, or by a combination of these designs.

Convenient means for carrying the invention into practice will now be described with reference to the accompanying drawings wherein:

FIGURE 1 is a partly diagrammatic side elevation of a rotary photogravure printing machine in accordance with this invention, and FIGURE 2 is a longitudinal cross-section showing in detail the ram means incorporated in the machine seen in FIGURE 1, and FIGURES 3 and 4 are diagrammatic drawings illustrating two modifications of the invention.

As seen in the drawings a cradle 6 of generally rectangular shape in plan is fulcrummed at 6a adjacent two of its corners on the frame 7 of the printing machine and is supported adjacent its opposite or free corners 6b by pneumatic ram means generally designated X for controlling the contact pressure which obtains between the printing cylinder 8 and a superimposed impression cylinder 9 rotatably mounted on the frame 7, the ram means being of single acting type to provide an upward thrust, the weight of the cradle and printing cylinder being sufficient to initiate downward movement of the cradle and cylinder.

As seen more particularly in FIGURE 2 the ram means provided at each of the two outer corners of the cradle consists of a pair of rams which are concentrically combined together within a single casing and comprise a circular inner piston 10 and a concentric annular outer piston 11 which are mounted for reciprocation within a pair of concentric inner and outer cylinders 12 and 13, the cylinders 12 and 13 being mounted between a common pair of end closure plates 14 and 15. Each piston 10 and 11 is provided with an integral upwardly extending hollow cylindrical skirt 16a, 16b at the upper ends whereof are coupled together, for example by bolts 17, so that the two pistons move together as one when either one or both of the chambers 17 and 18 defined beneath the pistons are subjected to fluid pressure, said air pressure, through their respective ports 19 and 20. The interconnected pair of pistons 10 and 11 are connected to the cradle 6 by means of a self-aligning connecting rod 21 having a ball and socket type mounting within the base of the hollow interior of the inner piston.

The inner and outer pistons 10 and 11 of the composite ram have relatively small diameter cross-sectional areas respectively, say in the ratio of 1:7, so that the connection of a common high pressure supply line to one or other of the chambers 17 and 18 will result in a relatively low or high pressure thrust being imparted through the connecting rod 21 to the cradle 6 according to which chamber or ram section is energised.

As seen in FIGURE 1 the pneumatic circuit associated with the rams consists of a high pressure air line 22 which is connected through a manually controlled changeover valve 23 and a pair of branch air lines 24 and 25 to the chambers 17 and 18 respectively of the composite ram. Conveniently the line 24 to the low pressure ram section may be permanently connected to the line 22 so that a high pressure thrust from the ram is obtained by the connection of the line 25 to the line 22 thereby to energise both ram sections. The pressure which obtains in the high pressure supply line 22 is governed by a manually controlled pressure reducing valve 26 incorporated between the line 22 and the high pressure air source (not shown), and is registered by a pressure gauge 27. By means of the reducing valve 26 the thrust which is imparted to the cradle and printing cylinder is continuously variable within the low pressure and high pressure ranges afforded by the pairs of rams. It will be appreciated however that a small variation of pressure in the line 22 will result in an insignificant variation in the thrust imparted by either ram section since both ram sections are energised at a high pressure level.

It will be realised that the feature of imparting low range and high range thrusts to the cradle may be obtained by means other than that above described and the following alternative embodiments of the invention may be mentioned by way of example:
In the embodiment illustrated in FIGURE 3 each side arm of the cradle 6 is supported by a pair of separate rams V and Z which are connected through control valve means to a common high pressure air supply line in a generally similar manner to that previously described. In this arrangement the outermost ram Y remote from the cradle fulcrum 6a embodies a piston and cylinder of relatively large cross-sectional area for the provision of a relatively heavy printing pressure whereas the ram Z in closer proximity to the cradle fulcrum embodies a piston and cylinder having a somewhat smaller cross-sectional area which, by virtue of this smaller area and also by virtue of its reduced leverage as compared with that of the outer ram Y, is adapted to exert a relatively light printing pressure when energized by the same high pressure air supply line as that employed by the ram Y.

In the further embodiment of the invention illustrated in FIGURE 4 the two corners of the cradle remote from the fulcrum are each articulated with a pair of oppositely actuating rams V and W. According to this arrangement the lower ram W embodies a cylinder and piston of relatively large cross-section which is adapted to exert a slightly larger thrust on the cradle than a somewhat smaller piston and cylinder embodied in the oppositely directed and superposed ram V so that a relatively light printing pressure may be obtained from the differential action of the two opposed rams V and W whereas a relatively heavy printing pressure may be obtained by the energization of the lower ram W alone. As in the other embodiments each ram cylinder is connected through control valve means to a common high pressure air supply line and the upper cylinder V of each pair of rams is desirably provided with a pre-set pressure relief valve.

We claim:

1. In a rotary photogravure printing apparatus, a frame, an impression cylinder mounted on said frame, a rockable cradle pivotally mounted on said frame, a rotatable printing cylinder supported on said cradle adjacent said impression cylinder, said printing cylinder being moveable with said cradle to press printing material disposed between said cylinders with a selected contact pressure and means for selectively controlling the contact pressure applied by said printing cylinder to said printing material comprising first and second ram means operatively connected to said cradle to shift said cradle in the same direction for selectively pressing said printing cylinder into bearing relation with said printing material with forces respectively corresponding to high and low ranges of contact pressures, and fluid pressure means for selectively actuating said first and second ram means.

2. The rotary photogravure apparatus as defined in claim 1 wherein said means connecting said pistons to said cradle comprises coupling means operatively connecting said pistons together so that said pistons move together and a connecting rod operatively interconnecting said coupling means with said cradle.

3. The rotary photogravure apparatus as defined in claim 1 wherein said first and second ram means comprise separate fluid pressure operated power pistons connected to said cradle at different spaced points from the pivotal axis about which said cradle is rocked to exert leverage forces of different magnitudes for moving said cradle.

4. The rotary photogravure printing apparatus as defined in claim 1 wherein said first and second ram means comprise separate fluid pressure operated power pistons having different cross sectional areas and means connecting said pistons to said cradle upon opposite sides and at a position spaced from the pivotal axis thereof so that the forces exerted by said pistons on said cradle are opposed to each other.

5. The rotary photogravure printing apparatus as defined in claim 1 wherein fluid pressure means includes a variable pressure reducing valve for controlling magnitude of fluid pressure applied to said first and second ram means.

6. The rotary photogravure printing apparatus as defined in claim 5 wherein said fluid pressure means includes a supply line connecting said valve with a source of fluid under pressure and said ram means, and pressure indicating means disposed in said supply line calibrated in two ranges to separately measure the forces applied by said ram means which correspond to said high and low ranges of contact pressures.

7. Apparatus for printing upon different thickness sheet or web material comprising an impression cylinder mounted for rotation about an axis and a parallel printing cylinder mounted for rotation upon an axis, a support for one of said cylinders which is in turn mounted for movement to displace that cylinder toward or away from the other cylinder, means for selectively moving the support in the same direction to apply printing pressures in one of two different spaced pressure ranges on the material between the cylinders comprising first and second power means operatively connected to the support and selectively operable to apply either high pressure range printing contact or low pressure range printing contact on the material between the cylinders, and means for optionally selecting energization of one or the other of said power means.

8. In the apparatus defined in claim 7, means for adjusting the printing pressures within each of said ranges.

9. In a rotary photogravure printing apparatus, a frame, an impression cylinder mounted on said frame, a rockable cradle pivotally mounted on said frame, a rotatable printing cylinder supported on said cradle adjacent said impression cylinder, said printing cylinder being moveable with said cradle to press printing material disposed between said cylinders with a selected contact pressure and means for selectively controlling the contact pressure applied by said printing cylinder to said printing material comprising first and second ram means operatively connected to said cradle to shift said cradle in the same direction for selectively pressing said printing cylinder into bearing relation with said printing material with forces respectively corresponding to high and low ranges of contact pressures, fluid pressure means for selectively actuating said first and second ram means comprising respectively first and second concentric cylinders, first and second pistons respectively operatively in said cylinders, and means connecting said pistons to said cradle, said pistons having different cross-sectional areas for exerting different forces on said cradle when actuated by equal magnitudes of fluid pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

2,138,142 Dietrich ----------- Nov. 29, 1938
2,208,688 Stevens ----------- July 23, 1940
2,601,220 Richardson et al. --- June 17, 1952
2,787,954 Gaudet ----------- Apr. 9, 1957
2,818,804 Harless ----------- Jan. 7, 1958
2,870,706 Urban ----------- Jan. 27, 1959

3,027,831