

Nov. 7, 1933.

B. A. MALKIN

1,934,233

PAPER CALENDER PRESSURE REGULATOR

Filed Jan. 9, 1931

3 Sheets-Sheet 1

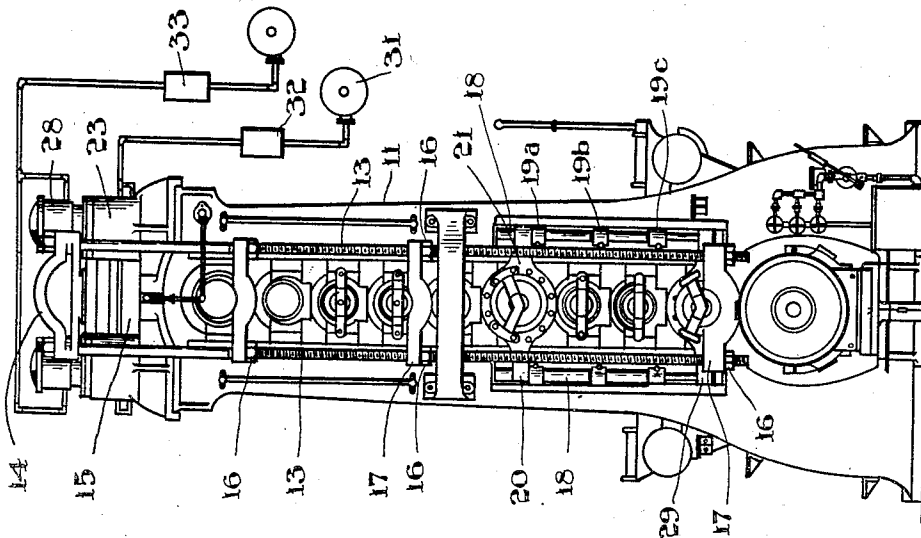


FIG. 2

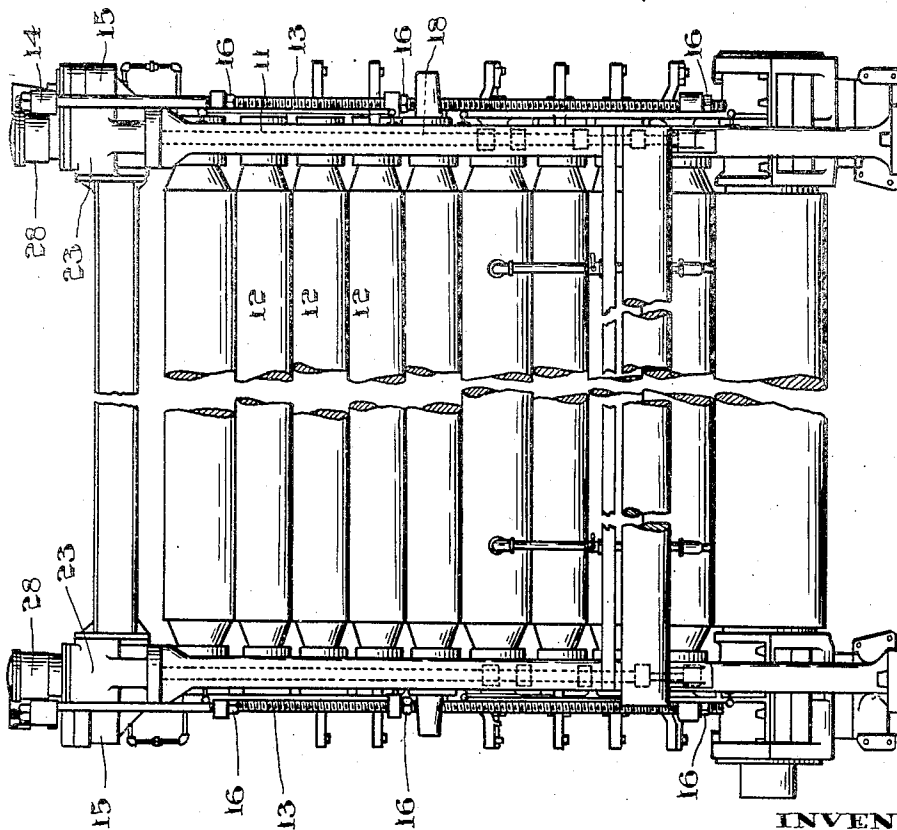


FIG. 1

INVENTOR  
BERNARD A. MALKIN  
BY *J. D. Connell*  
ATTORNEY

Nov. 7, 1933.

B. A. MALKIN

1,934,233

PAPER CALENDER PRESSURE REGULATOR

Filed Jan. 9, 1931

3 Sheets-Sheet 2

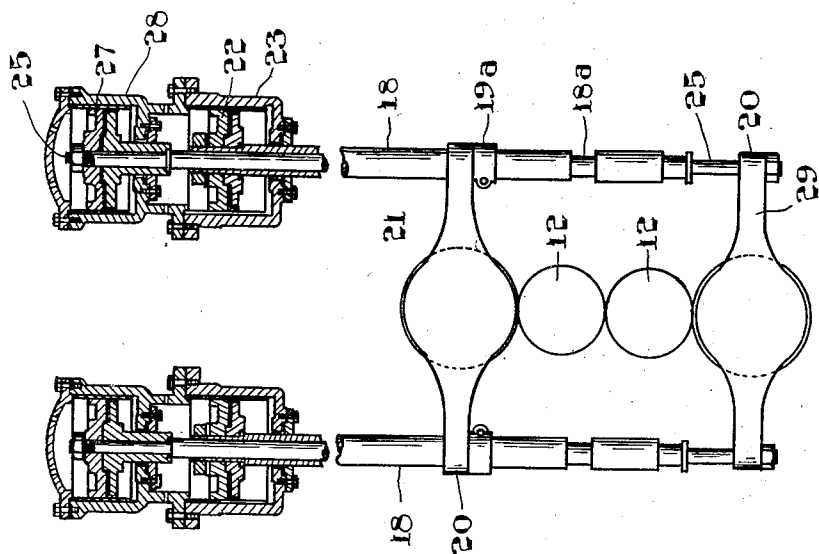


FIG. 3

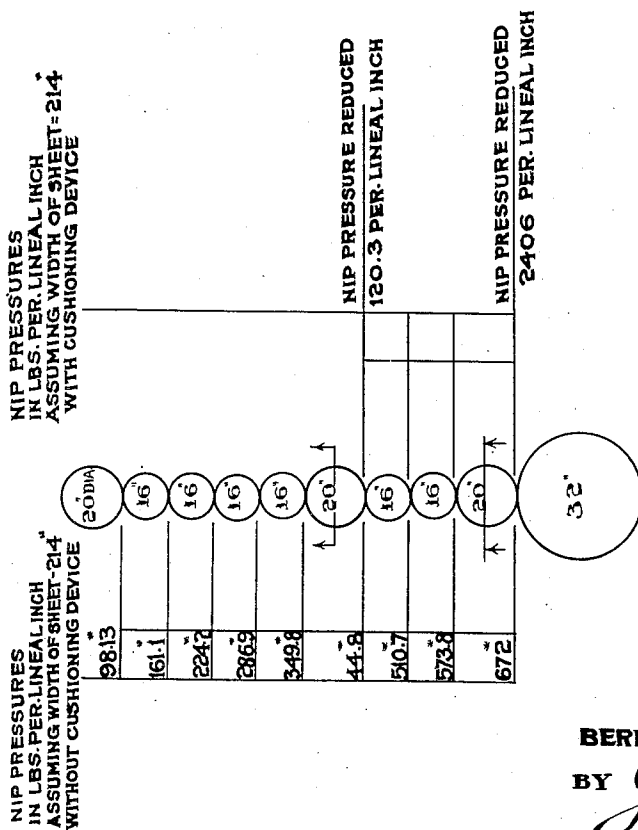


FIG. 4

INVENTOR  
BERNARD A. MALKIN

BY *J. DeConnell*  
ATTORNEY

Nov. 7, 1933.

B. A. MALKIN

1,934,233

PAPER CALENDER PRESSURE REGULATOR

Filed Jan. 9, 1931

3 Sheets-Sheet 3

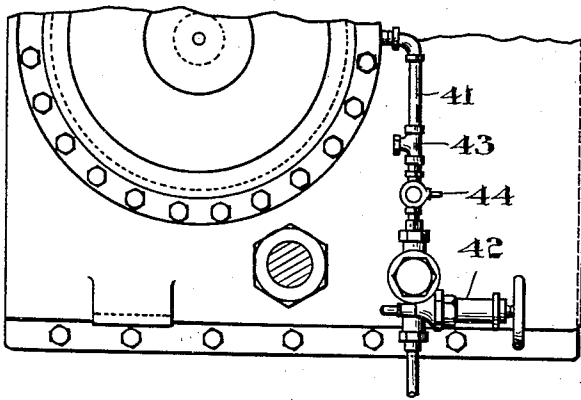


FIG. 6

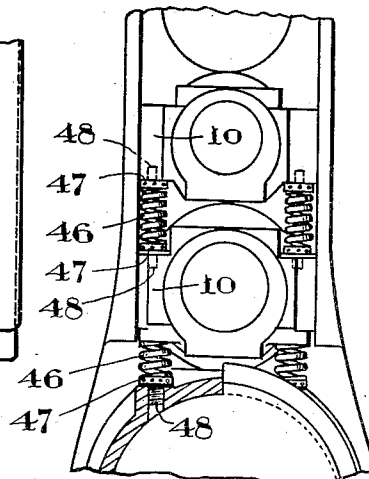


FIG. 8

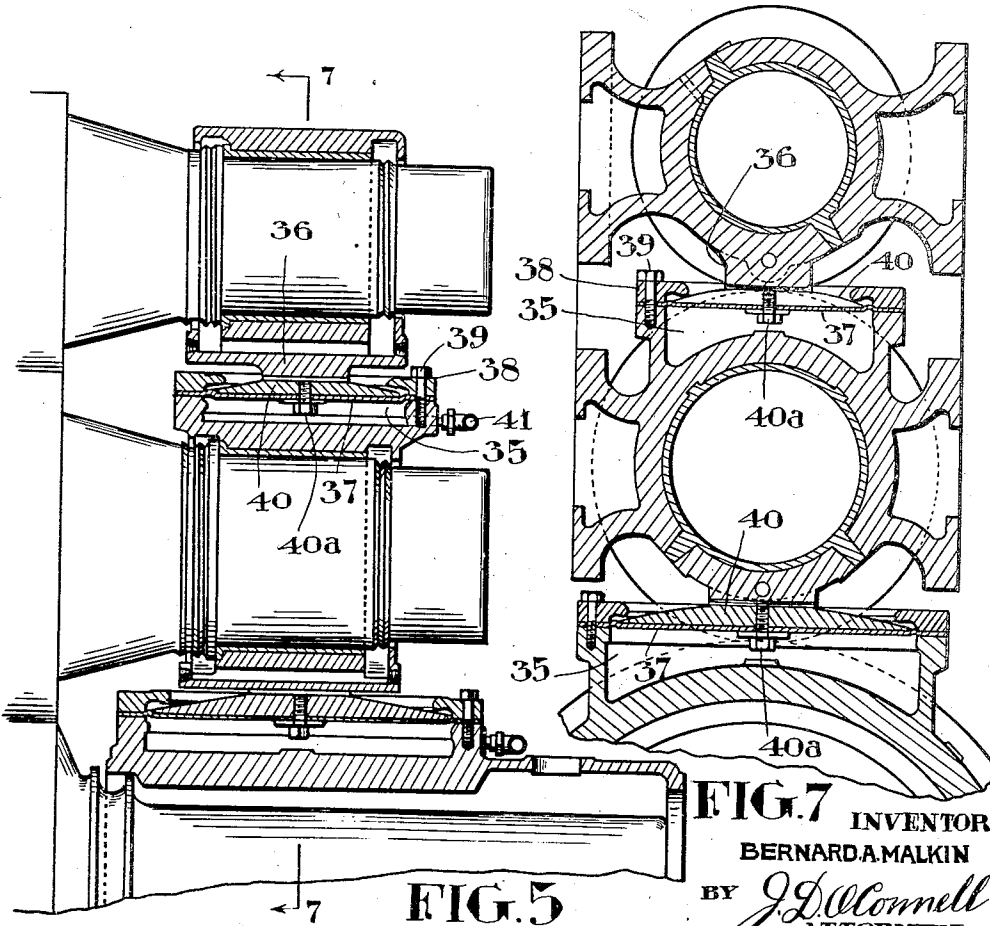


FIG. 5

FIG. 7 INVENTOR  
BERNARD A. MALKIN  
BY *J. D. Connell*  
ATTORNEY

## UNITED STATES PATENT OFFICE

1,934,233

## PAPER CALENDER PRESSURE REGULATOR

Bernard A. Malkin, Lachine, Quebec, Canada,  
 assignor to Dominion Engineering Works Limited,  
 Lachine, Quebec, Canada

Application January 9, 1931. Serial No. 507,665

12 Claims. (Cl. 92-75)

This invention relates to paper calendering machines and particularly to machines of the stack roll type.

The object of the invention is to regulate the "nip pressure" of the calender to prevent injury to the paper or other material being calendered.

We have found that the relatively large and heavy rolls used in modern calenders results in the development of excessive "nip pressures" which tend to seriously impair the quality of the paper or other material subjected to the action of the calender.

The present invention has been designed to alleviate this condition. In its preferred form, the invention consists in equipping the calender with fluid pressure cushioning or weight relieving devices to exert upward pressure on the journal bearings of one or more selected rolls of the calender to regulate the "nip pressure" at desired points and to prevent this pressure exceeding a predetermined maximum value. The same result may also be accomplished by the interposition of adjustable spring devices between the bearings of adjacent rolls.

Proceeding now to a more detailed discussion of the invention, reference will be had to the accompanying drawings wherein

Figure 1 is a side view of a calender equipped with "nip pressure" relieving devices constructed in accordance with this invention.

Figure 2 is an end view of the calender assembly shown in Figure 1.

Figure 3 is a view partly in elevation and partly in vertical section of the cushioning or weight relieving devices employed at one end of the calender. In this view the calender frame is omitted and only a few of the calender rolls appear.

Figure 4 is a diagrammatic view representing the extent to which the "nip pressure" is relieved when the weight relieving devices are operated to apply a given lifting pressure to the rolls attached thereto.

Figure 5 is a fragmentary vertical sectional view of a modified "nip pressure" relieving assembly.

Figure 6 is a fragmentary plan view of the assembly shown in Figure 5.

Figure 7 is a sectional view taken along the line 7-7 of Figure 5.

Figure 8 is a fragmentary end elevation of a calender equipped with adjustable spring devices interposed between the roll bearings to a further means for regulating the "nip pressure".

Referring more particularly to the drawings, 11 designates the side columns of a calender frame equipped with the usual arrangement of calender rolls or cylinders appearing at 12. The calender is also shown to be equipped with the usual roll lifting mechanism comprising a pair of spaced standards 13 located at each end of the calender and having their upper ends connected by a cross head 14 which is raised and lowered through the agency of suitable fluid pressure applying means generally indicated at 15. The standards 13 of each pair are threaded to engage with the usual adjusting nuts 16 supporting the roll engaging saddles 17.

The "nip pressure" regulating means comprising the present invention includes a pair of hollow vertical tubes 18 arranged within each of the frame columns 11 as shown to advantage in Figs. 1 and 2. Each tube 18 carries thereon a vertically spaced series of split clamps or collars appearing, respectively, at 19a, 19b and 19c. These collars are seated in suitable annular grooves formed in the tubes and appearing at 18a in Fig. 3. In the present instance the collars 19a, carried by each pair of tubes 18, are shown in supporting engagement with the ends 20 of a roll bearing supporting member 21 having its central portion attached to one of the journal bearings of the 5th roll from the bottom of the stack. It will be apparent, however, that the members 21 may be supported on the collars 19b and attached to the bearing of the 4th roll from the bottom of the stack or may be supported on the collars 19c and attached to the bearing of the 3rd roll from the bottom of the stack.

As shown more clearly in Fig. 3, the upper end of each tube 18 is connected to a piston 22 operating in a cylinder 23. Fluid pressure is supplied, as hereinafter described, to these cylinders to act on the lower faces of the pistons 22 in order to apply a lifting pressure to the movable journal bearings of the roll which is attached to the tubes 18 by the members 21. In this way a portion of the weight load imposed by the roll supported by the members 21 is sustained by the fluid admitted beneath the pistons 22 and, by controlling the effective pressure of this fluid, the "nip pressure" developed between said roll and the next lower roll may be regulated as desired.

Suitable rods 25 are mounted to slide vertically in the tubes 18 and have their upper ends connected to pistons 27 operating in cylinders 28

located above the cylinders 23. The lower ends of these rods carry roll bearing supporting members 29 corresponding to the members 21 and attached to one of the journal bearings of the second bottom roll of the stack. Fluid pressure admitted beneath the pistons 27 serves to apply a lifting pressure to the bearings of all the rolls positioned above the bottom roll of the stack to regulate the final "nip pressure" developed between the two bottom rolls. The pistons 22 and 27 may be operated independently or simultaneously to provide a wide range of control with reference to regulating the "nip pressure". Actuation of the pistons 27 serves to regulate the final "nip pressure" between the two lower rolls of the stack, whereas independent actuation of the pistons 22 serves to regulate the final "nip pressure" as well as the intermediate "nip pressure" developed between the roll attached to the tubes 18 and next lower roll of the stack. Simultaneous actuation of the pistons 22 and 27 provides for a further regulation of the final "nip pressure" in addition to that obtained through the independent operation of said pistons. Any suitable method of supplying fluid to the cylinders 23 and 28 may be employed. One method, which is cited merely by way of example, is shown in Fig. 2, wherein it will be noted that the cylinders 23 are supplied with fluid from a pump 31 through the medium of a combined accumulator and pressure reducing valve appearing at 32. The cylinders 28 are supplied with fluid in a similar manner from a suction pump through a combined accumulator and reducing valve appearing at 33. The particular method of controlling the flow of fluid to and from the cylinders is not believed to require extended discussion since any suitable method may be employed which will enable the desired lifting pressure to be applied to the bearings of selected rolls of the calender to regulate the "nip pressure" developed between the selected rolls and the lower rolls engaging therewith.

One example of the extent to which the "nip pressure" of the calender may be regulated in accordance with this invention is diagrammatically illustrated in Fig. 4. In this figure, the numbers at the left of the stack or rolls represent the "nip pressures" developed in the absence of the weight relieving device provided by this invention while the figures at the right of the stack indicate the reduced "nip pressures" developed between certain of the rolls when the weight relieving device is applied as previously described. In this example, the weight relieving devices are operated to exert a lifting pressure of approximately 6435 lbs. on the calender rolls connected therewith.

In the modified assembly shown in Figures 5 to 7 inclusive, a fluid pressure weight relieving device of the diaphragm type is interposed between the movable journal bearings of adjacent rolls. Each device includes a pressure chamber 35, formed in the upper side of each roll bearing 36. Each pressure chamber is closed at the top by a flexible diaphragm 37 having its marginal portion clamped between the side walls of the chamber and a clamping ring 38, the latter being secured in place by the screws 39. A plate 40 is fastened to the upperside of the diaphragm by a screw bolt 40a to provide a supporting surface for the under- side of the adjacent upper bearing 36. The

clamping ring 38 is provided with an inwardly projecting ledge 38a which overhangs the marginal portion of the plate 40 to limit upward movement thereof. The regulation of the fluid pressure in each chamber 35 may be effected in any desired manner. In the present instance there is shown for this purpose a supply line 41 equipped with a pressure regulator 42, a relief valve 43, and a three way cock 44.

In the further modification shown in Figure 8 a pair of springs 46 are interposed between the bearings 10 of adjacent rolls, each spring being confined between adjustable cap members 47 provided with shanks 48 in screw threaded engagement with the bearings. By adjustment of the cap members 47 the "nip pressure" of engaging rolls may be regulated as desired.

Having thus described my invention, what I claim is:

1. A stack roll calender equipped with weight relieving devices exerting lifting pressure on the bearings of one or more rolls of the stack to regulate the "nip pressure" of the calender.

2. A stack roll calender equipped with fluid pressure operated weight relieving devices associated with the bearings of one or more rolls of the stack to regulate the "nip pressure" of the calender.

3. A stack roll calender equipped with weight relieving devices associated with the bearings of one or more rolls of the stack to regulate the "nip pressure" of the calender and means for controlling the weight relieving action of said devices to prevent the maximum "nip pressure" exceeding a predetermined value.

4. A stack roll calender equipped with fluid operated weight relieving devices associated with the bearings of one or more rolls of the stack to regulate the "nip pressure" between said roll or rolls and the engaging lower roll or rolls and means for controlling the weight relieving action of said devices.

5. A stack roll calender equipped with piston members operable to apply weight relieving pressure to the bearings of one or more rolls of the stack to regulate the "nip pressure" of the calender, cylinders containing said pistons and means for supplying fluid pressure to said cylinders.

6. A stack roll calender equipped with a weight relieving device connected to the bearings of the roll engaging the bottom roll of the stack and serving to regulate the "nip pressure" between these two rolls, a second weight relieving device connected to the bearings of an intermediate roll located above the first mentioned roll to regulate the "nip pressure" between said intermediate roll and the next lower roll, and means for independently controlling the action of said devices.

7. A stack roll calender including a plurality of weight relieving mechanisms adapted to be respectively attached to the bearings of selected rolls of the stack to relieve the "nip pressure" developed between the selected rolls of the engaging lower rolls, one of said mechanisms including hollow tubular members having their lower ends connected to the bearings of a selected roll and pistons connected to the upper ends of said tubular members, cylinders containing said pistons, the remaining weight relieving mechanisms including rods slidably mounted in said hollow tubular members and having their upper ends connected to the bearings of a further roll of the stack and pistons

|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| connected to the upper ends of said rods and operating in cylinders arranged above the first mentioned cylinders, and means for supplying fluid pressure to said cylinders to exert a lifting                                      | devices interposed between the journal bearings of adjacent rolls and serving to exert pressure against at least one of said bearings to relieve th "nip pressure" of the rolls.                                                                                   |     |
| 5 pressure on said pistons.                                                                                                                                                                                                        | 11. A calendar equipped with fluid pressure chambers located between the journal bearings of adjacent rolls, one wall of each chamber being formed by a diaphragm engaging one of said bearings, and means for controlling pressure conditions with said chambers. | 80  |
| 8. A calender equipped with weight relieving devices interposed between the journal bearings of adjacent rolls, said devices being controllable to regulate the "nip pressure" of the calender.                                    | 12. A calender equipped with adjustable "nip pressure" relieving spring devices interposed between the journal bearings of adjacent rolls.                                                                                                                         | 85  |
| 10 9. A calender equipped with weight relieving devices interposed between the journal bearings of adjacent rolls, and independently controllable to regulate the "nip pressure" developed between selected rolls of the calender. |                                                                                                                                                                                                                                                                    |     |
| 15 10. A calender equipped with fluid pressure                                                                                                                                                                                     | BERNARD A. MALKIN.                                                                                                                                                                                                                                                 | 90  |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 20                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 95  |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 25                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 100 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 30                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 105 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 35                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 110 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 40                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 115 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 45                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 120 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 50                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 125 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 55                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 130 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 60                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 135 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 65                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 140 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 70                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 145 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                    |     |
| 75                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    | 150 |