Feb. 11, 1941. L. E. RANDECKER 2,231,171

METHOD OF AND APPARATUS FOR EMBOSSING

Filed Sept. 22, 1938

Fig:1.

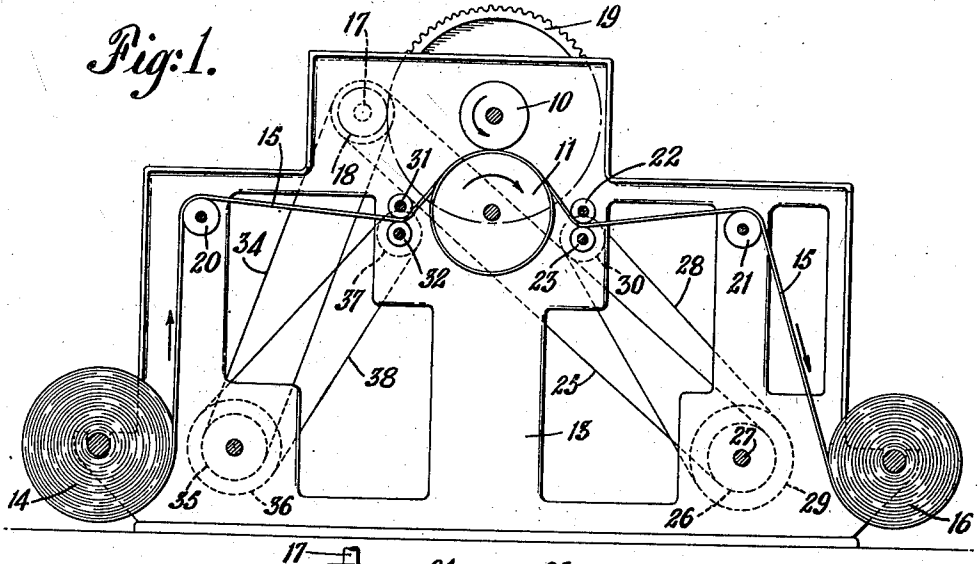
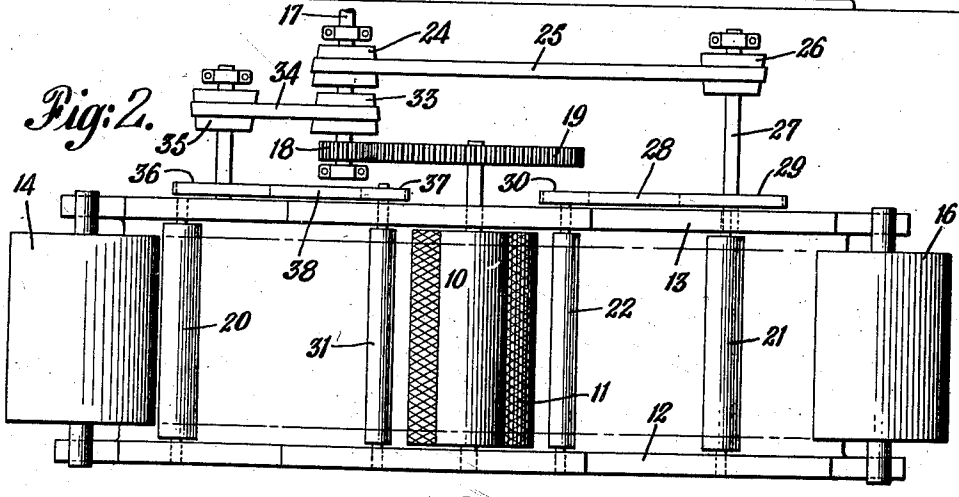


Fig:2.



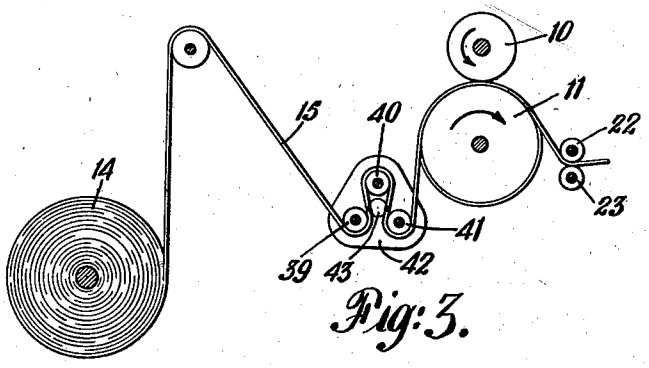


Fig:3.

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METHOD OF AND APPARATUS FOR EMBOSSING

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Application September 22, 1938, Serial No. 231,147

12 Claims. (Cl. 101—23)

This invention relates to the art of embossing. Machines including embossing rolls through which a sheet is passed for receiving impressions of a design therefrom have long been known. While such machines possess the advantages of fairly high operating speeds and ability to handle wide sheets, their embossing effect is not as clear and free as is frequently desired, and this is especially so at high speeds of operation.

An object of the present invention is the provision of a novel method and apparatus for obtaining an improved embossing effect without sacrifice of operating speed, and/or obtaining as good an embossing effect at increased operating speeds. The invention enables roll embossers to be operated at high speeds without interference with the attainment of clear and pronounced impressions from the embossing rollers. An outstanding feature of the invention resides in the provision of controlled tension in the sheet as the latter leaves the embosser nip. More specifically, the invention provides a zone of relieved tension in the sheet over an area starting before the nip and ending after the nip, and enabling the sheet to conform more freely to the contours of the design impression during its travel between the embossing rollers. A substantially improved embossing effect is thereby attained at a given operating speed, or a clear and free embossing effect may be obtained at a higher operating speed.

Further features and advantages of the invention will be hereinafter described and claimed.

In the accompanying drawing:

Fig. 1 is a view in elevation, with parts in vertical section, illustrating an embodiment for the practice of the invention.

Fig. 2 is a top plan view of said embodiment.

Fig. 3 is a diagrammatic view showing a modification.

Referring to the drawing, the invention is illustrated in conjunction with an embosser of well-known type including embossing rolls 10, 11, mounted in suitable frames 12, 13. Said embosser also includes a supply roll or unwind stand 14 from which the sheet of paper or other material 15 is drawn between the embossing rolls and onto the storage roll or wind up stand 16. The rolls 10, 11 are continuously driven in any suitable way, as by power shaft 17, and gear 18 thereon meshing with gear 19 on the shaft of the roll 10. The sheet may be passed, from supply roll 14 over a roller 20 and thence between the rolls 10, 11, over another roller 21 and onto the storage roll 16, the rotation of roll 10 being transmitted through the sheet to roll 11. During its passage between said rolls 10, 11 the sheet is embossed, and since the rolls 10 and 11 apply considerable pressure to the sheet passing between them, these rolls 10 and 11 serve to pull the sheet from the supply roll 14. While either of the rolls 10, 11 may carry embossing projections, the latter are shown in this instance as on the roll 10. The roll 11 may be formed of suitable yieldable material for enabling the sheet to receive the impression from roll 10, as is well understood in the art.

In carrying out my invention, in the embodiment illustrated in Figures 1 and 2, I provide a pair of squeeze rollers 22, 23 at the rear of the embossing rolls 10 and 11. Said rollers 22 and 23 are driven at such peripheral speed with respect to that of the embossing rolls as to provide tension in the sheet between the embossing rolls and the rolls 22, 23. This may conveniently be accomplished from shaft 17 through a cone pulley 24 and a belt 25 which passes over a cone pulley 26 on a shaft 27, connected by belt 28 and pulleys 29, 30 with the shaft of roll 23. The cone pulleys enable any desired adjustment of the speed of rolls 22, 23 to be obtained, depending upon the tension desired and the slippage of the sheet at the rolls 22, 23. By driving the rolls 22, 23 at a peripheral speed slightly greater than that of rolls 10, 11, and by positioning rolls 22, 23 as close as possible to the embossing rolls, I have found that the sheet may be passed through the embosser rolls under a minimum amount of tension readily controlled.

Another pair of squeeze rolls 31, 32 is shown in Figures 1 and 2 in advance of the embossing rolls 10, 11, which squeeze rolls are also driven at an appropriate peripheral speed with respect to that of said embossing rolls. Cone pulley 33 on shaft 17, belt 34, and cone pulley 35, enable said rolls to be driven at the desired speed from said shaft, through pulleys 36, 37, and belt 38. The driving of rolls 31, 32 at a peripheral speed slightly less than that of the embossing rolls and the close proximity of rolls 31, 32 to the embossing rolls provides a zone of controlled tension between the nip of said rolls 31, 32, and the nip of rolls 22, 23.

The upper rolls 31 and 22 of the pairs of squeeze rolls 31, 32 and 22, 23 respectively, are preferably held in contact with the lower rolls 32 and 23 by means of spring pressure to provide the desired amount of slippage of the sheet passing between these pairs of squeeze rolls. Such pressure and slippage are, of course, important factors in controlling tension of the sheet between the two pairs of squeeze rolls. If desired, the

upper rolls 31 and 22 may have spiral surfaces to serve as spreader rolls.

Between the nips of the pairs of rolls 31, 32 and 22, 23 is a zone in which the tension of the sheet can be controlled independently of that between the supply roll 14 and rolls 31, 32, and independently of that between rolls 22, 23 and storage roll 16. Thus between the supply roll 14 and the nip of rolls 31, 32, and between the storage roll 16 and the nip of rolls 22, 23, the tension of the sheet may be greatly reduced with respect to the tension required in the usual embossing machine.

It is customary to control tension in a sheet of paper being embossed by a braking mechanism on the unwind roll, the amount of tension usually being very high and frequently being so high in order to prevent transverse wrinkles that longitudinal wrinkles are formed in the sheet. Various devices including spreader rolls and the like have been used to take out such longitudinal wrinkles.

My invention obviates the need for such devices by providing the tension controlling rolls just before and just after the nip of the embossing rolls which reduces the free length of the web before and after the embosser nip to a minimum. I have found that this shortening of the free length of the sheet makes it possible to emboss the sheet while it is under less tension than would be possible with longer free lengths of the sheet before and after the embosser nip. The shorter free length of sheet requires less pull or tension to eliminate transverse wrinkles, and this lower tension together with the short free length of the sheet has less tendency to produce longitudinal wrinkles in the sheet. Consequently, a sheet of material may be machine embossed according to my invention under a minimum amount of tension, just sufficient to eliminate wrinkles from the very short free length of sheet before and after the embosser nip.

In practicing my invention, the supply roll 14 does not require the customary braking. I prefer to apply just enough of a drag on the supply roll 14 to keep it from running free. The sheet is pulled by the embossing rolls 10, 11 and squeeze rolls 22, 23 through the squeeze rolls 31, 32, and tension is supplied by adjusting the speed of the squeeze rolls 31, 32 and/or squeeze rolls 22, 23. The peripheral speed of the driven squeeze rolls 31, 32 will be more or less slower than the peripheral speed of the embossing rolls, depending upon the amount of slippage taking place between the sheet and the squeeze rolls 31, 32 and upon the tension desired. The squeeze rolls 22, 23 on the other hand are operated more or less faster than the embossing rolls, depending also upon the amount of slippage taking place at the squeeze rolls 22, 23 and upon the amount of tension needed in the sheet. Thus the portion of the sheet between the pairs of squeeze rolls 31, 32 and 22, 23 is under more tension than the remainder of the sheet, but because the free length of the sheet under tension has been reduced, the amount of tension in the sheet between these pairs of squeeze rolls does not have to be maintained as high as usual in order to eliminate wrinkles therefrom. In fact, by utilizing tension controlling means immediately in front of and immediately to the rear of the embossing nip, superior embossing results can be obtained.

This controlled zone of tension in the sheet proximate the embosser nip makes it possible to wind up the embossed sheet under very little, if any, tension a distinct advantage in many ways. Likewise, the cost of replacing the braking mechanisms on the supply rolls is largely eliminated. In addition, the positioning of tensioning control means just before and just after the embosser nip reduces the free length of sheet to a minimum and correspondingly reduces the amount of tension needed in the sheet to a minimum. The improvement thus effected by embossing under lower tension has in practice made possible the machine embossing of certain types of paper which heretofore required embossing in individual sheets.

In Fig. 3 the rolls 31, 32 are replaced by a snag roll assembly comprising rolls 39, 40 and 41 mounted in a frame 42 pivoted at 43 and provided with individual brakes (not shown). The sheet is shown passing under the roll 39, over the roll 40, and under the roll 41. It will be seen that by turning the frame 42 about its pivot the tension in the sheet between roll 41 and rolls 10, 11 may be varied within certain limits by varying the total amount of wrap of the sheet about the rolls 39 and 41. This snag roll assembly, similar to rolls 31, 32, provides, together with rolls 22, 23, for a short zone of controlled tension in the sheet passing through the embossing rolls, making it possible to carry out the embossing under less than the usual amount of tension. Suitable means such as a worm and gear operated by a hand wheel (not shown) may be provided for rotating frame 42 and for maintaining said frame in any adjusted position about its pivot.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

This application is a continuation-in-part of my copending application Serial No. 126,543, filed February 19, 1937.

I claim:

1. In combination, a pair of embossing rolls, means for passing a sheet of material therethrough, and adjustable tensioning control means positioned immediately in front of and immediately to the rear of said embossing rolls for applying a variable amount of drag and pull on said sheet, thus providing a zone of controlled tension in the sheet in the zone of the nip of said embossing rolls.

2. The method of embossing comprising passing a continuous sheet of paper or the like from a source of supply to a wind-up station under insufficient tension to remove wrinkles therefrom at an embosser nip, passing said sheet through embossing rolls at a point intermediate said supply source and wind-up station, and increasing the tension in the sheet a sufficient amount to eliminate wrinkles in a zone extending from a point immediately in advance of the embossing rolls to a point immediately rearward of said embossing rolls.

3. The method of embossing comprising passing a continuous sheet of paper or the like from a source of supply to a wind-up station under insufficient tension to remove wrinkles therefrom at an embosser nip, passing said sheet through embossing rolls at a point intermediate said

supply source and wind-up station, and increasing the tension in the sheet an amount just sufficient to eliminate wrinkles in a zone extending from a point immediately in advance of the embossing rolls to a point immediately rearward of said embossing rolls.

4. The method of embossing comprising passing a continuous sheet of paper or the like from a source of supply to a wind-up station under insufficient tension to remove wrinkles therefrom at an embosser nip, passing said sheet through embossing rolls at a point intermediate said supply source and wind-up station, exerting a retarding force on the sheet by means positioned immediately in advance of the embossing rolls, and exerting a pulling force on the sheet by means positioned immediately rearward of said embossing rolls, said forces being sufficient to eliminate wrinkles from the sheet between said two means.

5. Embossing apparatus comprising a pair of embossing rolls, means for passing a continuous sheet of material between said rolls, said means including means for engaging the sheet immediately in advance of said rolls to exert a retarding force thereon, and means for engaging the sheet immediately following said rolls for exerting a pulling force thereon.

6. Embossing apparatus comprising a pair of embossing rolls, a supply station for supplying a continuous sheet of material to said rolls, a wind-up station for receiving the embossed sheet from said rolls, the tension in the major portion of the sheet between said supply and wind-up stations being insufficient to eliminate wrinkles, means in advance of said embossing rolls for exerting a retarding force on said sheet, and means rearward of said embossing rolls for exerting a pulling force on said sheet, said forces being sufficient to eliminate wrinkles in the portion of said sheet between said two means.

7. Embossing apparatus comprising a pair of embossing rolls, means for passing a continuous sheet of material between said rolls, means for engaging the sheet immediately in advance of said rolls to exert a retarding force thereon, and means for engaging the sheet immediately following said rolls for exerting a pulling force thereon, said two means being adjustable independently of each other for exerting just sufficient forces to eliminate wrinkles in the portion of the sheet placed under tension.

8. Embossing apparatus comprising a pair of embossing rolls, a supply station for supplying a continuous sheet of material to said rolls, a wind-up station for receiving the embossed sheet from said rolls, the tension in the major portion of the sheet between said supply and wind-up stations being insufficient to eliminate wrinkles, means in advance of said embossing rolls for exerting a retarding force on said sheet, and means rearward of said embossing rolls for exerting a pulling force on said sheet, said means being adjustable to apply different degrees of tension to the portion of the sheet therebetween.

9. Embossing apparatus as defined in claim 5 in which the means for engaging the sheet in advance of and following the embossing rolls comprises pairs of positively driven squeeze rolls.

10. Embossing apparatus as defined in claim 6 in which the means for exerting a retarding force and the means for exerting a pulling force on the sheet each comprises squeeze rolls provided with positive drive means.

11. Embossing apparatus as defined in claim 5 in which the means in advance of the embossing rolls comprises a snag roll assembly, and in which the means following the embossing rolls comprises positively driven squeeze rolls.

12. Embossing apparatus as defined in claim 6 in which the means for exerting a retarding force comprises a snag roll assembly, and in which the means for exerting a pulling force comprises positively driven squeeze rolls.

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