

June 27, 1944.

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METHOD OF PREPARING NEWSPRINT PAPER FOR USE AS PENCIL SHEATHS

Filed Jan. 16, 1942

4 Sheets-Sheet 1

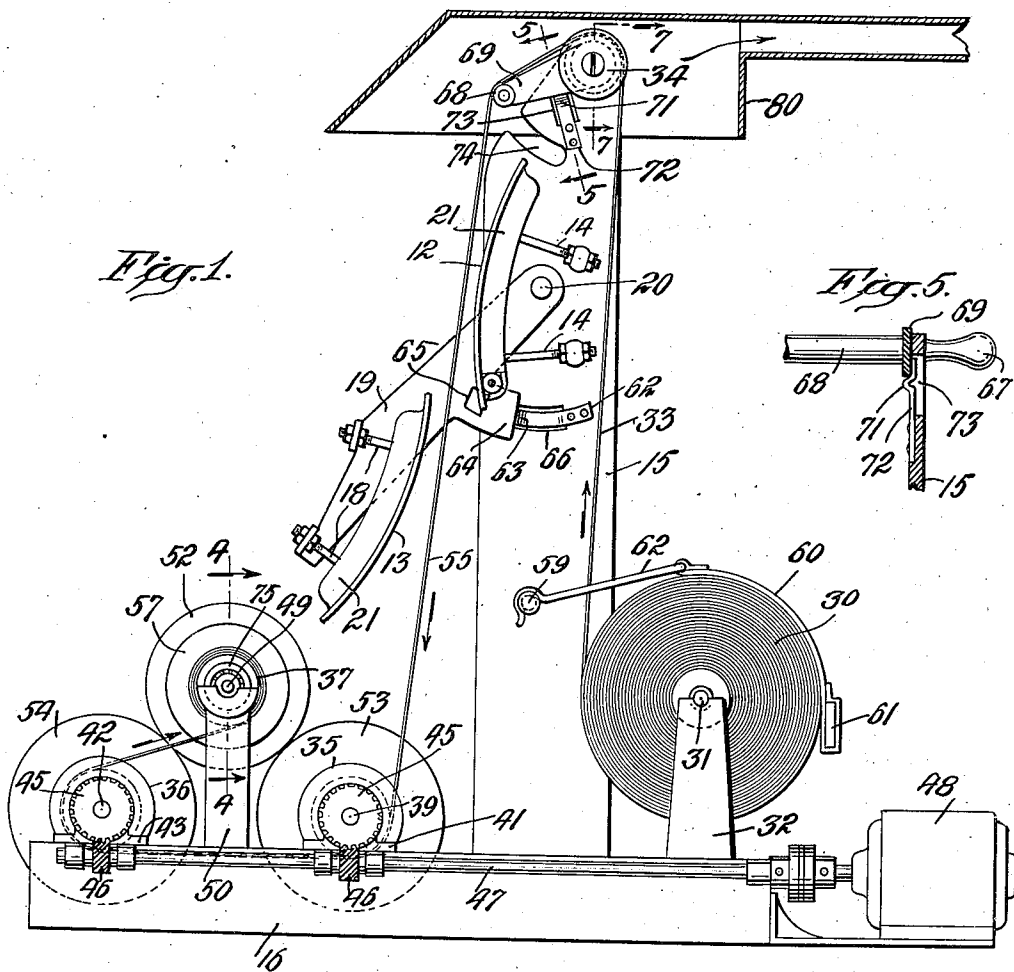


Fig. 1.

Fig. 5.

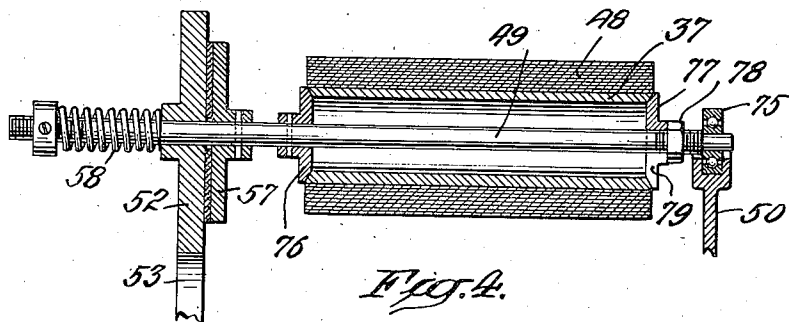


Fig. 4.

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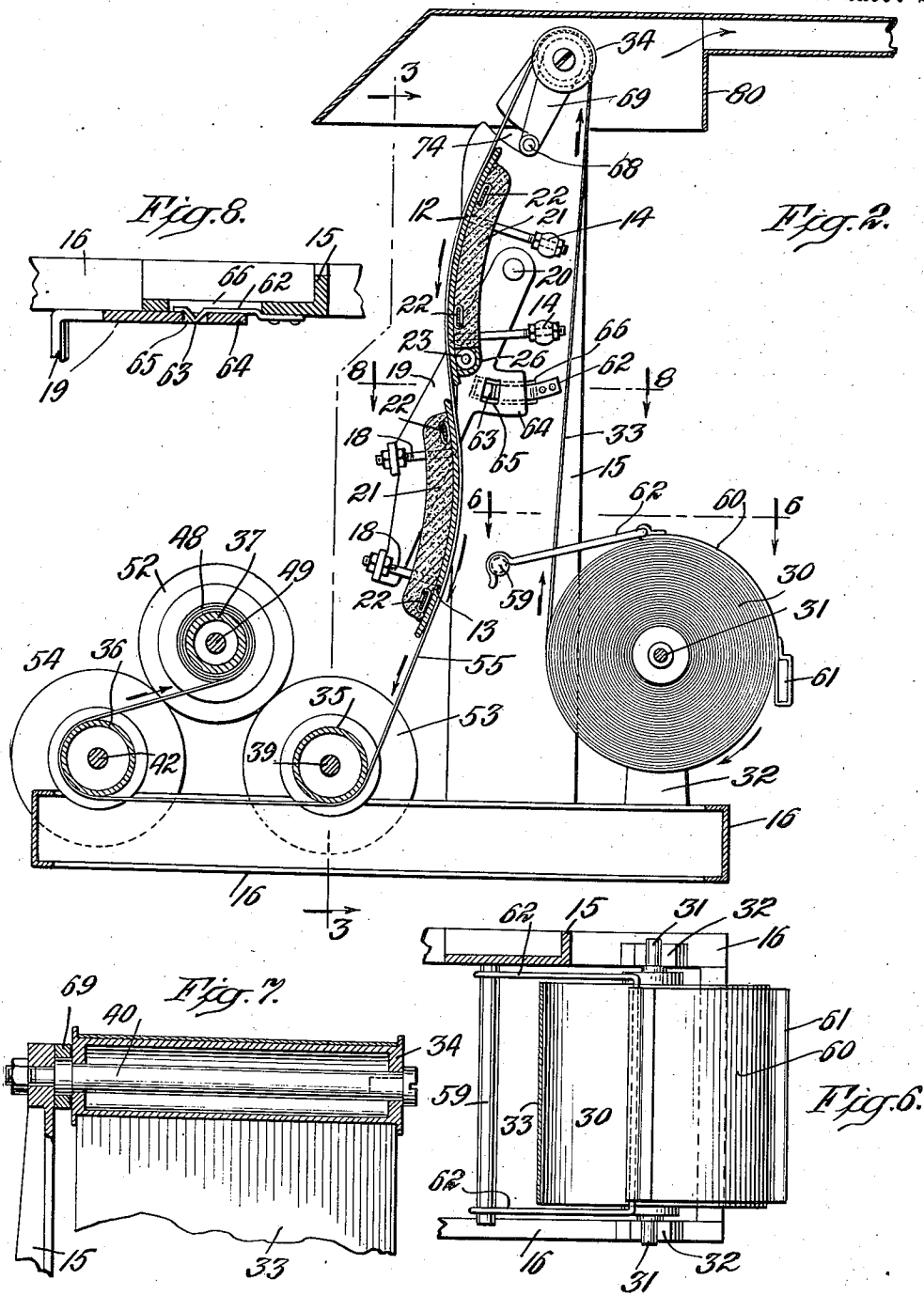
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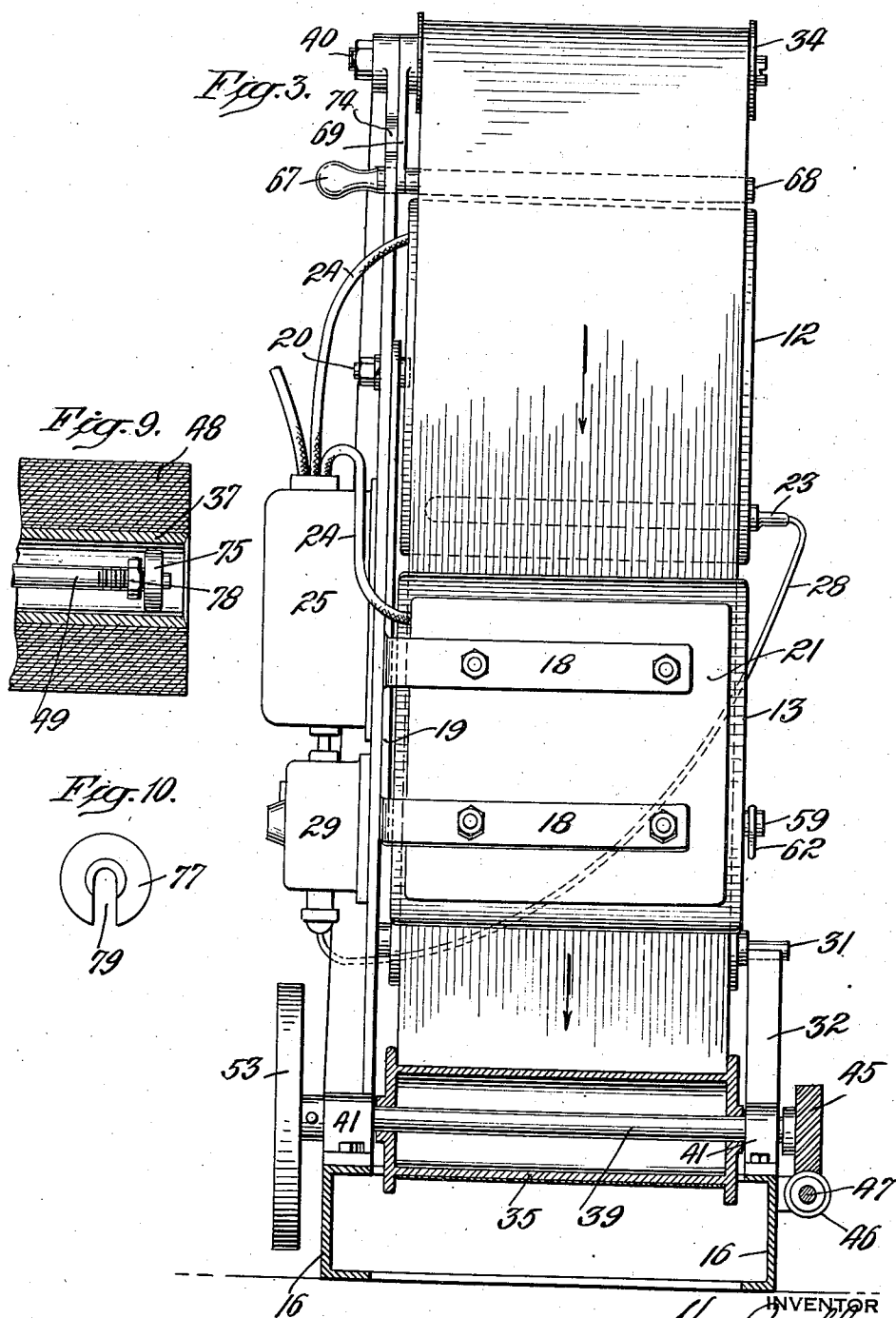
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4 Sheets-Sheet 3



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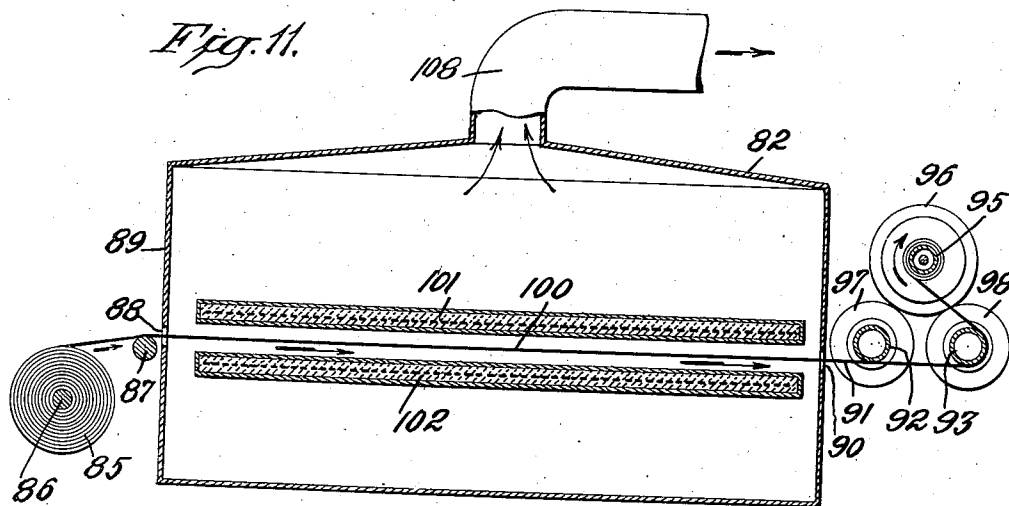
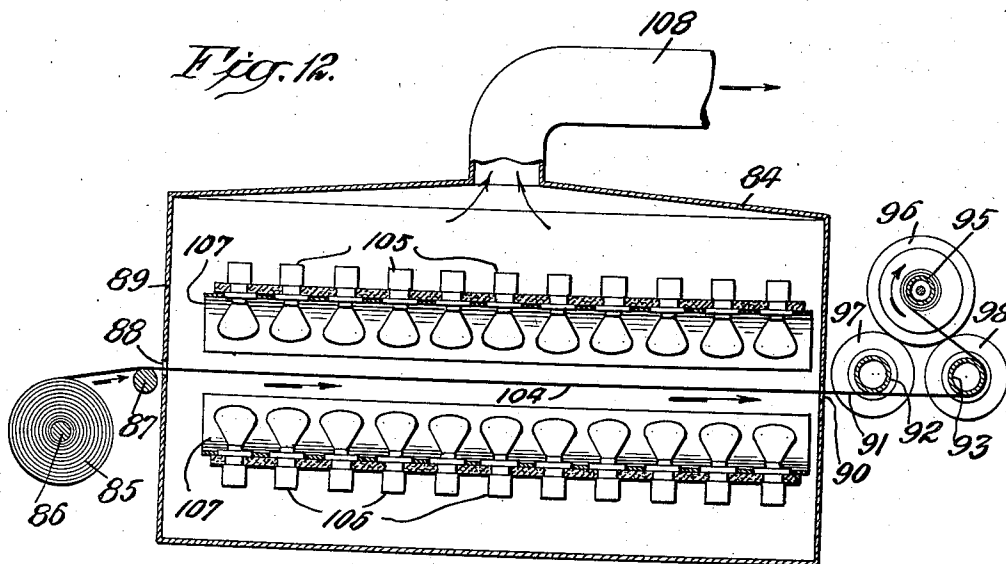
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4 Sheets-Sheet 4



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METHOD OF PREPARING NEWSPRINT
PAPER FOR USE AS PENCIL SHEATHS

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5 Claims. (Cl. 93—1)

The invention relates to a method of preparing newsprint paper for use as pencil sheaths, and more specifically to a method of heat treating newsprint paper to render it suitable for use as pencil sheaths in coil form. The heat treated paper produced by the method of the present invention is primarily intended for use as a substitute for the usual wooden pencil sheath. The heat treated paper is formed into a pencil sheath by being wrapped around the stick of marking material in tight successive convolutions which are caused to adhere together by means of a suitable adhesive applied between the convolutions of the coil. The paper to be treated is unaged, that is, fresh, unprinted newsprint, the paper of which commercial newspapers is composed. A pencil sheath composed of untreated commercial newsprint paper cannot be cut by a rotary pencil sharpener or by a knife blade as easily as pencil wood. In fact it is only with difficulty that a coil of untreated newsprint paper can be cut with a sharp blade, and the rotary cutter of the commercial pencil sharpener leaves fibers projecting from the cut surface. Accordingly it is necessary to treat the newsprint paper in such manner that when it is rolled into a pencil sheath it can be readily cut either with a knife blade or with a rotary cutter.

The usual type of newsprint paper consists of cellulose and a rather large proportion of lignin, that is, impurities of various kinds, some of which are volatilized by heat. Since a newsprint paper composed only of cellulose and lignin deteriorates too rapidly, about 10% sulphide pulp is added to it to make it more stable. But even with the addition of sulphide pulp it is the common observation that ordinary newsprint paper ages relatively quickly, that is to say, becomes brown and brittle. I have found that by coiling newsprint paper which has become brown and brittled by age into a pencil sheath it can be cut as readily with a knife blade or a rotary cutter as can the usual wood pencil sheath. But it takes months to age newsprint paper to the proper degree of brittleness to render it suitable for use as pencil sheaths in coil form. The newsprint paper must therefore be subjected to an artificial aging.

The newsprint paper may be quickly and artificially aged to sufficient brittleness by subjecting the paper to a bath containing an acid or an alkali, but this method requires a further bath to remove the traces of the acid or alkali, and as a result of these successive wettings the paper has a tendency to wrinkle, requiring ironing of the paper and drying it.

I have discovered that newsprint paper can be quickly and expeditiously artificially aged by bringing it to a proper degree of charred condi-

tion or brittleness by the application of heat to the paper, thereby avoiding the inconveniences incident to brittling the paper by means of an acid or alkali bath. Moreover, the heat treatment is more economical than the acid or alkali bath treatment and results in a superior product. The heat treatment of the paper can be effected by passing a strip of the paper through a heated chamber or the paper can be brought into contact with heated metal surfaces. The application of the heat to the paper must be carefully controlled in order that the degree of charring obtained will cause the cutting qualities of the charred paper to approximate the cutting qualities of the so-called "cedar" wood, usually used for wooden pencil sheaths. At the same time the charring or brittling must not be carried to such extent as seriously to impair the tensile strength of the paper.

When the unaged, unprinted newsprint paper is artificially aged to the proper degree of brittleness to render it suitable for use as pencil sheaths in coil form by means of exposing it to air in a closed chamber, I have found that if the air in the chamber is about 200° C. it requires about three minutes to brittlenize the paper properly. If the temperature of the air in the chamber is raised to about 345° C. the proper amount of charring or brittling of the paper takes place in about .11 of a minute. As the temperature of the air in the chamber is gradually raised the length of time the paper remains in the chamber to be properly charred or brittlenized proportionately decreases. The paper may be placed in the chamber in festoon-like form or it can be passed to the chamber as a continuous strip. When the air treatment is used I prefer to have the temperature of the air in the chamber at about 345° C. so that the paper will pass through the chamber in about .11 of a minute.

The alternative method of my invention is to bring each surface of a travelling strip of unaged, unprinted newsprint paper into contact with a heated metal element, the preferable rate of travel of the strip of paper being about twenty feet per minute in contact with a smooth heating element of about two feet long heated to about 350° C. The rate of travel of the strip of paper may be increased, but the temperature of the heating element must be proportionately increased, and this can be done up to a point somewhat below that at which the paper will ignite.

One form of machine for carrying out the method of treating newsprint paper to render it suitable for use as pencil sheaths in coil form comprises two metallic heating elements, means for moving the heating elements into and out of operative position, means for heating the heating elements, means for controlling the degree

of heat to which the elements are heated, and means for moving a strip of paper past the heating elements successively while they are in operative position, so that one surface of the strip of paper will contact with one heating element and the other surface of the strip of paper will contact with the other heating element.

The invention is more fully described herein-after and is particularly pointed out in the appended claims.

In the accompanying drawings illustrating the preferred form of machine in which one phase of the method of the invention may be practiced, Fig. 1 is a front elevation of the machine for heat treating a continuous strip of newsprint paper, showing the heating elements or plates disengaged from the strip of paper; Fig. 2 is a view similar to Fig. 1, but showing the heating elements or plates in engagement with the strip of paper, some of the parts being shown in section; Fig. 3 is a front end elevation and section of the machine taken on the line 3—3 of Fig. 2; Fig. 4 is an enlarged vertical section through the roll of treated paper and its supporting members, taken on the line 4—4 of Fig. 1; Fig. 5 is an enlarged detail section of the detent for holding the strip of paper away from the upper heating element, taken on the line 5—5 of Fig. 1; Fig. 6 is a section taken on the line 6—6 of Fig. 2, but showing in top plan view the roll of untreated paper; Fig. 7 is a section through the idler roll at the top of the machine, taken on the line 7—7 of Fig. 1; Fig. 8 is an enlarged horizontal section through the detent for holding the lower heating element away from the paper, taken on the line 8—8 of Fig. 2; Fig. 9 is an enlarged vertical section of the right hand end of the roll of treated paper, shown in the act of being removed from its supporting means; Fig. 10 is a front elevation of the slotted washer or disk of the supporting means for the roll of treated paper; Fig. 11 is a vertical longitudinal view through a chamber for heat treating the strip of paper by air heated by electrical elements; and Fig. 12 is a view similar to Fig. 11, but in which the heating elements are infra-red lamps.

The paper treating machine as illustrated comprises two arc-shaped heating elements or plates, an upper stationary plate 12 and a lower movable plate 13. The heating plates are somewhat wider than the strip of paper to be treated which is a little wider than the usual "lead" pencil is long. In length each plate is about 12 inches. Because of its high efficiency as a conductor, the heating elements are preferably composed of copper. The stationary plate 12 is supported by the brackets 14 from the front side of an upright or standard 15 rising from the rear edge of an elongated box-like base 16. The movable plate 13 is secured by the brackets 18 on the lower end of an arm 19 pivoted at 20 on the front side of the upright 15.

Each heating element or plate 12 and 13 is backed by a block of asbestos 21 in which are embedded resistant coils 22 connected by wires 24 with a relay 25. The temperature of the upper heating plate 12 (and therefore of the lower heating plate 13) is controlled by means of a thermostat 23 located at the lower end of the upper heating element 12 and supported by a pocket-shaped piece of copper 26 extending from the rear side of the lower end of the plate 12. The thermostat 23 is connected by a tube 28 with a control 29 through which the temperature of the plates 12 and 13 is regulated, the control 29 being connected

with the relay 25. All these heat controlling parts are of conventional construction and mode of operation.

The roll 30 of fresh or unaged, unprinted newsprint paper is provided at its center with a shaft 31 the outer projecting ends of which are supported on the upper ends of uprights 32 rising from the right hand end of the base 16, viewing Figs. 1 and 2. The free end 33 of the roll of paper passes upwardly to an idler pulley 34 which turns on a stud 40 secured to and projecting forwardly from the upper end of the upright 15 (see Fig. 7). The strip of paper then passes downwardly between the heating elements to the under side of the roll 35, thence forwardly under the roll 36 and then backwardly and upwardly to the core 37 on which the treated paper is rolled up.

The roll 35 is secured to the shaft 39, the outer ends of which turn in the journal boxes 41 secured to the upper side of the box-like base 16 of the machine. The shaft 42 to which the roll 36 is secured is similarly journaled in a front box 43, the rear journal box not being indicated.

On the forward ends of each shaft 39 and 42 is fixed a worm gear 45 which meshes with a worm 46 secured to a shaft 47 which extends throughout the length of the front side of the base 16 and is connected at its right hand end, facing Fig. 1, with a constant speed motor 48, so that the rolls 35 and 36 are driven at a constant rate of speed.

The core 37 on which is wound the coil of treated paper 48 (see Fig. 4), is mounted on a shaft 49, by an arrangement to be described later, which is supported at its forward end on an upright 50 rising from the base 16 and at its rear end by means of a disk 52 loosely mounted on the shaft 49. The periphery of the disk 52 bears upon the peripheries of a disk 53 secured to the rear end of the shaft 39 and a disk 54 fixed on the rear end of the shaft 42. It will be noted that the shaft 49 which supports the core of the coil of treated paper is located half way between the rolls 35 and 36 and that consequently, as the treated part 55 of the strip of paper passes over the roll 36 it embraces substantially one half of it, thereby assuring that there is no slippage between the strip of treated paper and the periphery of the roll 36 as the strip of treated paper 55 passes from the roll 36 to the periphery of the coil 48 being built up on the core 37. This arrangement also assures that there is a steady unslipping pull on the part 55 of the strip of paper as it travels between the heating elements and after it leaves them in treated condition.

The shaft 49 is driven by the friction plate 57 which is held against the front side of the plate 52, loosely mounted on the shaft 49, by means of the adjustable spring 58. Since the peripheries of the disks 53 and 54 on which the disk 52 is supported travel faster than the rolls 35 and 36, and the disk 52 has the same peripheral speed, the tendency is for the core 37 to have the same speed, through the friction plate 57. The result of this arrangement is that the treated paper is wrapped tightly onto the coil 48 on the core 37, the adjustment of the spring 58 assuring the proper slippage as the coil 48 increases in size.

When a fresh roll 30 of untreated paper is placed in position on the uprights 32 and the free end thereof is brought down between the heating elements 12 and 13 they are spaced apart as shown in Fig. 1, and when the free end of the paper is undergoing heat treatment the heating elements are in the position shown in Fig. 2. In order that the free end 33 of the roll of

untreated paper may be delivered to the heating elements with even tension a flexible brake 60 having a weight 61 at its lower end rests upon the roll 30. The brake 60 is secured at its other end of the hook 62 which passes disengageably over a stud 59 projecting forwardly from the upright 15.

The lower movable heating plate 13 is held in its inoperative position, the position shown in Fig. 1, away from the strip of paper by means of a flexible detent 62 secured to the front side of the upright 15, the free forward end of the detent being provided with a hump 63 the front side of which takes against the projection 64 on the rear side of the arm 19. When the lower heating plate 13 is in operative position, as shown in Fig. 2, the hump 63 is received in a recess 65 in the projection 64. To accommodate the lateral movements of the free end of the detent 62 the upright 15 is slotted at 66.

The upper heating plate 12 being stationary, it is necessary to hold the free end of the fresh roll of untreated paper away from its surface when the paper is being adjusted for treatment, and accordingly there is provided a pin 68 carried by the free end of an arm 69 pivoted on the stud 40 on which the idler roll 34 is mounted. On the rear end of the pin 68 is a handle 67 by which it is manipulated. The arm 69 is held in its raised position, as shown in Fig. 1, by means of the hump 71 of a flexible detent 72 secured at one end to the front side of the upright 15. The movements of the free end of the detent 72 are accommodated by the recess 73 in the upright. When the machine is in operation the pin 68 is received in the arcuate slot 74 in the upper end of the upright.

When the complete supply of untreated newsprint paper in the roll 30 is exhausted and the last end of it has passed by the heating plates 12 and 13 and been wound up on the roll of treated paper 48, the operator shuts down the motor, and then, before he leads the free end of a fresh roll of untreated paper over the roll 34 and under the rolls 35 and 36 to the core 37, he pulls outwardly on the arm 19 to bring the lower plate 13 to the position shown in Fig. 1, and at the same time raises the pin 68. The free end of the fresh roll may now be led down between the heating plates without touching either of them, and having been secured to a fresh core 37, the motor is started and simultaneously therewith the pin 68 is lowered into the slot 74 while the arm 19 is pushed toward the upright 15, with the result that the parts are in the position shown in Fig. 2, with one surface of the strip of paper fully engaging the arcuate upper heating plate 12 and the other surface of the strip of paper fully engaging the arcuate heating plate 13. The machine now continues to run until the roll of untreated paper passes as a strip past and is properly charred or brittlized for the intended purpose by the heating plates 12 and 13, and is wound into the roll 48 of treated paper ready for immediate use.

In aging artificially or brittlizing the newsprint paper to put it into such condition that when it is tightly coiled it can serve as a pencil sheath with cutting qualities comparable to those of the usual wood sheath, the degree of brittlizing depends on two factors, the degree of heat employed and the length of time the paper is exposed to the heat. Although the paper can be fed through the machine at controlled speeds, I have found it more satisfactory to feed the

paper between and in contact with the heating elements at a fixed rate of speed, say about twenty feet per minute and to vary the degree of heat to which the paper is subjected. This is done through the control 29 governed by the thermostat 23. By maintaining a constant rate of travel of twenty feet per minute, and with each heating element about twelve inches long, I have found that the paper is sufficiently artificially aged or brittlized for the intended purpose by heating the plates 12 and 13 to about 350° C. A substantially greater heat with the given rate of travel results in seriously affecting the tensile strength of the paper so that it cannot be properly wound around the stick of marking material without tearing. By substantially lowering the temperature of the heating elements the paper is not sufficiently charred or brittlized to result in easy and clean cutting by a knife blade or rotary cutter.

When the roll of untreated paper 30 is exhausted and has been built up on the core 37 as a roll of treated paper, it is then removed from the shaft 49 so that a fresh core 37 may take the place of the one on which the roll of treated paper has just been wound. The means for supporting the core 37 so that the roll of treated paper may be readily removed from the machine comprises a roller bearing 75 loosely supported in the upper end of the upright 50 and in which the reduced forward end of the shaft 49 is journaled. Each end of the core 37 is internally beveled, and on the rear end of the shaft 49 is fixed a disk 76 correspondingly beveled. On the forward end of the shaft 49 is a corresponding disk or washer 77 held against the forward end of the core 37 by means of a nut 78. The washer 77 shown in detail in Fig. 10 is provided with a slot 79. When it is time to remove the roll of treated paper 48 from the machine, the motor is stopped and the nut 78 is loosened so that the washer 77 can be slid forward and removed from the shaft 49. Then by simply lifting the forward end of the shaft 49, the rear end thereof pivoting by means of the disk 52 on the disks 53 and 54, the roll of treated paper may be slid axially off the shaft 49, as partially indicated in Fig. 9. Thereupon a fresh core 37 will be slipped over the shaft 49, the slotted washer 77 replaced, the ball bearing 75 dropped into its seat in the upper end of the standard 50 and the nut 78 tightened up against the forward end of the washer 77.

Upon completion of the treating of the roll of paper 30 the lower movable heating plate 13 is swung outwardly from the standard 15 and the pin 68 moved upwardly the parts now being in the condition shown in Fig. 1, so that when a fresh roll of paper 30 is placed on the standards 32 and the free end of the strip of paper passed over the idler pulley 34, then down to the roll 35 the paper will not contact with the hot plates 12 and 13. The free end of the new roll of paper having been passed under the roll 36 and fastened to the core 37 and the motor started, the pin 68 is pushed down into the slot 74 and the arm 19 moved toward the upright 15 so as to bring these parts into the relation with the strip of paper shown in Fig. 2, whereupon the process continues automatically until the whole of the new roll of untreated paper has been treated in the desired manner.

Vapor rising from the vicinity of the hot plates 12 and 13 is carried away through a hood 80 placed over the top of the upright 15.

When the newsprint paper is charred or brittled to the proper degree for use as pencil sheaths in coil form by means of hot air, I pass the strip of newsprint paper through either the heated chamber 82 shown in Fig. 11 or the chamber 84 shown in Fig. 12. The chambers 82 and 84 are the same in construction, except as to the heating elements, and the strip of newsprint paper is heat treated in both chambers in exactly the same way. Each chamber is a rectangular box-like structure of about three feet in length. The coil of untreated newsprint paper 85 is mounted on a shaft 86 corresponding to the shaft 31. The free end of the strip of paper passes over an idler 87 and enters the chamber through an opening 88 cut in its rear wall 89. The treated end 91 of the strip of paper as it leaves the chamber through the opening 90 passes under the idler roll 92 and under and over the roll 93, corresponding, respectively, to the rolls 35 and 36, and the free end of the strip of paper is wound up on the core 95. The winding of the treated paper on the core 95 is effected in the same manner in which the treated paper is wound on the core 37, the disks 96, 97 and 98 corresponding to and functioning like the disks 52, 53 and 54.

The part 100 of the strip of newsprint paper treated in the chamber 82 passes between two spaced-apart horizontally arranged, flat plate-like electrically heated elements, an upper heating element 101 and a lower heating element 102, somewhat wider than the strip of paper and almost as long as the chamber. The part 104 of the strip of paper treated in the chamber 84 passes between two banks of infra-red lamps, an upper bank indicated at 105 and a lower bank indicated at 106. The heat from the banks of lamps 105 and 106 is directed toward both sides of the strip of paper by the conventional reflectors 107. Gases are conducted from each chamber through an exhaust pipe 108.

Although newspaper has been successfully treated as to charring or brittling to render it when coiled tightly comparable in cutting qualities to the usual wood pencil sheath, by heating the air on both sides of the part of the strip in the chamber to only 200° C., that degree of heat would require the paper to remain in the chamber for about three minutes. So, in order to bring the heated-air treatment of the paper to an efficiency comparable with the heat treatment of the paper obtained in the machine illustrated in Figs. 1 to 10, I prefer to heat the air on both sides of the part of the strip of paper in the chamber to about 345° C. By subjecting the paper to heat of this degree, it requires only about .11 of a minute for the paper to pass by the heating elements 101 and 102 or 105 and 106 to be properly charred or brittled for use as pencil sheaths.

It will be understood that the figures given above as to the degree of heat to which fresh newsprint paper is subjected and the length of time the paper is under the heat treatment although substantially correct, being gathered from various readings of commercial instruments, they are empirical, and can be varied in considerable degree without departing from the spirit of the invention. The vital thing is that the fresh unprinted newsprint paper must be brittled to

such extent by artificial aging, that is, by subjecting the paper to the requisite degree of heat for the proper length of time, that when tightly coiled into a pencil sheath it can be cut by a sharp blade slantingly across the convolutions of the coil as readily and cleanly as can the usual "cedar" wood now employed for pencil sheaths. The artificial aging or brittling can be accomplished by subjecting the paper to relatively low degrees of heat for relatively long periods of time, or preferably to relatively high degrees of heat for relatively short periods of time. Both methods accomplish the same result and both are conceived to be included within the scope of the invention.

Having thus described the invention, what I claim as new is:

1. The method of heat treating newsprint paper to render it suitable for use as pencil sheaths in coil form which consists in exposing a strip of unaged unprinted newsprint paper to air heated to a degree ranging not less than about 200° C. and not greater than about 345° C. for a period of time ranging between not greater than about three minutes and not less than about .11 of a minute, the degree of heat to which the paper is exposed and the length of exposure being directly proportionate.

2. The method of heat treating newsprint paper to render it suitable for use as pencil sheaths, in coil form, which consists in subjecting a strip of unaged, unprinted newsprint paper to heat of from about 345° C. to about 350° C. for about .11 of a minute.

3. The method of preparing newsprint paper for use as pencil sheaths in coil form, which consists in subjecting a strip of unaged, unprinted newsprint paper to a degree of heat and for a length of time adequate to age or brittize the paper sufficiently so that when it is wound into a tight coil it can be cut by a knife blade or a rotary pencil sharpener substantially as readily and without leaving uncut fibers on the cut surface as can the usual wood pencil sheath, the degree of heat and length of time being substantially the equivalent of that obtained by causing each surface of the paper to pass at an approximate rate of speed of twenty feet per minute in contact with a smooth heating element heated to approximately 350° C. and approximately twelve inches long.

4. The method of heat treating newsprint paper to render it suitable for use as pencil sheaths in coil form, which consists in causing each surface of unaged unprinted newsprint paper to be subjected to substantially the amount of heat obtained by passing the paper at an approximate rate of speed of twenty feet per minute in contact with a smooth heating element heated to approximately 350° C. and approximately twelve inches long.

5. The method of heat treating newsprint paper to render it suitable for use as pencil sheaths in coil form, which consists in causing a sheet of unaged, unprinted newsprint paper to be subjected to substantially the amount of heat obtained by passing the paper at an approximate rate of speed of twenty feet per minute in contact with approximately two feet in length of heating element heated to approximately 350° C.

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