

(No Model.)

4 Sheets—Sheet 2.

H. C. SPAULDING.
MATCH MAKING MACHINE.

No. 536,402.

Patented Mar. 26, 1895.

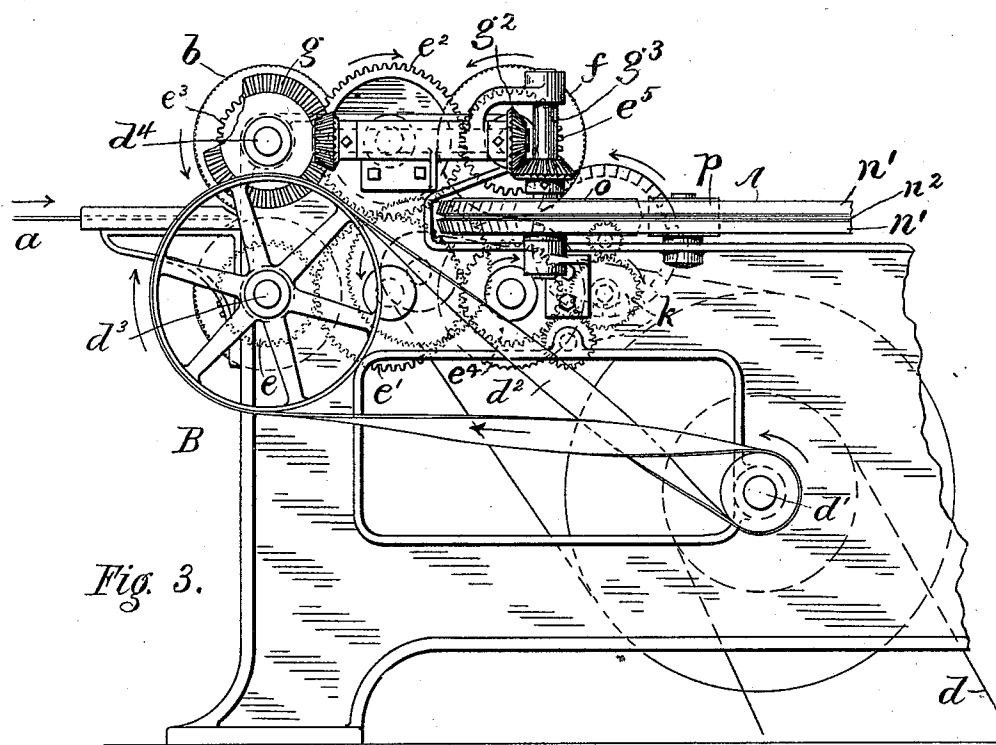


Fig. 3.

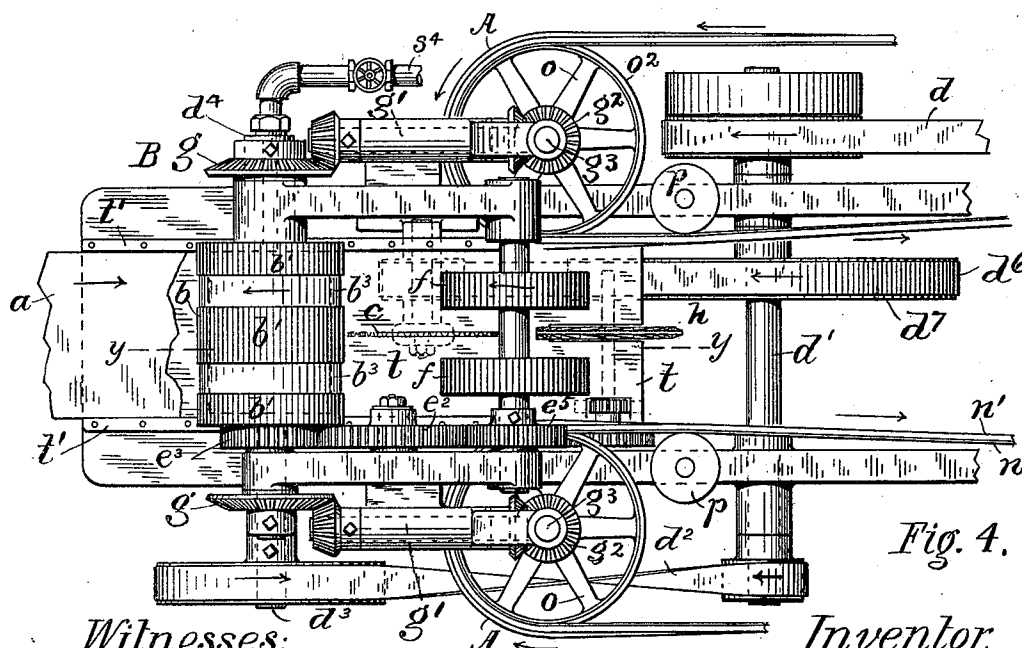


Fig. 4.

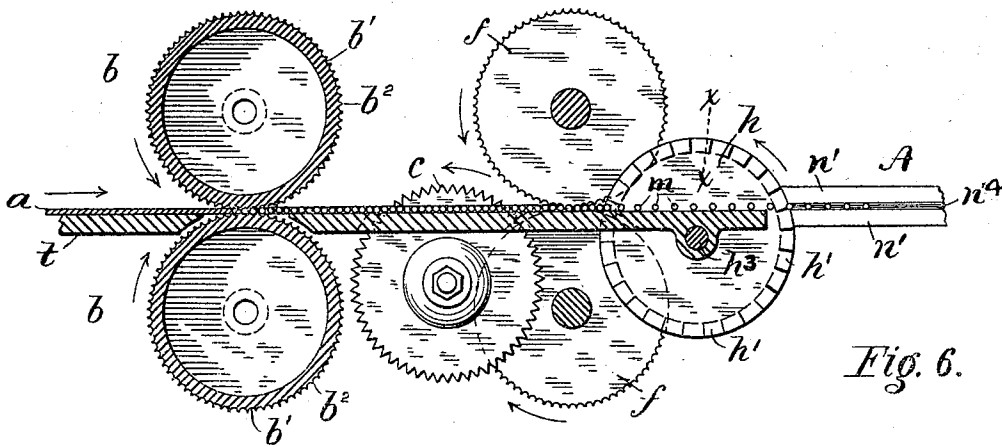
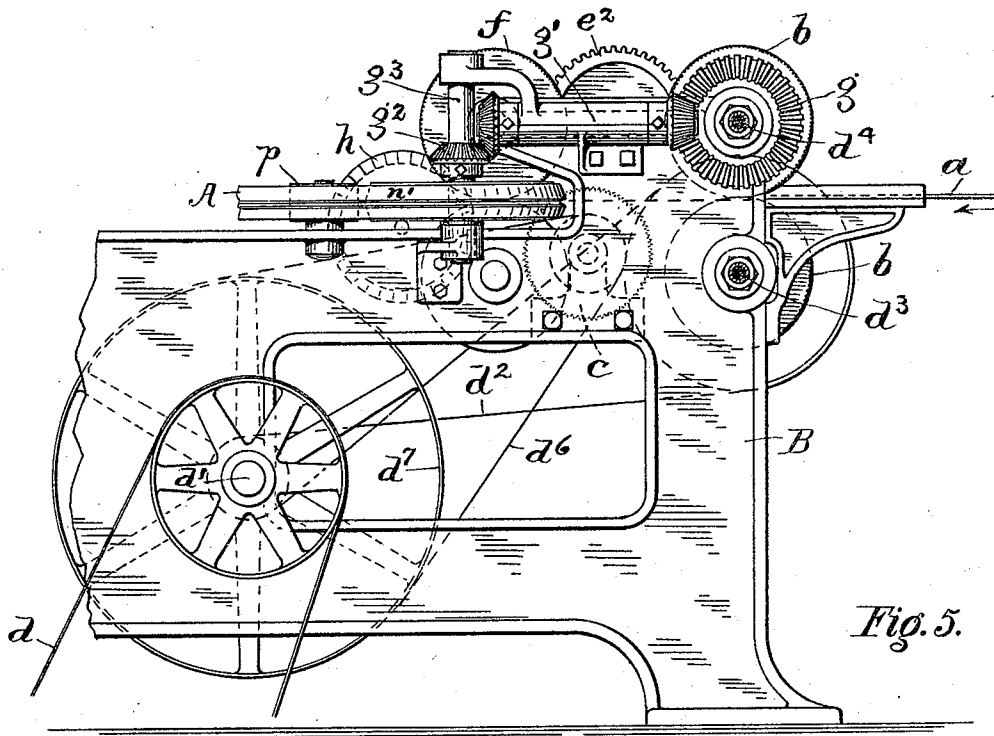
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Attys.

4 Sheets—Sheet 3.

Patented Mar. 26, 1895.



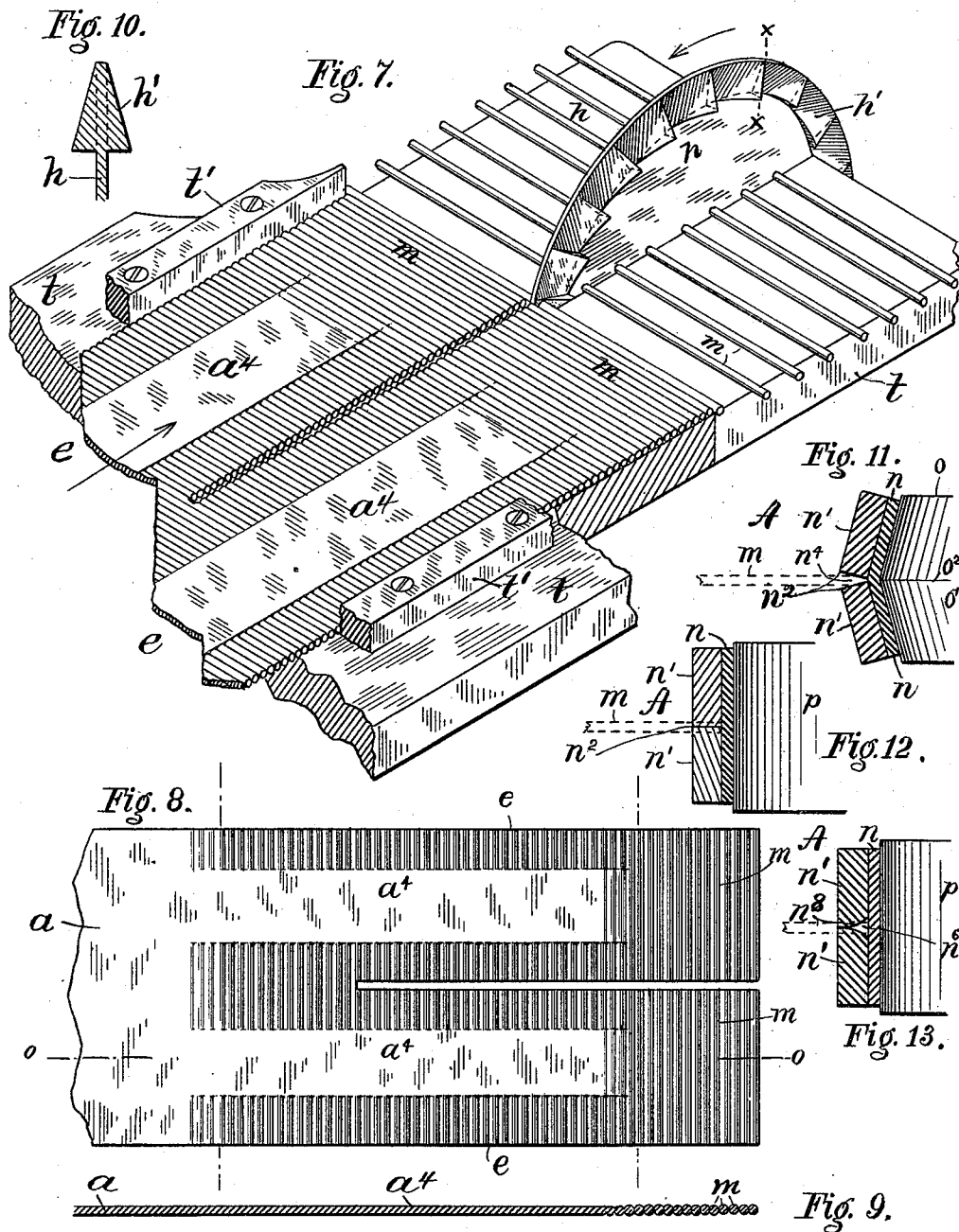
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Fig. 14.

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UNITED STATES PATENT OFFICE.

HOLLON C. SPAULDING, OF EXETER, NEW HAMPSHIRE, ASSIGNOR OF ONE-HALF TO FRANK W. HALE, OF BOSTON, MASSACHUSETTS.

MATCH-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 536,402, dated March 26, 1895.

Application filed August 15, 1892. Serial No. 443,098. (No model.)

To all whom it may concern:

Be it known that I, HOLLON C. SPAULDING, a citizen of the United States, residing at Exeter, in the county of Rockingham, and State of New Hampshire, have invented certain new and useful Improvements in Match-Making Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The invention forming the subject of my present application for United States Letters Patent relates to certain improvements in the art of manufacturing matches and in the mechanism therefor.

My invention pertains more especially to that class in which the match-splints or sticks are made from a continuous veneer or ribbon having a width equal to the length of two matches.

By means of my improvement the veneer while passing through the match-making machine is divided longitudinally, being transversely of the grain or fibers, each part being next separated into splints which are automatically fed singly to an endless carrier or conveyer. The splints are then subjected to the dipping and drying operations, while still mounted in the conveyer, after which they are automatically released therefrom and suitably packed.

The object I have in view is to produce a superior match at a minimum cost for labor or attendance and materials.

To that end my invention consists essentially in the combination of corrugated rolls arranged to form and detach splints transversely from a continuous strip or veneer; means for dividing the veneer longitudinally; a continuous flexible conveyer for holding and carrying the splints during the processes of dipping and drying, and mechanisms for automatically inserting or feeding the splints endwise into said conveyer and discharging them therefrom, all as will be more fully hereinafter set forth and claimed.

In the accompanying four sheets of draw-

ings, illustrating my invention, Figure 1, Sheet 1, is a side elevation, in partial longitudinal section, of a machine arranged to produce matches from a continuous veneer of wood, or other suitable fibrous material. Fig. 2 is a plan view. Fig. 3, Sheet 2, is a side elevation, in enlarged scale, of the head portion of the machine. Fig. 4 is a plan view of the same. Fig. 5, Sheet 3, is a side elevation, viewed from the opposite side of the machine, as compared with Fig. 3. Fig. 6 is an enlarged longitudinal sectional view, taken on line *yy* of Fig. 4. Fig. 7, Sheet 4, is a perspective view, showing the action of these separator or feed-wheel upon the traveling splints. Fig. 8 is a plan view of a piece of the veneer detached, showing the action of forming-rolls and saw. Fig. 9 is a longitudinal sectional view, taken on line *oo* of Fig. 8. Fig. 10 is a sectional view, taken on line *xx* of Figs. 6 and 7. Fig. 11 is an enlarged transverse sectional view of the carrier, mounted on the initial carrier pulley. Fig. 12 is a similar view, showing the carrier mounted on the guide pulley. Fig. 13 is the same, except that the gripping edges of the carrier are slightly modified, and Fig. 14 represents a finished match, as produced on my improved machine.

The driving mechanism is mounted in the head portion B of the machine. See Figs. 3, 4 and 5. As drawn a traveling main belt *d* rotates the shaft *d'*, which in turn through the medium of a belt *d²* drives the lower forming roll shaft *d³*. Secured to this last named shaft is a gear *e* meshing into an intermediate gear *e'*, the latter working in a similar gear *e²* which drives the upper forming roll *b* through the gear *e³*. These same intermediate gears *e'*, *e²*, also intergear with gears *e⁴*, *e⁵*, secured respectively to the lower and upper shafts carrying the forward forming rolls *f f*. By this arrangement of gearing the rolls *b* and *f* are simultaneously revolved in the proper direction to feed the veneer *a* at a uniform rate of speed, the said gears *e*, *e³*, *e⁴* and *e⁵* being alike.

As drawn the driving mechanism just described is employed to operate the endless flexible conveyers A, A, arranged to receive the splints as fast as formed and also carry them while mounted therein through the dip-

ping and drying devices. To each end of the upper roll shaft d^4 (Figs. 3 and 4) is secured a bevel gear g , which meshes into a smaller gear secured to a short horizontally mounted shaft g' and these in turn through the medium of a pair of bevel gears g^2 revolve the two vertical shafts g^3 . These shafts are suitably mounted in the frame work of the machine and carry each an initial conveyer-wheel or pulley o whereby the latter revolves in a horizontal plane; the relation of wheels o to the said forward forming-rolls f being clearly represented in Figs. 3 and 4. The faces o' of these wheels o are made slightly V-shape or beveled, see Fig. 11, thereby causing the traveling conveyers, which are divided longitudinally as hereinafter described, to automatically open and receive the adjacent ends of the splints.

The head portion of the machine is provided with a stationary bed or table t arranged to support the veneer-ribbons, &c., and is located between the upper and lower series of forming rolls. Side guides t' secured to the table serve to keep the veneer and severed splints m in position until the latter are fed into the separator h to be diverted by it, right and left, into the two conveyers. Extending upwardly through the table is a veneer dividing saw c . This latter as drawn is driven by a belt d^6 leading from a pulley d^7 secured to the shaft d^1 .

The separator h is secured to a shaft h^3 mounted to revolve in bearings located below the table t . Rotary motion is imparted to the separator by means of a gear-train k , operated by the gear e^4 , shown by dotted lines in Fig. 3.

Although the means or mechanisms represented for driving the several parts which operate upon the veneer and splints have been thus specifically described, yet it is apparent that other equivalent means may be employed without departing from the spirit of the invention.

In further carrying out my invention I employ fibrous stock having the form of a suitably prepared continuous veneer or ribbon a . Practically the stock thus used is some of the lighter kinds of wood, as pine, so cut that the "grain" or fiber lies transversely of the veneer; the width of the latter being equal to or slightly exceeding the length of two matches. The sticks or splints successively formed and detached from the forward end of the veneer are when finished termed "parlor" matches, as distinguished from bunched or carded matches. The veneer may be first moistened or steamed and wound into a roll and mounted at one end of the machine, as indicated in Fig. 1. The free end of the veneer is introduced between a pair of driven combined feeding and forming rolls b , having their faces provided longitudinally with a series of grooves or corrugations b' ; the same extending around the circumference of the rolls. The rolls are alike in size and are so adjusted

that the grooves in one are opposed by those of the other roll; the space thus formed being the counterpart of the match-splint transversely. The grooves are separated each by a sharpened longitudinal rib b^2 which forms a cutting edge. It will be seen that as drawn the veneer in width is equal to the length of two matches; and is divided longitudinally into two ribbons ee by a continuously revolving saw c after the said rolls have completed their work upon the veneer. In order to prevent a complete separation of the splints before the veneer is divided I provide portions of the surface of the rolls b with ribs b^3 having less height than the ribs b^2 , or if desired the grooves may be omitted entirely. See Fig. 4. These substantially plain portions leave an ungrooved surface a^1 (Fig. 8) upon each side of the veneer, corresponding to the center portion of the splint longitudinally and as clearly shown along the two ribbons e . The several rolls, especially the main rolls b , are kept hot if necessary, thereby evaporating the moisture from the veneer and rendering the splints more easily acted upon by the subsequent processes. The rolls may be hollow to receive steam or they may be heated by burning gas jets. As drawn the journals or axes of the rolls are hollow and connected with a suitable steam supply s^4 , Fig. 4. The splints are completed and separated from the said ribbons by means of the two pairs of narrow corrugated rolls f . These rolls are also positively driven and have a surface speed equal to that of the main rolls b . The rolls f act upon the ungrooved surfaces of the ribbons thereby shaping said portions to correspond with and form a continuation of the grooved part produced by the main rolls. I prefer to separate the two series of forming-rolls b, f , in order to locate the splitting or dividing saw c between them, as indicated in Figs. 4 and 6.

Up to this point it is clear that the machine operates to divide the veneer longitudinally and separate each of the two resulting ribbons into suitably shaped match splints m . Now, in order to prepare and tip the igniting end of the splints it is necessary to employ a conveyer which receives and holds them during the processes last referred to. In order to accomplish this result I have devised a novel mechanism for automatically placing the splints singly from both ribbons at intervals into the continuously traveling conveyers. The means employed consists essentially of a continuously revolving wheel h , which I term a separator or feed-wheel, located just forward of and between said series of rolls f , as clearly represented in Figs. 4 and 6. The peripheral edges and ends of this wheel are provided each with a series of ratchet or wedge-shaped lugs h' which extend toward the center or shaft h^3 on which the wheel is secured. The feed-wheel revolves in the saw-scarf produced by the saw c , its rate of movement and relation to the rolls f

being such that as each splint is detached from its neighbor its inner end is smartly struck by the adjacent wedge-face, thereby forcing the splint endwise into the carrier A.

5 By reason of the two series of wedge faces h' the splints as detached from both ribbons are forced into both carriers simultaneously. The speed of the feed-wheel is such that the time occupied in passing from one lug h' or
10 ratchet to the next is substantially equal to that of the rolls in feeding the ribbons, from splint to splint.

The carriers A are so mounted and operated that they travel at a rate of speed slightly in
15 excess of the ribbons so that as the detached splints are fed into them, by the action of the feed-wheel h , they are automatically spaced a short distance apart, to prevent them from sticking together when the free ends are
20 passed through the dipping pans.

The carriers A may be constructed in various ways, though I deem the one represented in Figs. 11 and 12 to be preferred. In this case it consists of an endless belt n of rubber, leather, canvas or other suitably flexible substance to which are secured, longitudinally, upper and lower strips n' , or sections, of elastic material, as rubber, in such a way that the inside or adjacent edges n^2 are normally
30 in contact and capable of gripping the splints and supporting them with the necessary rigidity while they are being subjected to the dipping process. In mounting the carriers I prefer to locate the initial carrier-pulleys o so
35 that they will revolve in a horizontal plane, the axes of rotation being substantially in line with or a little to the rear of the axes of the upper and lower shafts carrying the rolls f and at right angles therewith, as clearly
40 shown in Figs. 3 and 4. The face o' of the pulleys o may be angular or slightly V-shaped, the transverse axis or apex o^3 thus formed being substantially in line with and contiguous to the longitudinal axes of the passing splints.
45 From this it is obvious that the belt n in its passage around the carrier or guide pulley o conforms to the shape of it transversely, thereby causing the adjacent edges of the strips n' to separate along the joint n^2 , as at
50 n^4 Fig. 11, to freely receive the outer ends of the splints as they are successively fed into it by the action of the feed-wheel h . The carrier-belt is gradually transformed from the V-form to a flat or normal shape immediately
55 after the introduction of a splint, said transformation being effected by bringing the belt in contact with a small flat-faced guide-pulley p mounted just forward of the main guide-pulley. See Fig. 4. By means of this arrange-
60 ment it is obvious that the pulley p operates to close the carrier-joint upon the splints immediately after the latter are placed in position therein. Fig. 12 shows a cross-sectional view of this pulley and the carrier; the latter having a match-splint mounted therein.
65 The meeting or adjacent edges of the carrier strips n' may be at right angles with the belt,

as in Fig. 12, or the strip may be undercut or beveled, as at n^5 Fig. 13, thus forming a space n^6 next to the belt. In this case the gripping
70 surface will be at the outer portion only. When thus constructed the matches are more readily released during the passage of the carrier over the discharge pulley, or even the main carrier pulley—that is to say the action
75 of the latter upon the carrier may serve the double purpose of receiving the splints and discharging them from the carrier after they have passed through the dipping and drying
80 processes.

In machines of this class it is a common practice to mechanically pass the outer or free ends of the splints through suitably arranged dipping pans for the purpose of tipping them with sulphur, phosphorus or other
85 suitable materials or compositions such as are employed on the heads or igniting ends of friction matches. I make no specific claim in the present application for patent for means for effecting such tipping of the splints. In
90 the drawings, Figs. 1 and 2, forming a part of this specification I have, however, shown an arrangement of devices whereby the splints are tipped with igniting materials and dried before they are discharged from the
95 conveyers. As drawn the two endless conveyers A, A, are conducted to the rear end of the machine where they are mounted on a series of guide pulleys u so arranged that the conveyers travel back and forth a number of
100 times over a heating coil E. Located intermediate of the said carrier wheels o and pulleys u are placed suitable furnaces C, D, provided at the top with open pans or receptacles containing suitable materials or com-
105 positions into which the traveling splints are dipped. One of the pans say holds sulphur r kept at a suitable fluid state by means of the heated furnace, or a steam heated coil may be used for the purpose. It will be seen
110 that the conveyor passes around a series of guide-wheels y so constructed and arranged with relation to the wheels o that it is gradually turned or deflected from a vertical plane to travel in a horizontal plane, thus causing the
115 splints to point downwardly. While traveling in this position the free ends of the splints are passed through the liquid sulphur after which they are subjected to a similar operation which causes the phosphorus r' contained
120 in the pan of the furnace D to adhere to the sulphurized portion of the splints. The furnaces C, D may be separated from each other to facilitate the drying of the splints or if desired pans containing other suitable igniting
125 substances may be substituted for the ones shown, or they may be used in addition thereto. Upon leaving the last pan the splints are kept moving back and forth a number of times over the heated coil E thereby
130 thoroughly drying them by reason of their contact with the hot air rising from the coil after which they are discharged from the conveyers into receptacles s . The splints now

have been converted into matches *w* (Fig. 14) and provided with the usual igniting tip or end *w'*. The matches may be taken from the boxes *s* and packed in any well known manner, preparatory to being sold and used.

I do not limit my invention to its combination with dipping and drying devices such as just described, as the splints may be readily subjected to dipping operations arranged in a different manner and order. Neither do I limit myself to the production of any particular kind of friction match.

I claim as new and desire to secure by United States Letters Patent—

1. The improvement in the art of converting a continuous strip of veneer of fibrous material into match-splints, which consists in indenting or corrugating the veneer transversely along its central portion and outer edges, dividing the veneer through such central portion to form two narrower strips having corrugated edges, corrugating the plain portions of the two strips and then detaching or segregating the thus formed splints from the parent strips, substantially as hereinbefore described.

2. The improvement in the art of converting a continuous strip of veneer into match-splints, which consists in indenting or corrugating the veneer transversely along its central portion and outer edges, dividing the veneer through such central portion to form two narrower strips having corrugated edges, corrugating the plain portions of the two strips, then detaching or segregating the thus formed splints from the parent strips, and then subjecting the tips of the splints to the usual treating operations and drying them, substantially as hereinbefore described.

3. In a machine for automatically making matches from a continuously introduced strip or veneer of wood, a pair of initial semi-formative rolls between which the strip passes for simultaneously indenting or corrugating both sides of it transversely along its central and outer edge portions and means for revolving said rolls, substantially as hereinbefore described.

4. In a machine for making matches from a continuous strip or veneer of wood, the combination of a pair of initial rolls for partly forming the splints, means for dividing the thus acted upon veneer into two continuous narrower strips, a pair of rolls for completely shaping the splints and detaching them from the ends of both the said strips, endless flexible conveyers for receiving, holding and carrying the splints, means for treating or dipping and drying them during the passage of the conveyers, and mechanisms for introducing the splints into the conveyers and releasing them therefrom, substantially as described.

5. In a machine for making matches from a continuous strip or veneer *a* of wood, the combination of a pair of semi-formative corrugated rolls, as *b*, for feeding the veneer and partially shaping the splints, a saw for divid-

ing the veneer and partially shaped splints into two narrower strips *e e*, and a pair of driven corrugated rolls, as *f*, for completely shaping and detaching the splints from the strips *e*, substantially as described.

6. In a machine for making matches from a continuous strip or veneer *a* of wood, the combination of a pair of semi-formative corrugated rolls, as *b*, for feeding the veneer and partially shaping the splints, a saw for dividing the veneer and partially shaped splints into two narrower strips *e e*, a pair of driven corrugated rolls, as *f*, for completely shaping and detaching the splints from the strips *e*, a pair of endless flexible conveyers traveling at a greater rate of speed than the veneer, and a continuously rotating combined feed-wheel and separator, as *h*, for inserting the outer ends of both series of splints into said conveyers, substantially as described.

7. In a machine for automatically making matches from a continuous strip or veneer of wood, a pair of initial or semi-formative corrugated feed rolls between which the veneer is first introduced, a pair of corrugated shaping rolls for receiving the thus acted upon strip to complete the formation of the splints and means for revolving the several rolls, in combination with a saw located between the said two pairs of rolls for dividing the veneer into two narrower strips or ribbons before they pass to said shaping rolls, and mechanism for rotating the saw.

8. In a machine for making matches from continuous strips or ribbons of fibrous material, an endless flexible conveyer provided with a longitudinal opening or slit having yielding sides adapted to receive the splints intermittently and hold them during the treating or dipping and drying processes, and a series of traveling ratchets or wedge faces arranged to engage the inner or free ends of the splints and force them endwise into said opening of the conveyer, substantially as described.

9. In a machine for making matches from continuous strips of fibrous material, the combination of mechanisms for feeding, dividing, forming and detaching the splints singly from the free end of the strip or stock transversely, endless flexible conveyers for carrying the splints, a combined feed-wheel and separator, as *h*, for inserting the splints into the conveyers, suitably mounted and arranged receptacles for holding the treating substances into which the free ends of the splints are dipped during the passage of said conveyers, and means for facilitating the drying of the splints.

10. In a match-making machine, the combination with forming rolls arranged to shape and detach splints from a longitudinally divided continuous veneer of fibrous material and a saw for effecting such division, of suitably mounted oppositely located endless flexible conveyers arranged to receive and carry the splints and a rotating feed-wheel located between the two ribbons provided on each end

face with a series of inclines or wedge-faces into which the splints are fed as detached and from which they are forced endwise into the respective conveyers by contact with the said wedge-faces, substantially as described.

11. In a machine for making matches from a continuous veneer, rolls for partly shaping the splints, means for longitudinally dividing the thus acted upon veneer and rolls for completely forming and detaching the splints, substantially as described.

12. In a machine for making matches from a continuous veneer, rolls for partly shaping the splints, means for longitudinally dividing the thus acted upon veneer, rolls for completely forming and detaching the splints, conveyers for receiving the splints and means for feeding the splints into said conveyers, substantially as described.

13. In a machine for making matches from a continuous veneer, the combination with mechanisms for feeding and dividing the veneer and forming it into splints and traveling flexible conveyers adapted to receive the thus formed splints, of a rotating separator or feed-

wheel, as *h*, provided circumferentially with a series of lateral projections arranged to force the splints endwise singly into said conveyers and means for feeding the splints to the separator, substantially as described.

14. In a machine for automatically making matches, the combination of an endless conveyer consisting of a flexible belt or base portion and upper and lower strips or sections of yielding material secured thereto to form a substantially continuous longitudinal slit or seam adapted to receive and hold the match-splints, suitably mounted carriers and guide-wheels for propelling the conveyer having the peripheries thereof arranged to open and close the seam of the conveyer, and mechanisms for feeding the splints singly to the conveyer and detaching them therefrom substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

HOLLON C. SPAULDING.

Witnesses:

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IDA M. WARREN.