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A. & E. B. BEECHER.

MAKING MATCHES.

No. 37,562. Patented Feb. 3, 1863.

Fig 1

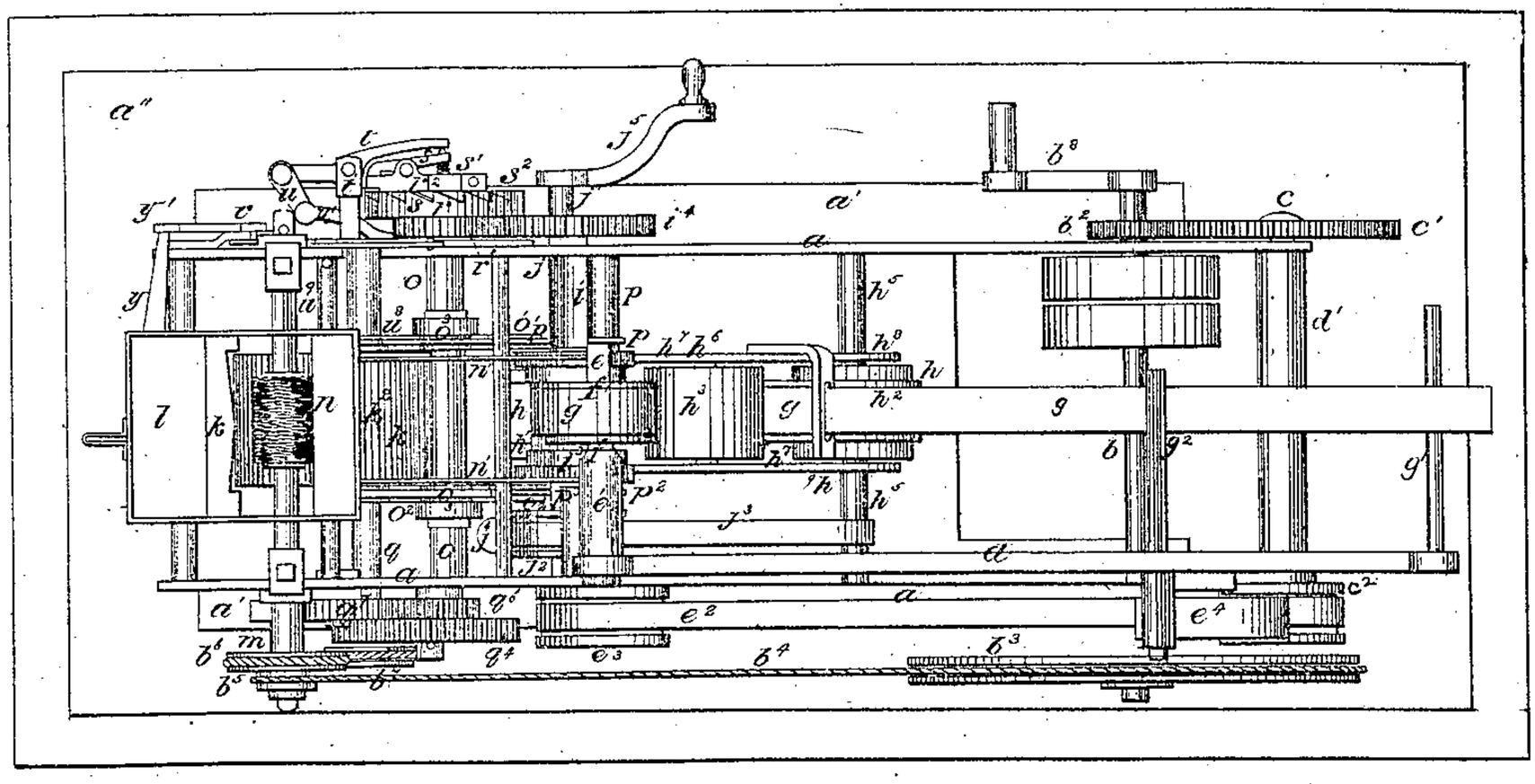

Fig 5

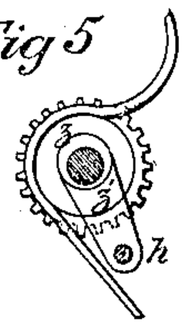

Fig 2

Witnesses:

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A. & E. B. BEECHER.

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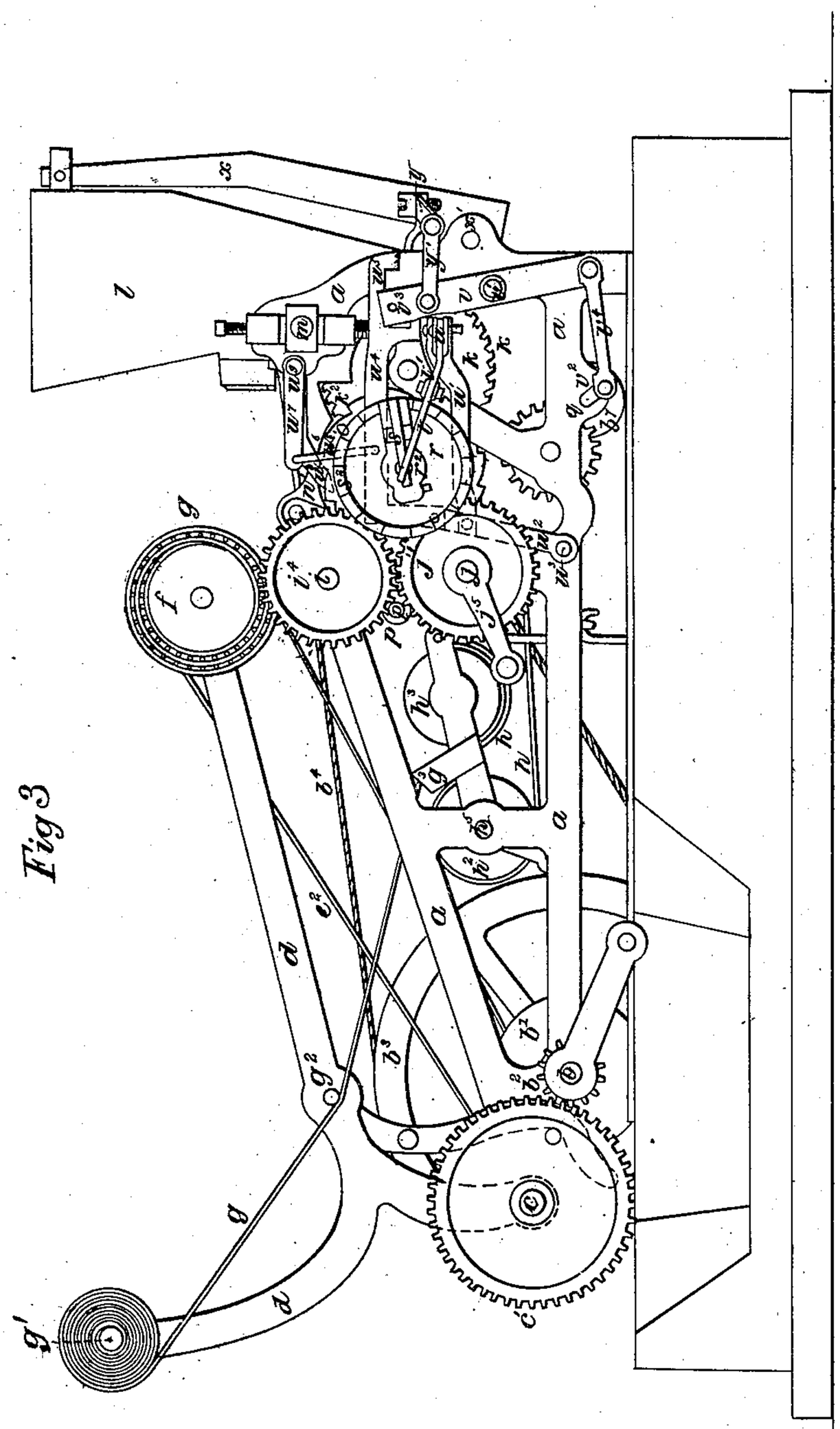

Fig 3

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MAKING MATCHES.

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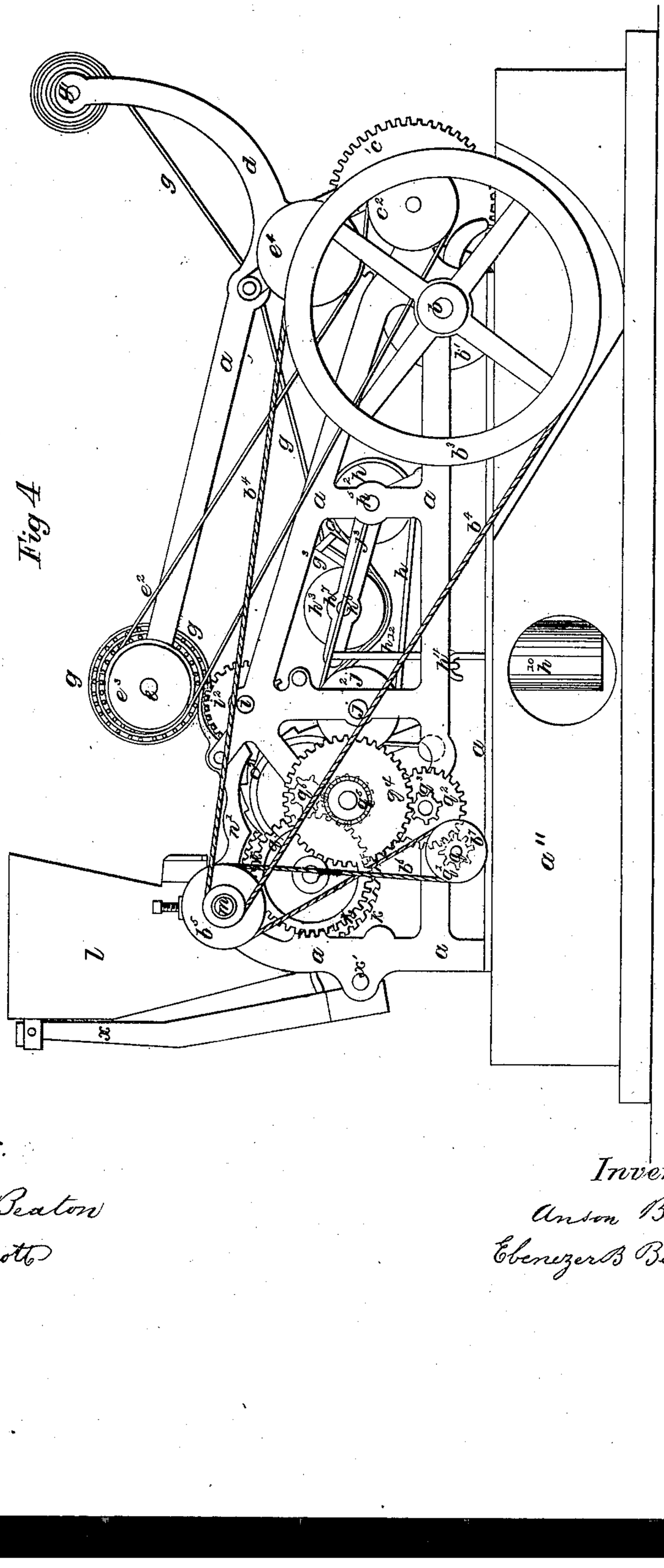

Fig 4

Witnesses.

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Henry B Scott

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UNITED STATES PATENT OFFICE.

ANSON BEECHER AND EBENEZER B. BEECHER, OF NEW HAVEN, CONN.

IMPROVED MACHINE FOR FRAMING LUCIFER-MATCH SPLINTS FOR DIPPING.

Specification forming part of Letters Patent No. **37,562**, dated February 3, 1863.

To all whom it may concern:

Be it known that we, ANSON BEECHER and EBENEZER B. BEECHER, of New Haven, New Haven county, in the State of Connecticut, have invented a new and useful Machine for Framing Lucifer-Match Splints for Dipping; and we do hereby declare that the following is a full and correct description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

Prior to our said invention matches have been dipped in two ways—viz., the bundle dip and the frame or clamp dip. In the former case the dipper takes a bundle of splints, tied round with string, and, grasping it with both hands, causes the ends of the splints, by a skillful movement, to expand into so wide a circle that they become detached, and upon being dipped each will receive its own separate portion of the composition. In frame or clamp dipping, as practiced before our invention, the splints are placed by hand or by machinery between the members of a series of clamps, arranged in a frame, the grasping-surfaces of the clamps being grooved at suitable intervals to separate the splints properly, or the splints are set by hand or by machinery in a series of parallel holes through a board of suitable size for a dipping-frame. Endless bands have been used to connect and carry a series of clamps fastened thereto instead of being secured to a frame, as above mentioned.

One of the principal features of our invention consists in a new mode of framing match-splints for dipping. For this purpose we use as a binder a long flexible tape or band of cotton webbing, or other suitable material, about the thickness of the splint, but considerably narrower than its length, in combination with a cylinder or drum shorter than the splint, and adapted to a rotating mandrel or axis, so as to be rotated thereby and readily removed therefrom when the frame is completed. The cylinder or drum is used as a center or form for the frame of match-splints, which is made by setting the splints at proper intervals between the coils of the flexible binder-band as it is being continuously wound upon the drum by the rotation thereof until a frame of desired size and quantity for dipping is completed, when the end of the binding-tape is secured to the preceding coil by a pin or is fastened to the frame in any secure manner, and the drum and the frame of match-splints thus bound upon it are ready to be removed from the mandrel for dipping, the splints being disposed around the drum in a continuous spiral between the coils of the binder parallel with each other and with the axis of the drum, the splints being separated from each other by the thickness of the flexible binder, and by setting them the thickness of a splint apart in the coils each receives its proper proportion of composition when dipped, and can conveniently be dried in the frame. This frame may be used for splints of the length or of double the length of the matches by setting the splints close together in the coil, but lapping them so that the ends project alternately from each end of the frame; but we prefer setting the splints at a suitable distance apart—about the thickness of a splint apart—as it gives the flexible binder a better grasp of the splints in the successive spiral layers to hold them while being set and for dipping. We also prefer to use splints of double the length of the matches, both for economy in making the splint and the saving of time in feeding and setting them in the frames. The two-length splint is dipped at both ends while in the frame, and after being dried is cut in two in the middle.

Our said invention further consists in mechanism for receiving the splints from a hopper or other suitable presenting device and setting them at regular distances apart between the coils of the flexible binder, and also of mechanism for controlling and guiding the flexible binding-tape while it is being wound around the splints upon the drum, so as to hold them tight within its coils until the whole frame is completed.

But to more particularly describe our invention, we will refer to the accompanying drawings, of which—

Figure 1 is a plan view of machine; Fig. 2, a longitudinal section; Figs. 3 and 4 opposite side elevations; Fig. 5, a detached view of modification of arrangement of guide roller for tape.

Letter *a* represents the frame of the machine; *a'*, a bed-plate, to which the legs of the frame are fastened; *a''*, a base on which the machine stands. On the main driving-shaft

b are tight and loose driving-pulleys b' b', and a cog-wheel, b^2, by which it is geared to a counter-shaft, c, by the cog-wheel c' on said counter-shaft. This counter-shaft, between its bearings, is surrounded by a sleeve, d', attached to the vibratable frame d, which swings thereon as its axis irrespective of the rotation of the shaft. The splint-frame mandrel e rotates in a long pipe-bearing, e', attached to the end of the frame d, that hangs over the mechanism, for setting the splints. Upon this mandrel is placed the drum or cylinder f, upon which the splints are framed, it being slipped on the mandrel at the end thereof, and held so as to rotate with it and be readily removed by friction or by a spline or by making the drum-hole and mandrel square, or in any other suitable manner.

In order to compensate for the increasing size of the frame, and to maintain a constant tension on the binding-tape, which is held in the grasp of a feeding mechanism, by which it is regularly paid out to the frame-drum, the frame-drum mandrel is driven by a rapidly-revolving friction-surface or slip-band, e^2, driven by the pulley c^2 on the counter-shaft c, the band running and slipping on the mandrel-pulley e^3, its tension being regulated by the adjustable tightening-pulley e^4. We have found this slip-band sufficient for the purpose, but any adjustable friction-connection between the frame drum and its motive power will answer. The frame-drum should be about three inches in diameter, and for two-length splints about three inches wide. The binding-tape g—which we prefer of cotton webbing about the thickness of the splints and about two and a half inches wide, such as used for driving-reins—is attached at one end to the frame-drum by winding a coil around the same or in any suitable manner. The other end of the tape is placed in a coil upon the horizontal pin g' on the vibratable frame d, from which as it uncoils it passes down under the guide-pin g^2 and through the slotted guide g^3 into the grasp of a holding and feeding mechanism consisting of an endless-band, h, which is mounted on drums h' h^2, and a weighted pressure-roller, h^3, which serves to tighten the endless band, and at the same time to grasp the binding-tape for the purpose of holding and feeding the same between its periphery and the top surface of the endless band. The binding-tape passes from the holding and feeding mechanism upward to and partially around a guide-roller, g^4, and from thence onto the frame-drum, which, with its accumulating coil of splints, rests on the guide roller g^4. The guide-roller turns loose on the shaft i between the two notched setting-wheels i^2 i^3, which are fast to said shaft i, and constructed and arranged, as shown in the drawings, with opposite-matched notches, the thickness of a splint apart, to take the splints one by one from the count-wheels at a point above the binding-tape as it passes over the guide-rollers g^4, and, as they revolve, carry in the splints regularly between the binding-tape, going onto the frame and the preceding coil, the splints being lifted out of the notches of the setting-wheels by the binding-tape as it passes onto the frame. The splint-setting wheels are rotated by a cog-wheel, i^4, on the end of the shaft i, which gears into and is driven by a cog-wheel, j', on the shaft j, which actuates the holding and feeding mechanism of the binder-tape, so that the setting-wheels and feed mechanism move together simultaneously. The driving-drum h', which moves the endless belt h, is fast to the shaft j, and the loose drum h^2 runs on a bearing in the middle of the tie rod h^5, which is fast at both ends to the sides of the machine-frame. The pressure-roller h^3 runs loose on a fixed bearing or axis, h^6, fast to the swinging frame h^7, which swings on bearings h^8 h^9 on the rods h^5, at each side of the loose drum h^2, and is connected with a heavy weight, h^{10}, by links h^{11} h^{12}.

To prevent the feeding and setting mechanism, when disconnected from the other part of the machine whereby it is driven, from being moved by the pull of the binder-tape, sufficient friction is applied to the surface of a pulley, j^2, fast to the shaft j, by means of a strap, j^3, fastened at one end to the tie-rod h^5, and passing partly around the pulley j^2, is held against the surface thereof by a weight, j^4, attached to the pendent end of the strap. The inertia and friction of the feeding and setting mechanism will of itself oppose the pull of the friction-driver of the frame-drum on the flexible binding-tape, and therefore such additional friction as is necessary to apply by the strap to overcome the friction driver of the drum-mandrel does not materially interfere with moving the feeding and setting mechanism when thrown in gear by the clutch with the count-wheels and receiving-cylinder. For this purpose of holding the binder-tape in a stationary position by the feeding mechanism when the same is not moved regularly for the purpose of paying out the binding-tape, we prefer the friction-drag, as above described, to a positive locking device, acting in conjunction with the self-acting clutch, by which the feeding and setting mechanism is connected with and receives motion from the count-wheel shaft, because it permits the movement of the feeding and setting mechanism, by hand, for the purpose of adjustment, when necessary, by means of the crank j^5 on the shaft j; but it is evident that any device which will keep the feeding and setting mechanism stationary when disconnected with its motive power will enable it to perform the function of overcoming the pull of the friction-driver of the frame-drum on the flexible binder, and therefore not only to keep up a proper tension on the flexible binder to hold the frame of splints together, but also, by maintaining it in a stationary position, will preserve the regular distance between the splints in the coils of the

frame, which would not be the case were the frame suffered to continue to turn unsupplied with splints or at the rate it would be moved by the pull of the frame-drum mandrel on the binding-tape.

Having described the mechanism for framing and setting the splints, we will now proceed to describe the mechanism by which the splints are taken into the machine and placed in the setting-wheels. It consists of a receiving-cylinder, grooved regularly across the face with inclined or hooked grooves, each of suitable size to pick up splints presented by a hopper or other suitable presenting device, and carry them forward as the cylinder rotates, and a pair of inclined tooth-wheels, which lap over the ends of the receiving-cylinder, and by means of their opposite inclined teeth lift the match-splints, one at a time, by their projecting ends out of the grooves of the receiving-cylinder and carry them forward to and place them in the notches of the setting-wheels. We call these wheels "count-wheels," because there is mechanism connected with them, hereinafter described, whereby the setting and framing mechanism is stopped when the count wheels do not present splints at the proper time to the setting-wheels, (by reason of the failure of some one or more of the grooves of the receiving-cylinder to pick up spints,) and set in action again by the next splint brought to the setting-wheels. A rotating wire-brush—a cylinder covered with card-teeth inclined backward—is placed over the receiving cylinder, as close to it as possible, and rapidly rotated in the direction of the arrow, for the purpose of sweeping match-splints from the surface of the cylinder that are not taken into the grooves of the same. There are also curved guides placed over the receiving-cylinder and count-wheels and running up in front of the setting-wheels, for the purpose or keeping the splints in the grooves and notches of these devices.

Letter k is the receiving-cylinder, mounted on the shaft k'; k^2, the grooves for the splints. The hopper l, which is of suitable width for the splints, is wider than the receiving-wheel, the excess of width being equally apportioned at both ends of the receiving-cylinder, so that the splints, when taken into the grooves of the receiving-cylinder, project equally from both ends of the same, in order that the count-wheels may-lift them by their projecting ends and transfer them to the setting-wheels.

The wire brush is marked n; the guides $n\,n'$.

Letters o' o^2 represent the count-wheels, which are mounted on a shaft, o, and overlap the ends of the receiving-cylinder, as shown. The face of each wheel has a groove, o^3, cut in it around its entire circumference, and is also divided into opposite-matched inclined teeth, arranged as shown with reference to the grooves of the receiving-wheel so as to lift the splints, one at a time, from the grooves of the receiving-cylinder by the projecting ends of the splints as the inclined teeth sweep by the ends of the grooves, the speed of counting-wheels being duly proportioned to that of the receiving-cylinder, so that each groove of the latter, as it comes to the proper place, will be served by a pair of the inclined teeth on the counting-wheels. A pair of stationary cams, p' p^2, fast at one end to the tie-rod p, come up close to the sides of the setting-wheels, and extend forward with a curve into the grooves of the counting-wheels. These cams assist in the transfer of the splints from the count-wheels to the setting-wheels by lifting them from the count-wheels at the point of transfer.

Motion is communicated to the mechanism above described from the fly-wheel b^3 on the main shaft by a round band, b^4, running onto a grooved nest-pulley, b^5, fast to the wire-brush shaft m, and which, by a groove of larger diameter, drives a cross-band, b^6, which turns a grooved pulley, b^7, fast to the shaft q, which rotates in bearings on the under side of the frame of the machine. On this shaft q is a pinion, q', which gears with a carrier cog-wheel, q^2, running on a stud-pin at the side of the frame, and carrying with it the pinion q^3, which is fast to the cog-wheel q^2, and drives a second carrier cog-wheel, q^4, with pinion q^5 fast thereto. The pinion q^5 gears with the cog-wheel q^6, fast to the receiving-wheel shaft, and also gears with the cog-wheel q^7, fast to the counting-wheel shaft o. The wheels on the receiving-cylinder and count-wheel shafts, being both driven by the same pinion, q^5, must be proportioned to each other as the number of opposite pairs of teeth in the count-wheels is to the number of splint-grooves in the receiving-cylinder.

The mechanism for setting the splints being geared to the mechanism for holding and feeding the binding-tape, as hereinbefore described, both are driven from the count-wheel shaft o, as follows, viz: Upon one end of the shaft o which carries the count-wheels is a clutch-wheel, r, loose upon said shaft and fast to a cog-wheel, r', behind it, which is also loose upon said shaft. The cog-wheel r' gears into the cog-wheel j', which drives the feeding and setting mechanism. An arm, r^2, fast to the shaft o, carries a lever-pawl, s, actuated by a spring, s', so as to take into the inclined teeth s^2 of the clutch-wheel and connect it with the shaft o. The number of teeth in the clutch-wheel is the same as in either one of the count-wheels, and the cog-wheel attached to the clutch-wheel is proportioned to the cog-wheel which it drives as the number of teeth in the counting-wheels is to the number of notches in the setting-wheels. The clutch is operated to stop the feeding and setting mechanism when the count-wheels fail to bring a splint at the proper time to the setting-wheels, and to set said mechanism in motion when the next splint is brought to the setting-wheels by the count-wheels, as follows, viz: The pawl is lifted by a lever, t, which moves

on a fulcrum-pin in the slotted end of the horizontal stud-pin t', and is operated by a toggle, u, one member of which is jointed to the lever t, and the other is confined by a fulcrum-pin to the side frame of the machine. A bent connecting-rod, u', joins the toggle to an upright vibrating lever, u^2, which vibrates on the fulcrum-pin u^3 at the bottom of the frame. A crooked arm, u^4, with a hook, u^5, at one end, and jointed at the other end to the vibrating lever u, is suspended horizontally by a link, u^6, depending from an arm or lever, u^7, framed with a lever, u^8, both moving freely on bearings on the tie-rod u^9, the end of the power-arm of the lever u^8 being shaped so as to enter and lie in the groove around the count-wheel o', as shown, so that if a splint be not present in that notch of the counting-wheel below the end of the lever the lever drops in the groove, and thereby lowers the hooked arm so that the hook u^5 catches on a pin, v^3, projecting from a lever, v, which is constantly moved back and forth upon its fulcrum-pin v' by a crank, v^2, on the end of the shaft q. A connecting-link, v^4, joins the crank to said lever. The shaft q makes as many revolutions for each revolution of the count-wheels as there are pairs of splint-carrying notches on the count-wheels. Therefore whenever the hooked arm is let down, in consequence of the absence of a splint in one of the pairs of notches of the count-wheel, which, as the same revolves, approaches the setting-wheels, the vibratory lever v catches the hook with its pin, and through the intermediate system of levers above described lifts the pawl from the notch in the clutch-wheel where it happens to lie, and from each succeeding notch or tooth in the clutch-wheel, so long as the count-wheel notches do not bring splints to the setting-wheels, thus stopping the splint-frame and its setting mechanism until the count-wheels bring forward a splint, when, the hook arm being lifted out of the track of the pin on the vibrating lever v by the action of the splint against the lower side of the lever u^8, the pawl, released from the lever t, is thrown into the notch on the clutch contiguous to it, and sets the frame and setting mechanism in motion. The hopper l is pivoted in front upon a seat upon the tie-rod u^9, to which it is confined, so as to vibrate freely by the screw-pin w, and is also supported behind, near the top, by being jointed to a long springy rod, x, fast at the lower end to the tie-rod x'. A shaking motion is given to the hopper by the bell-crank y, connected by a link, y', with the lever v, and playing between the pins y^4, projecting from the bottom of the hopper.

In place of the hopper, any known device by which the splints can be presented horizontally to the grooves of the receiving-cylinder may be substituted.

A modification of the arrangement of guide-roller and setting-wheels is shown in the drawings, detached, at Fig. 5. In this modification the binding-tape is aided in lifting out the splints from the notches in the setting-wheels by the eccentric position of the guide-roller, which turns on an eccentric bearing, z, surrounding the setting-wheel shaft, but not confined to it, being held in a stationary position by the arm z', which is fast to the tie-rod p. A crank, b^8, is placed on the main shaft b for the purpose of moving the machine by hand when adjusting the drum and binder.

We claim—

1. The employment of a flexible binding tape or band, in combination with a drum adapted to be rotated by a mandrel and removed therefrom, substantially as described, as a means of forming a spiral frame of match-splints for dipping, substantially as hereinbefore set forth.

2. In combination with a frame-drum moved by friction, the endless band and pressure-roller, or equivalent feeding mechanism, for the purpose of holding and paying out the flexible binding-tape to the frame, substantially as described.

3. In combination with the frame-drum, binder, setting and feeding mechanism, the friction-drag, or its equivalent, for the purpose of stopping the frame when the feeding and setting mechanism is disconnected from its motive power.

4. The receiving-cylinder, grooved across its periphery with grooves suitable to take in and hold only a single match-splint each, substantially as described.

5. The wire brush, or its equivalent, in combination with the receiving-cylinder, substantially as described.

6. In combination with the setting-wheels and receiving cylinder, the count-wheels, substantially as described.

7. The setting-wheels, in combination with the frame-drum and binding-tape, substantially as described, and substantially for the purpose of setting the splints in the coils of the binding-tape, as set forth.

8. In combination with the feeding and setting mechanism, the clutch and system of levers, or their equivalents, whereby the frame is stopped when splints are not supplied at the proper time and set in action again by the splint itself, substantially as described.

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