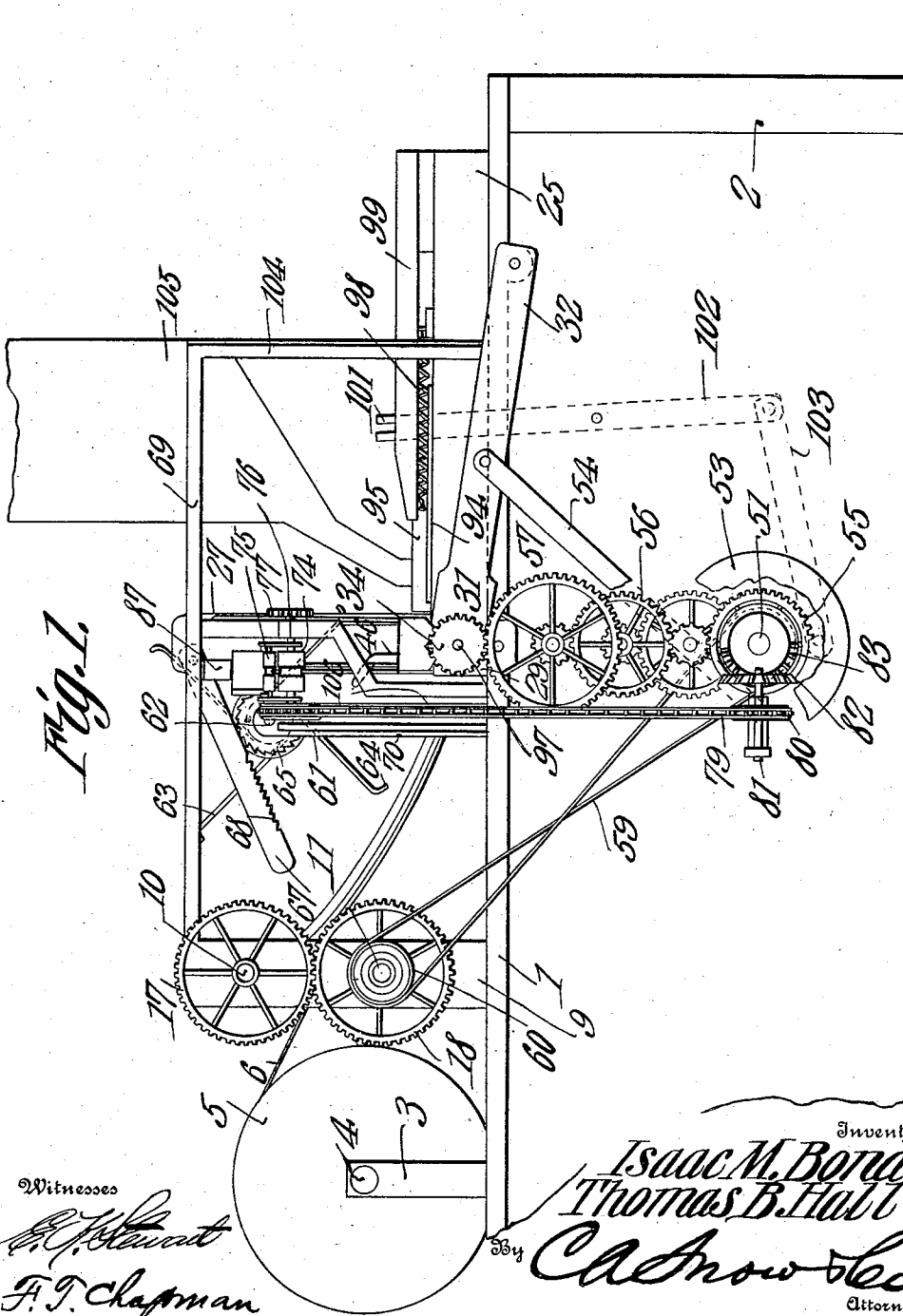


I. M. BOND & T. B. HALL.
MACHINE FOR MANUFACTURING FIRE CRACKERS.
APPLICATION FILED JULY 8, 1909.

965,560.

Patented July 26, 1910.

5 SHEETS--SHEET 1.

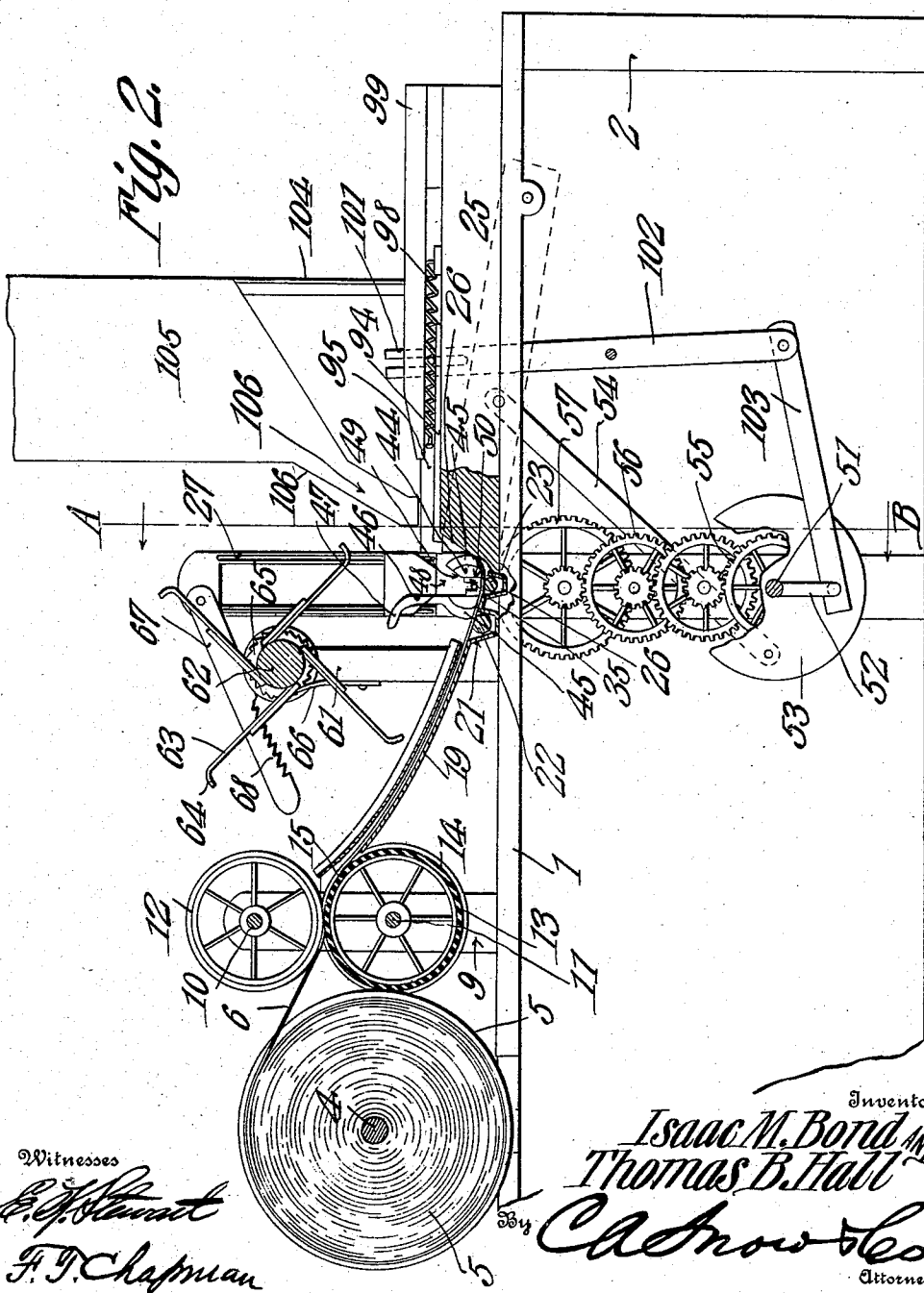


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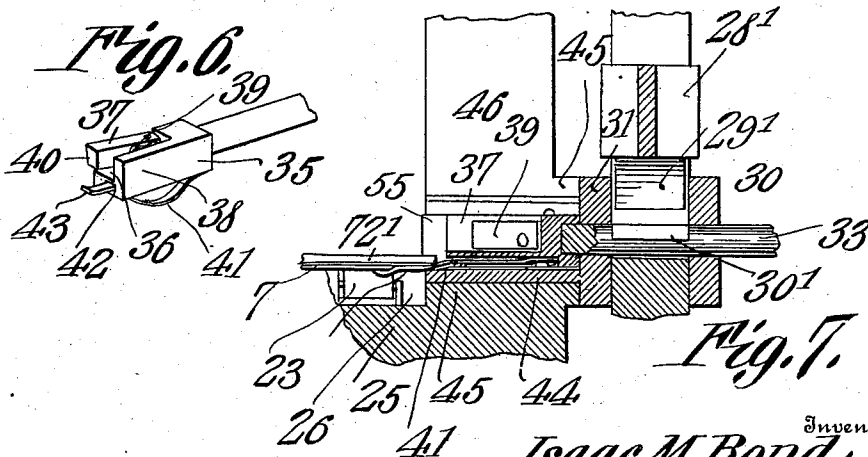
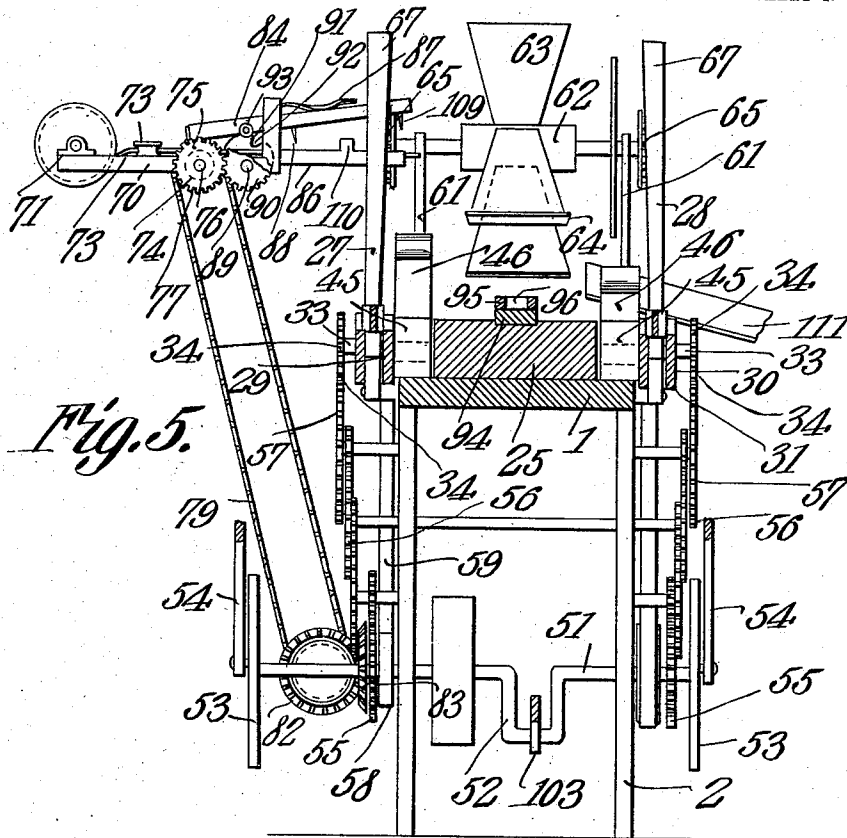


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5 SHEETS—SHEET 4.



Witnesses

E. J. Stewart
F. T. Chapman

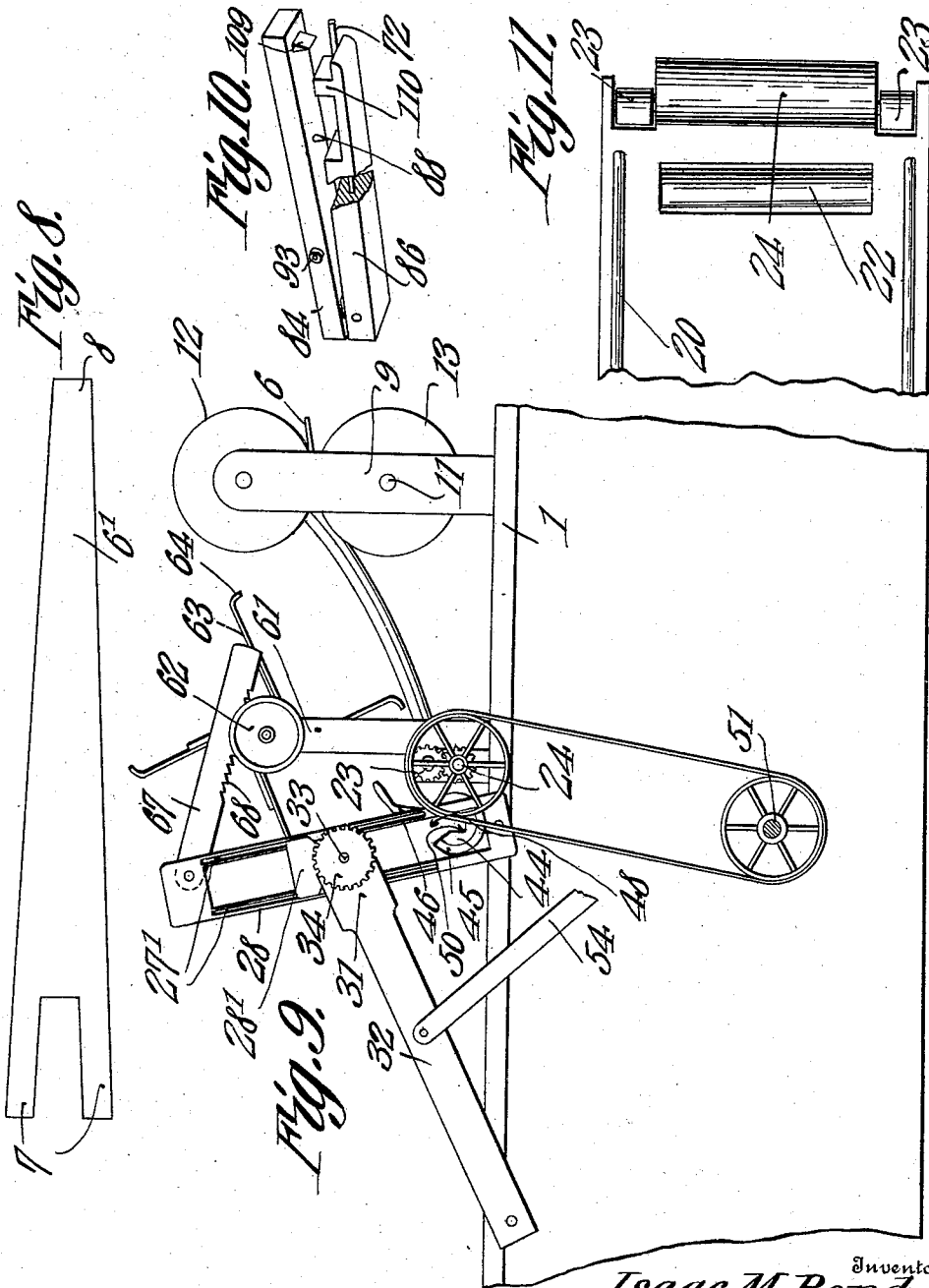
Inventors
Isaac M. Bond
Thomas B. Hall
By *C. A. Snow & Co.*
Attorneys

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5 SHEETS—SHEET 5.



Witnesses

R. J. Stewart
H. P. Chapman

Inventors
Isaac M. Bond and
Thomas B. Hall
By *C. A. Snow & Co.*
Attorneys

UNITED STATES PATENT OFFICE.

ISAAC M. BOND AND THOMAS B. HALL, OF TACOMA, VIRGINIA.

MACHINE FOR MANUFACTURING FIRE-CRACKERS.

965,560.

Specification of Letters Patent.

Patented July 26, 1910.

Application filed July 8, 1909. Serial No. 506,523.

To all whom it may concern:

Be it known that we, ISAAC M. BOND and THOMAS B. HALL, citizens of the United States, residing at Tacoma, in the county of Wise, State of Virginia, have invented a new and useful Machine for Manufacturing Fire-Crackers, of which the following is a specification.

This invention has reference to improvements in machines for manufacturing fire crackers and is designed more especially for the manufacture of fire crackers such as shown and described in Letters Patent No. 901,317 granted to one of us, namely, Isaac M. Bond, on October 20, 1908, for improvements in fire crackers.

The firecracker described in the said Letters Patent is conoidal at the ends and one of the ends is provided with a striker made of a composition and similar to that of a friction match, preferably of the safety type and this striker is designed to set fire to the fuse which will convey the fire thus produced to the explosive housed within the body of the fire cracker.

In accordance with the present invention a web of paper is fed continuously to cutting rolls which cut out blanks of elongated form with approaching sides and narrow at one end and wide at the other, the wide end being incut by the narrow end of the next succeeding blank, thereby forming two legs with an intervening space, these portions of the blank being utilized, as will hereinafter appear to cause the formation of the powder chamber. From the cutting rolls the paper blanks are fed in succession to a winding mechanism at which point the fuse is fed into position to be inclosed by the paper blank while being acted upon by the winding mechanism which forms the paper blank into a tubular member with tightly wound ends tapering toward the point in the form of elongated conoids between which the powder chamber is located. Provision is made for the automatic deposition into the powder chamber in the body of the fire cracker of measured quantities of explosive whether the latter be ordinary powder or some other explosive, this deposition of the powder taking place before the powder chamber is closed by the continued rolling of the blank into the final form. After being rolled into shape, cementing material having been supplied to the paper to cause the adherence of the successive lay-

ers, the finished product as produced by the machine is then automatically discharged into a suitable receptacle.

The invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings forming a part of this specification in which drawings,

Figure 1 is a side elevation of the machine with parts broken away. Fig. 2 is a longitudinal section in a vertical plane with parts shown in elevation. Fig. 3 is a plan view of the machine with parts omitted. Fig. 4 is a plan view of the fuse feed mechanism. Fig. 5 is a section on the line A—B of Fig. 2. Fig. 6 is a detail perspective view of a gripper used in connection with the machine. Fig. 7 is a detail section showing the gripper of Fig. 6 in active position. Fig. 8 is a view of one of the paper blanks as cut from a paper web. Fig. 9 is a view of a portion of the machine from the side opposite that shown in Fig. 1. Fig. 10 is a perspective view partly broken away of the structure for cutting a fuse strand into proper lengths. Fig. 11 is a detail view of the gluing mechanism. Fig. 12 is a perspective view of the means for feeding explosives to the forming fire cracker the parts being shown in separated relation.

Referring to the drawings there is shown a table 1 mounted on legs 2 and constituting the main supporting frame of the machine. Near one end of the table 1 there are erected spaced standards 3 in which is journaled the arbor 4 of a spool 5 containing a roll of paper in the form of a web 6 of suitable width for the cutting of blanks such as shown in Fig. 8. The blank shown in Fig. 8 comprises a paper strip 6' as wide at one end as the web 6 and gradually narrowing toward the other end and in the formation of these blanks the narrow end of the blank is cut out of the wide end of the next succeeding blank so that each blank has at its wide end two spaced legs 7 separated by an intervening space corresponding to the narrow end 8 of the preceding blank in the order of cutting the blanks, the wide end of the blank being in the direction of feed of the web. Adjacent to the standards 3 are other standards 9 carried by the table 1 and in these standards are journaled the arbors 10—11 of two rollers 12—13 respectively.

The surface of the roller 13 carries a cut-

ting knife 14 extending around the periphery of the roller and of suitable shape to cut out a blank such as shown in Fig. 8 by one revolution of the roller. The space between the blades of the cutting knife 14 is filled with an elastic material indicated at 15, which elastic material may be rubber.

The surface of the roller 12 carries a band 16 of some soft metal such as Babbitt metal, which band conforms in shape to the knife 14 of the roller 13, and when the two rollers 12 and 13 are rotated the knife 14 is in engagement at all times with the soft metal band 16, thus providing a cutting surface for the knife which is harmless to the edge of the knife.

In the operation of the machine the roller 13 is brought into such close relation to the roller 12 that the paper strip 6 in passing between the rollers is ripped by the elastic filling 15 between the members of the blade 14 and is forced thereby against the surface of the roller 12 so that the paper is held in such manner as to prevent the slipping of the paper while being acted upon by the knife 14. Beyond one of the standards 9 the arbors 10 and 11 carry respective gear wheels 17 and 18 which may be of the same diameter and are in mesh one with the other so that the meeting surfaces of the two rollers move in the same direction at the same speed. The manner of driving the drums or rollers 12 and 13 will be considered later. Following the progress of the web after leaving the rollers 12 and 13 and now cut into blanks it passes along a guide 19 mounted on the table 1. This guide consists of two closely related parallel strips or plates separated sufficiently to permit the blanks 6' to pass therebetween, the blanks being directed by properly located side ribs 20. At the end of the guide 19 there is located a tank 21 containing glue or other cementing material in a liquid or semi-liquid state and dipping into such material is a transfer roller 22 suitably journaled, and over this roller the central portion of the blanks formed from the web 6' are carried just prior to being rolled into a tube, causing the rotation of the roller and the transfer of the glue or other cementing material to the surface of the blanks cut from the web 6. After leaving the cement applying roller 22 ends 7 of the blanks 6' pass over short gluing rollers 23—23 adjacent to the winding mechanism. The guide 19 ends in a trough 24 which may be yieldingly supported.

Mounted on the table 1 at the end remote from the spool 5 is a block 25 having at the end adjacent to the rollers 23—23 a concavity 26 into which the trough 24 extends in which trough these blanks are rolled into the final tubular form with conoidal ends.

Pivoted to the table 1 on each side there-

of and in line with the concavity 26 are two normally upright frames 27—28 each with a longitudinal rectangular passage or slot therethrough and these frames are so shaped as to be more widely separated one from the other at the bottom or pivot end than at the normally upper or free end. Capable of sliding along the frames 27 and 28 through the slots therein are guide blocks 29—30 respectively. Each block 29 and 30 is carried by the forked end 31 of an arm 32 pivoted to the side of the table 1 near the end carrying the block 25. There are two of these arms 32, one on each side of the table and when these arms are moved about their pivots in a manner to be described the guide blocks within the frames 27 and 28 are carried longitudinal of these frames through a curved path thus causing the frames 27 and 28 to rock on their pivots for a distance agreeable to the curved path of the forked ends of the arms 32 and for a purpose which will presently appear. Each arm 32 at the forked end carries a short shaft 33 having at the outer end a pinion 34 and at the inner end formed with a head 35, best shown in Figs. 6 and 7 which head is formed at the free end with a recess 36 in which is located a pivoted block 37 capable of moving to and from the solid wall 38 of the recess and normally held in a position away therefrom by a spring 39. The outer edge 40 of the block 37 is beveled for a purpose which will presently appear.

On the bottom of the head 35 as viewed in Fig. 6 there is secured one end of a leaf spring 41 with its free end extending through a slot 42 in the corresponding end of the head 35 and at the extreme end slightly curved as shown at 43. The block 25 at each end of the concavity 26 is formed with a circular pocket in which is housed a mutilated rotatable cylinder 44 within a like fixed casing 45 having an upwardly directed guide finger 46 with its free end bent in a direction away from the main body of the block 25. Along one side of the casing 45 there is formed an opening 48 and the cylinder 44 has a like opening 49 leading into a narrow longitudinal recess 50. The casing 45 is so located that the shaft 33 with the head 35 may be moved longitudinally in the frames 27 or 28 and then the head 35 may be moved into or out of the pocket 50. The cylinder 44 when the head 35 is in the recess or pocket formed therein is free to rotate with said head. Each frame 27 and 28 has guide grooves or slots 27' on opposite sides and in these guides there slides a block 28' having its lower end forked as shown at 29' to engage a prismatic portion 30' of the corresponding shaft 33. The guides 27' stop short of the lowermost point of travel of the shaft 33 so that the latter will move to a point

below and separated from the fork 29' when the block or head 35 is seated in the cylinder 44. The block 29' slides freely along the respective frame 27 or 29, being lifted by the block 30 or fork 31 and dropping by gravity.

Mounted in the framework of the structure below the table 1 is a power shaft 51 formed with a crank 52 and at the ends carrying crank disks 53 each of which latter is connected by a link or pitman 54 with the respective arm 32. The shaft 51 also carries near each end a gear wheel 55, driving through a suitable train of gears 56 another gear wheel 57 which latter is in position to be in mesh with the pinion 34 carried by the forked end 31 of the respective arm 32 when the said arm is in its lowermost position with the head 35 seated in the recess in the cylindrical block 44. The shaft 51 also carries a pulley 58 connected by a belt 59 to a pulley 60 on the arbor 11. It will be understood of course that the belt 59 may be replaced by a sprocket chain and the pulleys 58 and 60 be replaced by sprocket wheels, these being ordinary mechanical equivalents.

Mounted on the table 1 adjacent to the feed rollers 22 and 23 are standards 61 in the upper end of which is journaled the arbor of a roller 62 carrying a number of radial arms 63 of considerable lateral extent and having the free end formed into a ledge 64. The roller 62 carries at one end a ratchet wheel 65 held against rotation except in one direction by means of a spring pawl 66 carried by one of the standards 61 and this ratchet wheel is in the path of an arm 67 pivoted at one end to one of the frames 27 or 28, or as shown in the drawings there may be two such arms 67, one on each frame 27 and 28 and there may be two ratchet wheels 65 on the roller or drum 62 at opposite ends of the latter. The arms 67 are provided on one edge with a series of teeth 68 so arranged as to engage the ratchet wheels 65 to rotate the drum or roller 62 through an arc equal to the distance between the free ends of the arms 63. In the structure shown in the drawings the roller 64 is given a quarter turn at each operation of the arms 67 and these arms are impelled actively each time the frames 27 and 28 are moved from their normal vertical positions under the action of the arms 32.

One of the posts or standards 9 forms a support for one end of a frame 69 extending along one edge of the table 1. This frame 69 has a lateral extension or bracket 70, the ends of which are forked to form bearings for the arbor of a reel or drum 71 on which is wound a supply of fuse material 72 in the form of a circular strand of suitable diameter and made of suitable material for the purpose. The fuse strand 72

passes from the reel 71 through guide rollers 73 to feed rollers 74—75, the roller 74 being mounted on a shaft 76 carrying at one end a gear wheel 77 and at the other end a sprocket wheel 78 which latter is connected by a sprocket chain 79 to another sprocket wheel 80 mounted on a short shaft 81 journaled in extensions of the main frame and this shaft 81 carries a bevel gear 82 meshing with the teeth of a mutilated beveled gear 83 on the main shaft 51.

Pivotaly supported at one end by suitable bearings in the frame or bracket 70 is a lever 84 extending toward the main body of the machine and over a guide or support 86 for the fuse 72 after it leaves the feed rolls 74 and 75. The lever 84 is urged in a direction toward the fuse on the support 86 by a spring 87 and this lever carries a stabbing point 88 designed to engage the fuse and perforate the same. Parallel with the shaft 76 is another shaft 89 carrying a pinion 90 meshing with the pinion 74 and this shaft carries a disk 91 in which there is formed a peripheral notch 92 having one shoulder radial to the axis of rotation of the disk. A pin 93 on the lever 84 normally rides on the periphery of the disk 91 and is forced into the notch 92 whenever brought coincident therewith by means of the spring 87. This pin 92 may be a roller pin and one side of the notch 92 may be inclined so that the pin will readily ride out of the said notch when the disk 91 is rotated in the proper direction.

Mounted on the top of the block 25 in a groove thereon so as to travel longitudinally of the block is a slide member 94 and on this slide member 94 is another slide member 95 formed with a pocket 96 near one end and at the same end with a stop member 97 normally held in engagement with the corresponding end of the slide 94 by a spring 98. The slide 95 is held in engagement with the slide 94 and both slides are held to the block 25 by an overhanging guide 99 carried by the block 25. The slide 95 has projecting therefrom a pin 100 engaged by a fork 101 on one end of a lever 102 connected by a link 103 with the crank 52 of the power shaft 51.

The table 1 carries by a suitable support 104 a reservoir 105 for powder or other explosive, and this reservoir 105 is provided with a discharge neck or conduit 106 in close relation to the upper surface of the slide 95. The slide 94 is provided with a longitudinal slot 107 in which there projects a limiting pin 108 rising from the block 25.

Let it be assumed that the machine is in motion with a suitable supply of paper web upon the reel 5 and a suitable supply of fuse 72 upon the reel 71 and a suitable supply of paste or glue for the rollers 22 and 23. The paper blanks pass over the paste rollers and

thereby have a layer of paste deposited upon one surface and the ends 7 are directed into the trough 24. The web 6 is of course continuously cut into blanks by the knife 14 on the roller 13, as has already been explained. In the meantime the rotation of the feed rolls 74 and 75 through the sprocket connections with the power shaft has caused an advance of the fuse strand 72 for a distance determined by the number of teeth on the mutilated bevel gear 83 when the further advance of the fuse strand is arrested while other portions of the machine continue in operation.

Immediately before the fuse has ceased its motion the notch 92 arrives beneath the pin 93 and the lever 84 is impelled toward the strand already fed by the action of the spring 87 which is purposely made quite powerful. The fuse strand is acted upon by the point 88 which perforates the outer coating of the fuse while a knife 109 carried by the lever 84 severs the projected portion of the fuse from the strand immediately behind the same in the direction of feed. A stop 110 on the fuse support 86 limits the active movement of the lever 84. The downward movement of the lever 84 toward the fuse is very quick because of the abrupt shoulder of the notch 92 and the other side of the notch is made steep enough so that the lever 84 is quickly raised out of engagement with the severed portion of the fuse. The feeding movement of the fuse strand 72 has in the meantime caused a previously cut portion to be forced off the support 86 and this previously cut portion falls upon one of the arms or blades 63 carried by the roller 62 and is retained in the curved portion 64 at the free end of the particular arm 63. When this occurs the two heads 35 are moving downward toward the recess or pocket 49 in the cylinder 44 at the two ends of the concavity 26 and the movements of the parts are so timed that a fuse held by an arm 63 will drop with its ends in the recesses of the heads 35 and these heads 35 continue downward until the blocks 37 engage by the bevel portions 40 the fingers 46, these fingers being so shaped as to cause the closure of the blocks 37 onto the fuse ends and clamp them against the wall 38 of the corresponding recesses in the blocks 35. As soon as the fuse ends are clamped, the blocks are drawn slightly apart by the more separated portions of the frames 27 and 28 and the fuse is thereby held in a taut condition. As the heads 35 move into the recesses 50 in the cylinders 44 the fuse is brought into engagement with the ends of the two legs of a paper blank which, by the timed operation of the structure are at this time entering the trough 24. The downward movement of the heads 35 cause the springs 41, which, in their normal position are downwardly bowed, to

come into contact with the bottoms of the recesses 50 and these springs are straightened out thus projecting the ends 43 toward the legs 7 of a paper strip in such manner as to slightly overlap and grip these legs from below. The complete downward movement of the shaft 33 brings the pinions 34 into engagement with the gear wheels 57 and the shafts 33 then begin to rotate with great rapidity as compared with the movements of the other parts of the machine. The two shafts 33 and two heads 35 rotate synchronously winding the legs 7 of the paper blank around the corresponding ends of the fuse indicated at 72' in Figs. 3 and 7. As the winding progresses the main portion of the blank begins to wind about the fuse 72'.

While the operations described have been progressing powder has been deposited in the pocket 96 from the reservoir 105 and the action of the crank shaft upon the lever 102 has caused a movement of the slide 95 toward the concavity 26, the slide 94 participating in this movement until its further movement is arrested by the pin 108 engaging the rear end wall of the slot 107. The slide 95 continues its movement toward the concavity 26 while the forward end of the slide 94 has assumed a position directly over the concavity above the fuse 72' seated therein. The continued movement of the slide 95 carries the pocket 96 beyond the end of the slide 94, which latter slide constitutes the bottom of the pocket, and the contents of the pocket 96 are therefore free to fall therefrom, and in this position of the parts the charge of powder within the pocket 96 falls into the portion of the main body of the paper blank then underriding the central portion of the fuse between the wound-up leg 7 of the blank, the number of turns in these wound-up portions determining the size of the powder pocket within the finished fire cracker. As soon as the forward movement of the slide 95 has ceased it begins its rearward movement and this continues until the pocket 96 is again brought into coincidence with the discharge end of the reservoir when another charge of powder is deposited therein and the forward movement begins again. Immediately after the deposition of the powder into the paper receptacle, the powder is closed in by the continued rotative action of the shafts 33 and this rotative movement continues until all of the paper blank has been rolled on itself thus forming a tube inclosing a charge of powder and having a fuse extending longitudinally of the same and beyond the ends, with the body of the tube gradually decreasing in diameter toward the ends so that the ends are substantially of elongated conoidal shape. Because of the increasing diameter of the fire cracker body the speed of the

blank becomes greater than it was at the beginning and the consequence is that the narrow end of the blank is withdrawn from between the two legs 7 of the next succeeding blank so that by the time these two legs reach the glue rollers, the end 8 of the preceding blank has escaped and has been wound upon the body of the fire cracker.

The parts are so timed that as soon as the end 8 of the paper blank has been rolled upon the main body of the fire cracker the arms 32 begin their upward movement. As the arms 32 move upward to carry the heads 35 out of the cylinders 44 the spring impelled members 37 are then free to release the ends of the fuse 72' grasped thereby when the heads 35 are in the cylinders 44. During this movement the head 35 at one side of the machine will release the corresponding end of the fuse 72' before the other head 35 will release its end of the fuse 72' since one of the guide members 46 is made longer than the other and it is not until the head 35 has risen above the vertical portion of the guide member 46 that the member 37 is permitted to move under the action of the spring 39 so as to release the corresponding end of the fuse 72'. As the head 35 rises from the cylinder 44 the spring 41 will be retracted because of its normal tendency and by properly proportioning the parts, the head 35 on passing by the longer guide member 46 may be given a slightly greater travel so as to pull the fuse away from the other head and thus allow that end of the finished fire cracker body to drop. When in this position the fire cracker body will over-ride a discharge chute 111 and when the fire cracker is released from the head 35 holding it the longer it will drop into the chute 111 and move therealong by gravity until it is discharged from the machine.

The parts are so timed that during the rotation of the drum 62 on the return of the frames 27 and 28 to their normal upright position the freshly cut fuse is moved onto an arm 63 when in substantially the horizontal or a little above the horizontal position and the continued movement of this arm about the axis of the drum 62 will cause the arm to assume a more or less inclined position with the end 64 lower than the rest of the arm. Consequently the fuse deposited thereon will move down the arm and ultimately pass off the end of the same into the recesses in the ends of the heads 35 and this fuse will be supported by these heads until the movement of the heads into engagement with the guides 46 will cause the clamping of the fuse and the slight stretching before mentioned.

Since the momentum of the rotating shafts 33 and parts carried thereby may cause them to move rotatively after the pinions 34 leave the driving gears the forked ends 29' of the

blocks 28' are provided so that by engaging the prismatic portion 30' of the shaft 33, the latter may be positively positioned to return to its lowermost place in proper relation to the other parts with which the head 35 and devices carried thereby cooperate. The rest of the operation follows as already described.

It will thus be seen that fire crackers such as described in the aforesaid Letters Patent may be made successively and continuously with great rapidity so long as a supply of the proper material is maintained and the machine is kept in operation.

What is claimed is:—

1. In a machine for making fire crackers, a cutter for forming blanks from a web of paper, means for applying cementing material to the blanks so formed, means for cutting fuses into proper lengths, means for grasping and holding each fuse length and for grasping and winding the paper blank thereabout, means for depositing a charge of explosive into the winding blank, and means for causing the several operations in timed relation.

2. In a machine for making fire crackers, a cutter for forming blanks from a web of paper with one end of the blank wider than the other end and with the wide end formed into two spaced members, means for grasping a fuse at the ends and for grasping and winding the spaced members of the blank about the ends of the fuse and subsequently winding the remainder of the blank about said fuse to form an inclosed chamber for an explosive, means for depositing a quantity of explosive in the chamber in the body of the fire cracker while the blank is being wound about the fuse, and means for causing the several operations in timed relation.

3. In a machine for making fire crackers, rotatable clamp heads in spaced relation and adapted to receive and clamp the ends of a fuse, and a clamp member on each head for holding one edge of a blank to the fuse while being wound spirally about said fuse, said clamp member projecting from the head in the direction of the length of the fuse when the latter is clamped by the head.

4. In a machine for making fire crackers, a winding head provided with a recess for receiving one end of a fuse, a clamp member adapted to grasp and hold the fuse while in the clamp head, an elastic grasping member carried by the head and having a normal tendency to a retracted position, and a receptacle for the head into and out of which the head is movable, said receptacle coacting with the head to move the clamping member into clamping engagement with the fuse and the spring member into clamping engagement with a paper web adapted to be wound about the fuse.

5. In a machine for making fire crackers,

a clamping head for grasping a fuse and for holding paper to said fuse while being wound thereabout, said clamping head having a normally open jaw adapted to be moved to grasping position with relation to the fuse, a normally retracted spring member adapted to be extended to grasp the paper blank and hold the same to the fuse while being wound thereabout, a rotatable recessed member into and out of which the clamping head is adapted to be moved, means for moving the clamping head into and out of operative position, and means for causing a rotative movement of the clamping head when in active position.

6. In a machine for making fire crackers, means for supplying the fuses in predetermined lengths, a rotatable carrier for receiving the fuses one by one, clamp heads for receiving the ends of the fuses, and means for moving the clamp heads into and out of operative position with relation to the fuse carrier to receive the fuses one by one therefrom.

7. In a machine for making fire crackers, clamping heads for the ends of a fuse, means for causing the clamping heads to grasp and hold the ends of a fuse, and a separating means for the clamping heads, active to put the fuse under longitudinal strain after being clamped by the heads.

8. In a machine for making fire crackers, clamping heads for the ends of a fuse movable from one position to another, and guides for the heads imparting longitudinal movement to the heads in the direction one away from the other when approaching one of the said positions.

9. In a machine for making fire crackers,

a rotatable carrier for receiving and delivering fuses, a rotatable clamping member for the ends of the fuses, means for moving the rotatable clamping members from one position to another position, rocking guides for the clamping members, and actuating means between the rocking guides and the fuse carriers for causing movement of the latter in timed relation to the movement of the clamping members.

10. In a machine for making fire crackers, means for producing fuses in predetermined lengths from a continuous strand of the same comprising feeding rollers, a carrier provided with a knife and with a stabbing point and having a normal tendency toward the fuse, and a member controlled by the actuating mechanism of the device for releasing the knife carrier with the stabbing point at predetermined intervals.

11. In a machine for making fire crackers, feed rolls for advancing predetermined lengths of fuse, a notched disk receiving motion from the driving power of the feed rolls, a lever spring-impelled toward the fuse and provided with a severing knife and a stabbing point for engaging the fuse, and a retaining member carried by the lever and adapted to drop into the notch on the notched disk at predetermined intervals.

In testimony that we claim the foregoing as our own, we have hereto affixed our signatures in the presence of two witnesses.

ISAAC M. BOND.
THOMAS B. HALL.

Witnesses:

R. P. BREWER,
R. P. HAMILTON.