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H. HOFFMANN.

APPARATUS FOR MAKING THREADS OF EXPLOSIVES.

(Application filed July 13, 1896.)

(No Model.)

Fig. 1.

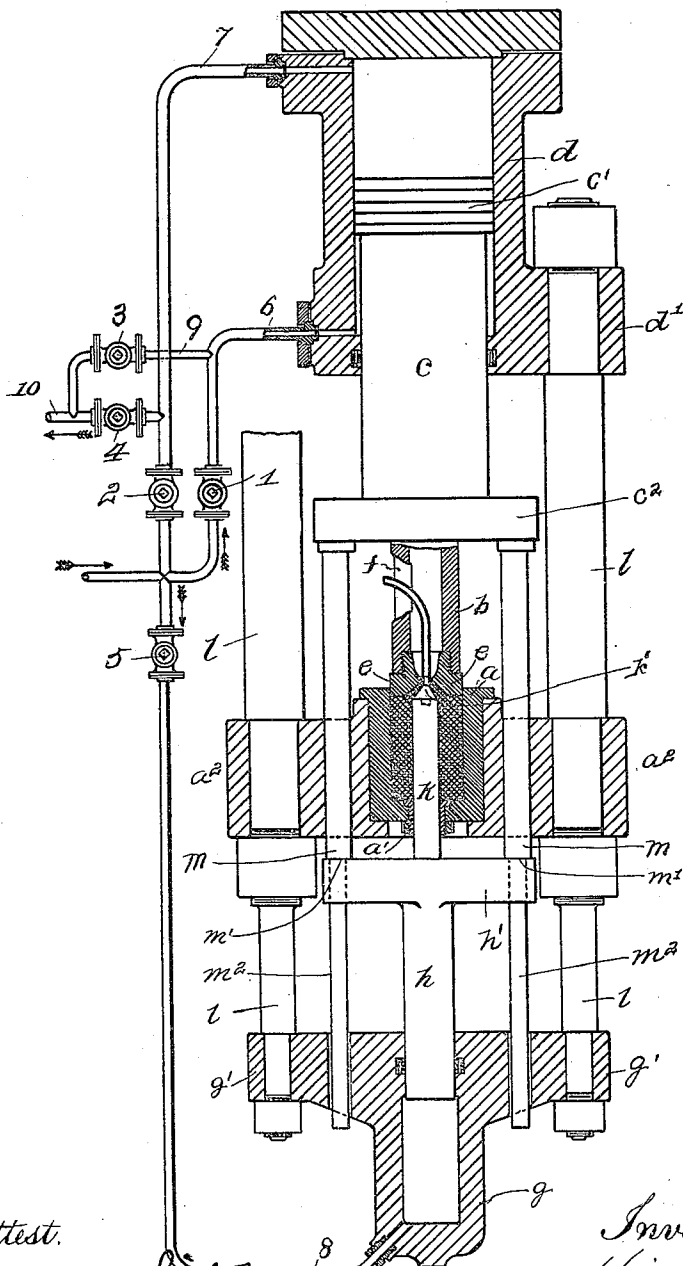
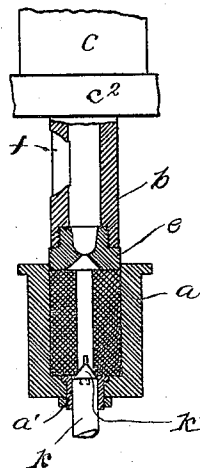


Fig. 2.



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APPARATUS FOR MAKING THREADS OF EXPLOSIVES.

SPECIFICATION forming part of Letters Patent No. 620,775, dated March 7, 1899.

Application filed July 13, 1896. Serial No. 598,985. (No model.)

To all whom it may concern:

Be it known that I, HEINRICH HOFFMANN, a subject of the King of Bavaria, residing at Magdeburg, in the Kingdom of Prussia and
5 Empire of Germany, have invented a certain new and useful Apparatus for the Manufacture of Threads or Cords of Explosive Material, of which the following is a specification.

This invention relates to an apparatus for
10 the manufacture of tubular or other threads or cords from a mass of explosive material previously operated upon by rollers.

In the preparation of certain kinds of smokeless explosives kneading by means of sets of
15 rollers or roller-mills has proved to be an advantageous and serviceable operation, even in those cases where the explosive material is to be used in other forms than that of small plates or scales or of cubical blocks.

Now the object of this invention is to enable the desired form to be imparted to the explosive material fed to the rollers in the shape of a band, and the said invention will be best understood by reference to the accom-
25 panying drawings, which represent by way of example a press adapted to produce threads or cords of explosive material.

Figure 1 in said drawings is a vertical axial section of the device, and Fig. 2 a similar
30 detail view showing a different position of the parts.

The said press mainly consists of a suitably-shaped pressure-chamber *a*, seated on a support *a*² and into which a stamp *b* is adapted
35 to be forced. The stamp *b* is secured to a double-acting plunger *c*, having a piston *c*¹ and arranged to reciprocate vertically within a hydraulic cylinder *d*. The said stamp *b* is hollow and carries at its lower end a die or
40 matrix *e*, through which the explosive mass or paste is forced in the condition of a thread or cord, which issues through an aperture *f*, provided on one side in the wall of the hollow stamp. Below the chamber *a* is arranged a
45 second hydraulic cylinder *g* of smaller size than the cylinder *d* and connected by a lower pipe-section 8 and upper pipe-section 7 with the upper part or space of the said larger cylinder *d* and having a piston or plunger *h*,
50 which carries a rod *k*, surmounting the cross-head *h*¹. The rod *k*, having a pointed end or

mandrel *k*¹, passes through the bottom of the chamber *a*, being made tight at the joint by means of a packing or stuffing box *a*¹, as shown. This rod *k* is designed to accomplish
55 a double purpose—that is to say, its upper end receives the pointed end or mandrel *k*¹ whenever it is desired that the thread or cord produced should be hollow or tubular, while at the same time the said rod condenses and
60 forces the explosive material in the chamber *a* toward the stamp, so as to expel any air that may be present in such material. The upper cylinder *d* is connected by its head *d*¹ with the head *g*¹ of the lower cylinder *g*
65 through the support *a*² by means of tie-rods *l*. The upper plunger *c* carries at its lower end a cross-head *c*², from which depend guide-rods *m*, whose lower ends *m*² extend through the cross-head *h*¹ of the lower piston or plunger *h*
70 and through the head *g*¹ of the lower cylinder *g*.

6 is a branch pipe connecting the lower pipe-section 8 with the lower end of the upper cylinder. Extending from the branch pipe 6
75 is an upper lateral pipe 9, connecting the branch pipe 6 with the lower lateral pipe 10, which is connected with the upper pipe-section 7.

1 is a valve controlling the branch pipe 6. 80

2 is a valve controlling the upper pipe-section 7.

3 is a valve controlling the upper lateral pipe.

4 is a valve controlling the lower lateral
85 pipe.

5 is a valve controlling the lower pipe-section 8.

The operation of the press is as follows—that is to say, the explosive paste, supplied
90 from the rollers in the form or condition of a band, is wound in a roll or coil upon a rod or pin, of wood or other suitable material, less in diameter than the rod *k*. The outer diameter of the roll or coil thus formed should fit
95 the inner diameter of the chamber *a*. The roll as soon as formed is placed in the said chamber *a*, and while it is being so inserted into the said chamber the stamp *b* remains in its highest position and the rod *k* remains at
100 the extremity of its downward stroke to permit the introduction of the roll or coil, as both

the stamp *b* and rod *k* must be withdrawn to admit the roll or coil. Upon the insertion of the coiled band of explosive material into the chamber *a* the stamp *b* is allowed to descend as far as is necessary to enable it to rest upon the material to be pressed. The water or other fluid acting as a pressure medium is at the same time admitted into the cylinder *g*, whereby the piston *h*, and with it the rod *k*, are caused to rise. The pointed end *k'* of the rod *k* is consequently driven into the body or mass of explosive paste, thereby enlarging or expanding the same. The air confined between the several convolutions of the coiled material is thus displaced and caused to escape through the passage in the die or matrix *e*. While the stamp *b* still remains stationary, the rod *k* continues to ascend until it completely fills the hollow space of the coil or roll of explosive material and has so far expanded the latter that the diameter of that space is equal to its own. By this time the mandrel at the upper end of the said rod *k* has taken up its proper position relatively to the die *e* and the cross-head of the lower plunger *h* has risen into contact with the shoulders of the rods *m' m'*, attached by the cross-head *c'* to the upper plunger *c*. At this moment the compression of the gunpowder paste or the molding of the cord or thread is commenced. Through the medium of the aforesaid rods and cross-head *h'* on the lower plunger *h*, together with its mandrel, rod *k* will be forced downward by the upper plunger *c* in proportion as the stamp *b* is forced down in the chamber *a*, so that the die *e* retains its position relatively to the rod *k*, the consequence being that the explosive material is forced between the mandrel and die, whence it issues in the form of a tubular cord through the lateral aperture *f*, provided in the stamp *b*, as above described.

First. To open the press for the entrance or introduction of the rolled powder-band, the valve 2 in the upper pipe-section 7 and the valve 5 in the lower pipe-section 8 of the connecting-pipe are closed, as well as the valve 3 in the upper lateral pipe 9. The valve 1 in the branch pipe 6 and the valve 4 in the lower lateral pipe 10 are opened. The water will now pass in through the branch pipe 6 under the butt-end or piston of the upper plunger and bring this plunger to its uppermost position, the water compressed by the butt-end or piston *c'* of this plunger *c* being forced out through the upper pipe-section 7 and out through the valve 4 of the lower lateral pipe 10. The rolled powder-band is next inserted in the chamber *a* to form the powder roll or coil.

Second. To set the stamp *b* on the powder roll or coil within the chamber, the valve 1 in the branch pipe 6, the valve 5 in the lower pipe-section 8, and the valve 4 in the lower lateral pipe 10 are closed and the valve 2 in the upper pipe-section 7 and the valve 3 in the upper lateral pipe 9 are opened. The wa-

ter passes in through the upper pipe-section 7, and the butt-end or piston *c'*, with the upper plunger *c*, sinks until the stamp *b*, with its die or matrix *e*, rests on the powder roll or coil. At this time the water passes in through the valve 2 and the upper pipe-section 7 above the butt-end or piston *c'*, and the water under the butt-end or piston *c'* passes out through the branch pipe 6 and the valve 3.

Third. To press the rod in the roll or coil, the valve 1 in the branch pipe 6, the valve 2 in the upper pipe-section 7, the valve 3 in the upper lateral pipe 9, and the valve 4 in the lower lateral pipe 10 are all closed, while the valve 5 in the lower pipe-section 8 is opened. The lower piston or plunger *h* will now rise until the cross-head *h'* thereof strikes against the shoulders *m'* of the guide-rods *m*. The rod *k* passes into the powder roll or coil until its pointed end or mandrel is inserted in the die or matrix *e*, so as to form a mold for a thread or cord.

Fourth. To press the powder thread or cord, the valve 1 in the branch pipe 6 and the valve 4 in the lower lateral pipe 10 are closed and the valve 2 in the upper pipe-section 7, the valve 3 in the upper lateral pipe 9, and the valve 5 in the lower pipe-section 8 are opened. Water enters through the valve 2 and the upper pipe-section 7 above the butt-end or piston *c'* and through the valve 5 and the lower pipe-section 8 under the lower plunger *h*. As the butt-end *c'* has greater diameter than the lower plunger, both the upper and lower plungers go with equal rapidity downward. The position of the rod *k*, with its pointed end or mandrel *k'*, with relation to the die or matrix *e* remains unchanged during this movement, and the powder comes out of the die or matrix as a thread or cord and then out through the aperture *f* in the side wall of the hollow stamp *b*.

When it is desired to form the explosive cord otherwise than hollow or tubular, it is only necessary to dispense with the mandrel *k'* on the rod *k*, the end of which being thus left blunt, as it were, in that case only rises to the bottom end of the die.

When the forcing process is completed, the position of the parts is as illustrated in Fig. 2, the mandrel-rod *k* and stamp *b* with the die having descended to their lowest position and returned, in which position the said rod for the time being remains, while the stamp, by the operation of the reversing-valves, reascends to its initial or upper position, leaving the orifice of the chamber *a* free to receive a fresh charge of plastic explosive material.

Not only does the method of press-molding hereinabove described enable the material to be treated or worked directly as delivered from the roller mechanism, but it also permits all the air confined in the body of the material to be got rid of without necessitating any preliminary forcing process. Therefore the product finally obtained—viz., the explosive cord or thread—may be relied upon

as being homogeneous and free from air-bubbles, the consistence or density imparted to the explosive material by the rollers undergoing no diminution in consequence of the change of form to which it is subjected in the press.

Having now particularly described my invention, what I claim is—

1. An apparatus for the manufacture of threads or cords of explosive material, comprising a chamber into which the material is introduced, a condensing-rod, a stamp having a hollow die or matrix through which the material passes in the form of a thread or cord, means whereby the condensing-rod is caused to enter the chamber in advance of the die or matrix to condense the material, drive out the air, and force the material against the die or matrix, and means for forcing the die or matrix into the chamber and returning the condensing-rod as the die or matrix advances, substantially as described.

2. An apparatus for the manufacture of threads or cords of explosive material, comprising a chamber into which the material is introduced, a hollow stamp having an aperture at one side thereof and a hollow die or matrix, a condensing-rod, and means whereby the condensing-rod is caused to enter the chamber in advance of the die or matrix to condense the material and drive out the air; the material being forced through the die or matrix and through the opening or slot in the stamp when the stamp with the die or matrix is forced into the chamber, and the condensing-rod returns; substantially as described.

3. An apparatus for the manufacture of threads or cords of explosive material, comprising a chamber into which a rolled powder-band is introduced in the form of a roll or coil, a stamp having a hollow die or matrix, the condensing-rod, and means whereby the

condensing-rod is inserted through the roll or coil in the chamber in advance of the die or matrix, and working in conjunction with the die or matrix to compress the material in the chamber; the material being forced through the die or matrix when the stamp with the die or matrix is forced into the chamber, and the condensing-rod returns; substantially as described.

4. An apparatus for the manufacture of threads or cords of explosive material, comprising a chamber into which a rolled powder-band is introduced in the form of a roll, or coil, a stamp having a hollow die or matrix, the condensing-rod having a pointed end and means whereby the condensing-rod is inserted through the roll or coil in the chamber, in advance of the die or matrix, and working in conjunction with the die or matrix to compress the material in the chamber; the material being forced through the die or matrix when the stamp, with the die or matrix is forced into the chamber, and the condensing-rod returns; substantially as described.

5. The combination of the support, the pressure-chamber mounted on the support, the upper cylinder, the upper plunger having a piston and an upper cross-head, the stamp having a die and secured to the upper plunger, the lower cylinder, the lower piston or plunger carrying a lower cross-head and a rod surmounting the lower cross-head, the guide-rods secured to the upper cross-head limiting the upper movement of the lower plunger, and extending through the lower cross-head and through the head of the lower cylinder, and means for operating the plungers; substantially as described.

HEINRICH HOFFMANN.

Witnesses:

EMIL KATTNECKER,
FRIED. ABEL.