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G. W. BELL.

PROCESS FOR THE PRESSING OF LONG GUNCOTTON BLOCKS.

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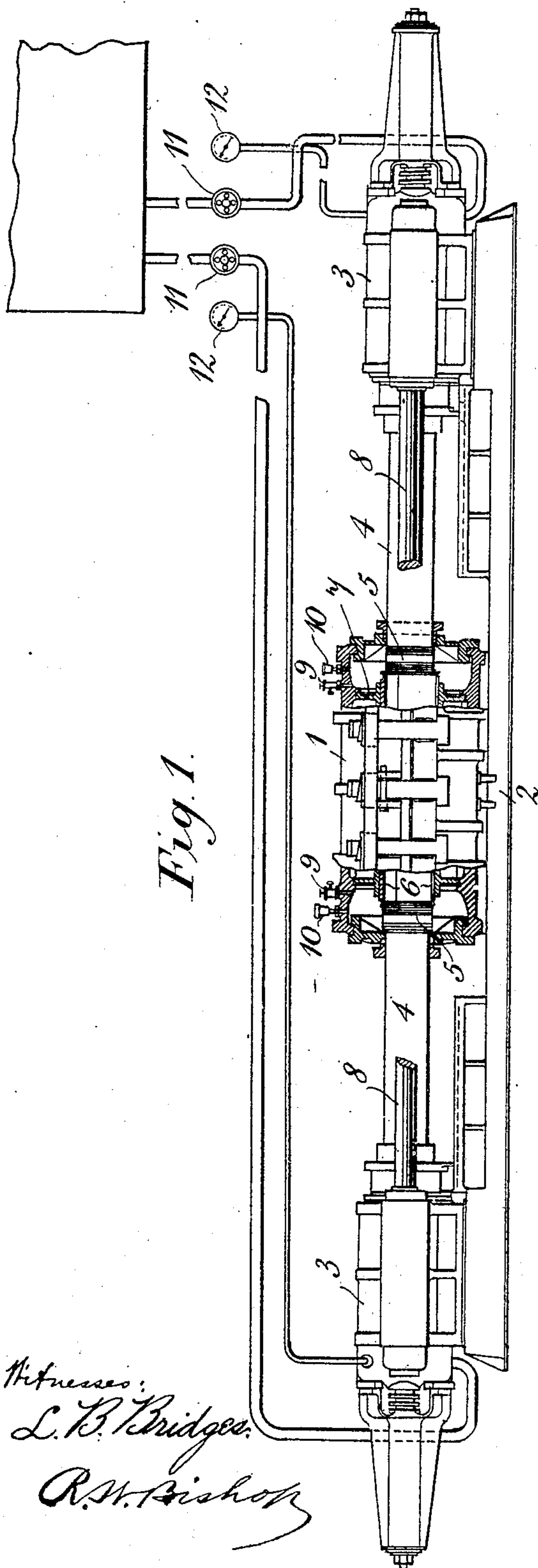


Fig. 1.

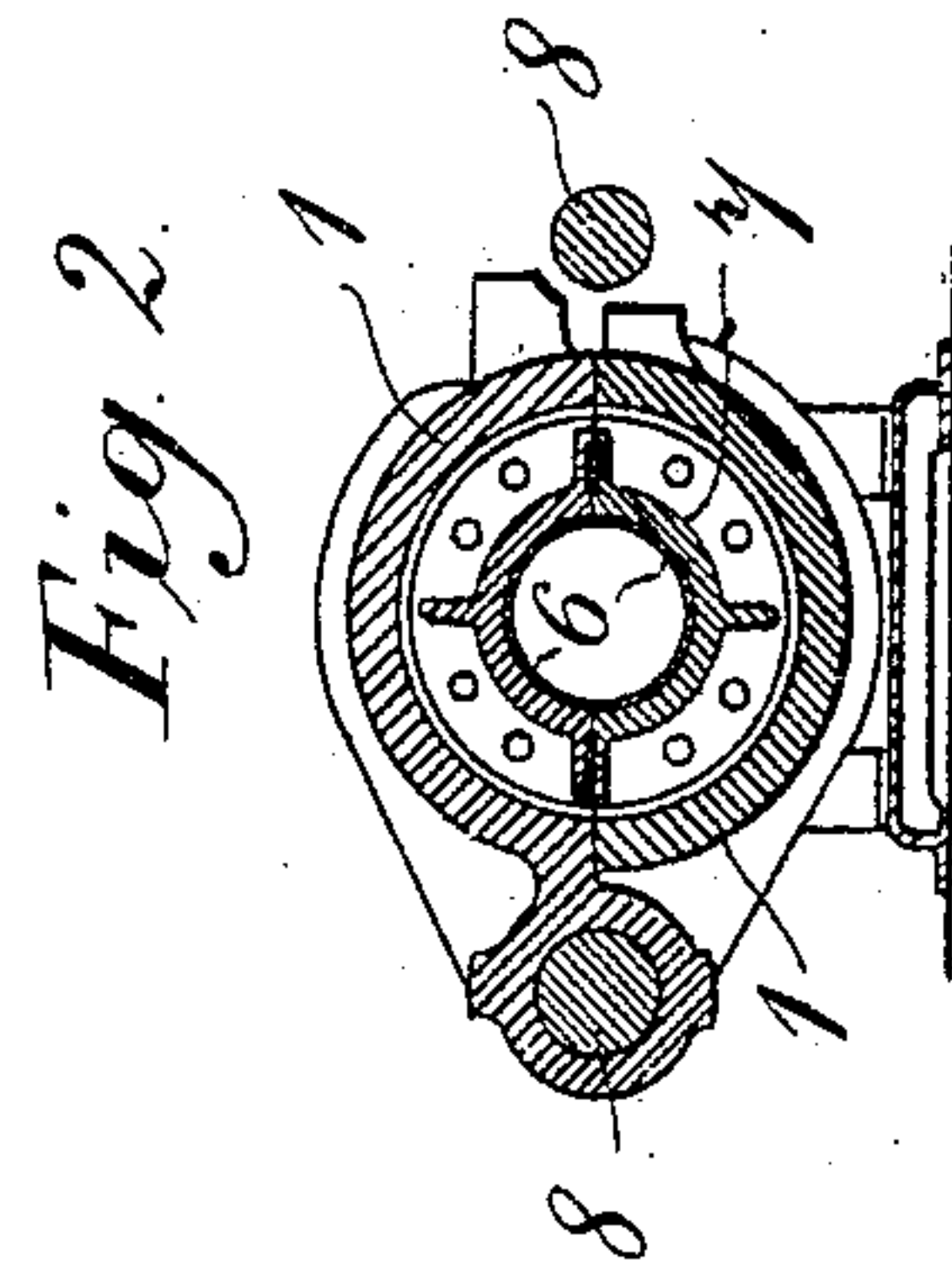


Fig. 2.

Witnesses:
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UNITED STATES PATENT OFFICE.

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PROCESS FOR THE PRESSING OF LONG GUNCOTTON BLOCKS.

No. 835,297.

Specification of Letters Patent.

Patented Nov. 6, 1906.

Application filed March 22, 1906. Serial No. 307,441.

To all whom it may concern:

Be it known that I, GEORGE WILSON BELL, a subject of the King of Great Britain and Ireland, residing at Hayle, in the county of Cornwall, England, have invented a Process for the Pressing of Long Guncotton Blocks, of which the following is a specification.

This invention has for its object to produce long blocks of guncotton suitable for use as charges for submarine mines, torpedoes, and shells. Except where my method is practiced it is, so far as I am aware, the universal practice to construct such a charge of a number of small blocks of not more than five centimeters in thickness. This building up of the charges rendered the loading or charging of submarine mines, torpedoes, and shells a very tedious and hazardous operation, and, moreover, the charges when built up were unsatisfactory, because the layers of air between the adjacent small blocks considerably retarded the progress of the detonation. It has already been attempted to avoid these disadvantages by compressing guncotton into large blocks each of sufficient length in cross-section to form a charge, the process employed being to compress an already preparatorily-formed block by acting upon it by a hydraulic ram at only one end in a mold, the other end of which was closed. These attempts were, however, unsuccessful inasmuch as the blocks produced did not possess the necessary uniformity of density and uniformity of moisture, it being found that each block produced was much denser at the end that had been the nearer to the ram than at the other end, which latter besides being considerably too moist was so soft that it had to be cut away when the other end had been compressed to the required degree of density and moisture or even beyond the degree of moisture regarded as safe. Uniformity of moisture in such a block is necessary, because if the amount of moisture be too small at any part the block will be unsafe, it being well established and usually required by governments that the percentage of water should not be less than eighteen, and, on the other hand, if there be excess of water at any part of the charge the detonation will under ordinary priming conditions be incomplete.

Uniformity of density is necessary in the case of a charge of a locomotive-torpedo in order that the proper balance of the torpedo

containing it may be maintained when submerged, for the successful delivery of such a torpedo depends on very delicate adjustments of weights and propelling and guiding apparatus, so that a difference in weight between the ends of a torpedo charge might well be sufficient to render the torpedo useless unless that difference in weight were known beforehand and the proper allowance were made for it in the manufacture and adjustment of the torpedo, which would be impossible, or at least very difficult, and such a procedure would be so expensive as to interfere materially with the employment of locomotive-torpedoes.

Now by means of the present invention it is easy to produce a long block of guncotton that is suitable for the purposes mentioned and is practically uniform in moisture and density from end to end, differing therein no more than from one-half to one per cent. between one end and the other, whereas a block made according to the process previously employed would differ as much as seven or eight per cent., and the new process is attended by the advantage that the manufacture is effected with much less danger to life than the process hereinbefore referred to, wherein even to produce unsatisfactory blocks such as described pressures had to be employed very much greater than those required to produce uniform blocks according to the present invention.

The process will be described with the aid of the accompanying drawings, which represent apparatus suitable for the carrying out thereof, Figure 1 being a sectional side elevation of the apparatus and Fig. 2 a cross-section thereof.

The apparatus comprises a horizontal receiver 1, fixed to a base 2, to which are also fixed the cylinders 3 of two hydraulic arms 4. The rams 4 are provided with heads 5, that fit within a mold 6, which is held by liners 7 centrally within the receiver 1. To facilitate the insertion and the removal of the mold 6, containing the charge, the upper part of the cylindrical portion of the receiver 1 is hinged to the lower part, one of the rods 8, by means of which the two hydraulic cylinders 3 are secured together, serving as a hinge-pin and means being provided at the other side of the receiver for fixing the upper and lower parts of the receiver together in their position of closure, all as described in the specification of

my application for Letters Patent, Serial No. 202,280. The mold 6 and the liners 7 are perforated, so that the interior of the mold communicates with the surrounding portion of the interior of the receiver 1, which is provided with means for securing water-tight joints between its parts and between it and the rams 4 and also with means for supplying it with water and with cocks 9 for allowing of the escape of air and with cocks 10 for preventing the escape of water until a given pressure is attained, all as described in the aforesaid specification.

A preparatorily-formed block of guncotton of, say, one meter and three-quarters in length and contained within the mold 6 (in which it has preferably been formed in accordance with the specification of my application for Letters Patent, Serial No. 212,432) is placed within the receiver 1, in which when it is closed water-tight, as described in the specification of my application, Serial No. 202,280, the mold is held centrally by the liners 7. The heads 5 of the hydraulic rams 4 being located outside the mold 6, the interior of the receiver 1 is filled with water, which is confined therein as soon as water issues from the air-cocks 9, showing that air has been expelled from the receiver. The rams 4, the cylinders 3 of which are preferably connected to a common source of water under pressure, are now caused to move toward each other slowly and to exert upon the ends of the block a gradually and slowly increasing pressure. It will be seen that water has been shut in between each ram and the adjacent end of the charge, so that as the ram is moved inward it first forces that water into the charge and causes the water to permeate the charge so as to drive out therefrom any air that might have been contained therein and cause it to pass out of the mold into the upper part of the interior of the receiver, so that there is secured for the block freedom from air, which is extremely important from the point of view of danger, as will be seen from the fact that whereas in the compression of small blocks of guncotton of about four centimeters in thickness which are not properly free from air it is usual in government factories to employ a pressure of over a thousand kilograms per square centimeter in effecting in the manner and by means of the apparatus shown, whereby the whole of the air is got rid of as described, the compression of large blocks of guncotton each suitable for a torpedo charge, the pressure required is only about two hundred and seventy-five kilograms per square centimeter, so that the risk of explosion, which increases with every kilogram of pressure employed, and consequently the danger of loss of life, are very greatly reduced. By applying the pressure gradually and slowly, as above set forth, the escape of the water from the inte-

rior of the block is facilitated and opportunity is given for the particles at the interior of the block to move in response to the end pressure, so as to enable the block to be condensed with substantial uniformity. The maximum pressure, which may be about two hundred and seventy-five kilograms per square centimeter, as above indicated, is exerted when the block has been reduced almost to the desired degree of density and moisture and the rams have almost reached their inmost positions, the block having then a length of about a meter and a quarter. As the maximum pressure or slightly less is preferably maintained for a minute or two, the rams naturally move forward slightly after the maximum pressure is reached. After the block has been compressed to the desired extent pressure is maintained for about half an hour to a sufficient degree to prevent the expansion of the block, which might otherwise occur.

As above stated, the preliminary formation of the block is preferably effected according to the specification of my application for Letters Patent, Serial No. 212,432, and consequently, as such formation takes place with the mold vertical, the density of the block in its preparatory condition is slightly greater at the end which was the lower in the forming operation than at the other end. Consequently if the rams were allowed simply to adjust themselves the pressure at the denser end would attain a given intensity sooner than that at the other end of the block, and accordingly I prefer to regulate by hand and independently the supply of pressure-water to the cylinders 3, so that the ram at the end of the block of less density is moved rather faster than the ram at the other end in order to bring about substantial equality of pressure at the two ends as quickly as practicable. I find that by so regulating the pressures of the rams I secure greater uniformity of density and moisture than by allowing the rams to adjust themselves automatically. To enable this independent manual regulation to be effected, I provide the cylinders 3 with valves 11 for regulating the supply of pressure-water thereto and with pressure-gages 12 in proximity to the valves.

Although the receiver has been described as provided with means for closing it water-tight and making water-tight joints between it and the rams, as is preferred, the invention may be carried out in a receiver otherwise constructed. Moreover, although the receiver has been shown as incapable of rotation and being hinged to facilitate the insertion and the removal of the mold the cylindrical portion of the receiver might be made in one piece and mounted so that it could be turned about a vertical axis to facilitate the insertion and the removal of the mold. The

receiver must, however, be stationary or fixed as regards motion toward or away from either of the cylinders 3.

What I claim is—

5 1. The method of compressing long gun-cotton blocks consisting in causing a charge to be held in a stationary receiver and causing two rams acting on opposite ends of the charge to move toward each other or inward
10 slowly and with a pressure that increases very gradually until the rams have almost reached their inmost positions.

2. The method of compressing long gun-cotton blocks consisting in causing a charge
15 to be held in a stationary receiver, causing two rams acting on opposite ends of the charge to move toward each other or inward slowly and with a pressure that increases very gradually until the rams have almost
20 reached their inmost positions, and at the same time so regulating the supply of pressure liquid to actuate said rams as to render the pressures on the ends of said block more nearly equal at given points of their strokes
25 than, owing to initial difference of density between the two ends of the block, would be the case were the cylinders of the rams to be both in free communication with a common source of pressure liquid.

30 3. The method of compressing long gun-cotton blocks consisting in causing a charge to be held in a stationary receiver, causing two rams acting on opposite ends of the charge to move toward each other or inward
35 slowly and with a pressure that increases very gradually until the rams have almost reached their inmost positions, and after the block has been compressed to the full extent retaining pressure on the ends of the block
40 for a considerable time to a sufficient degree to prevent expansion that would otherwise be liable to occur.

4. The method of compressing long gun-cotton blocks consisting in causing a charge
45 to be held in a stationary receiver and causing two rams acting on opposite ends of the charge to move toward each other or inward simultaneously and slowly and with a pressure that increases very gradually until the
50 rams have almost reached their inmost positions.

5. The method of compressing long gun-cotton blocks consisting in causing a charge to be held in a mold in a stationary receiver
55 adapted to prevent the mold from moving longitudinally therein and further causing two rams acting on opposite ends of the charge to move inward or toward each other slowly and with a pressure that increases
60 very gradually until the rams have almost reached their inmost positions.

6. The method of compressing long gun-cotton blocks consisting in causing a charge to be held horizontally in a mold in a sta-
65 tionary receiver adapted to prevent the

mold from moving longitudinally therein and further causing two rams acting on opposite ends of the charge to move horizontally inward or toward each other slowly and with a pressure that increases very gradually until
70 the rams have almost reached their inmost positions.

7. The method of compressing long gun-cotton blocks consisting in causing a charge to be held horizontally in a mold in a sta-
75 tionary receiver adapted to prevent the mold from moving longitudinally therein, causing two rams acting on opposite ends of the charge to move horizontally and longitudinally inward or toward each other simul-
80 taneously and slowly and with a pressure that increases very gradually until the rams have almost reached their inmost positions, and after the block has been compressed to the full extent retaining pressure on the ends
85 of the block for a considerable time to a sufficient degree to prevent expansion that would otherwise be liable to occur.

8. The method of compressing long gun-cotton blocks consisting in causing a charge
90 to be held horizontally in a mold in a stationary receiver adapted to prevent the mold from moving longitudinally therein, causing two rams acting on opposite ends of the charge to move horizontally and longitu-
95 dinally inward or toward each other simultaneously and slowly and with a pressure that increases very gradually until the rams have almost reached their inmost positions, at the same time so regulating the supply of
100 pressure liquid to actuate said rams as to render the pressures on the ends of said block more nearly equal at given points of their strokes than, owing to initial difference of density between the two ends of the block,
105 would be the case were the cylinders of the rams to be both in free communication with a common source of pressure liquid, and after the block has been compressed to the full extent retaining pressure on the ends of
110 the block for a considerable time to a sufficient degree to prevent expansion that would otherwise be liable to occur.

9. The method of compressing long gun-cotton blocks consisting in causing a charge
115 to be held in a stationary receiver and causing two rams acting on opposite ends of the charge to move toward each other or inward slowly and with a pressure that increases very gradually until the rams have almost
120 reached their inmost positions, a body of water being initially confined between each ram and the adjacent end of the block so that as the rams move toward each other the water will be forced into and throughout the
125 body of the block and thus positively force out any air confined in the interstices thereof.

10. The method of compressing long gun-cotton blocks consisting in causing a charge to be held in a stationary receiver, causing
130

two rams acting on opposite ends of the charge to independently move toward each other or inward slowly and with a pressure that increases very gradually, and after the
5 block has been compressed to the full extent retaining pressure on the ends of the block for a considerable time to a sufficient degree to prevent expansion that would otherwise be liable to occur.
10 11. The method of compressing long gun-cotton blocks consisting in causing a charge to be held horizontally in a mold in a stationary receiver adapted to prevent the mold from moving longitudinally therein,
15 causing two rams acting on opposite ends of

the charge to move independently horizontally inward or toward each other simultaneously and slowly and with a pressure that increases very gradually, and after the block has been compressed to the full extent retaining pressure on the ends of the block for a considerable time to a sufficient degree to prevent expansion that would otherwise be liable to occur. 20

Signed at Falmouth this 7th day of March, 25
1906.

GEORGE WILSON BELL.

Witnesses:

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W. H. DANIELL.