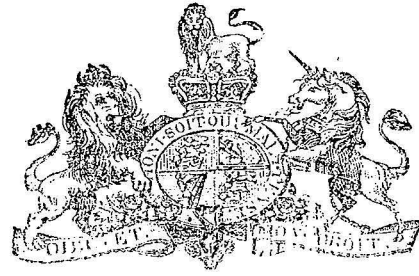


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M/C for the Manufacture  
of GP  
Patent 3937 1815  
Wm. Congreve



A.D. 1815 . . . . . N° 3937.

**Machine for the Manufacture of Gunpowder.**

**CONGREVE'S SPECIFICATION.**

TO ALL TO WHOM THESE PRESENTS PRESENTS SHALL COME, I, Colonel Sir WILLIAM CONGREVE, Baronet, of Parliament Street, in the City of Westminster and County of Middlesex, send greeting.

5 WHEREAS His most Excellent Majesty King George the Third did, by His Letters Patent under the Great Seal of His United Kingdom, bearing date at Westminster, the Third day of July, in the fifty-fifth year of His reign, give and grant unto me, the said Sir William Congreve, my exors, admors, and assigns, His especial license, full  
 10 power, sole privilege and authority, that I, the said Sir William Congreve, my exors, admors, and assigns, during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick-upon-Tweed, my Invention of "A NEW MODE OF MANUFACTURING GUNPOWDER;" in  
 15 which said Letters Patent there is contained a proviso, that if I, the said Sir William Congreve, shall not particularly describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, and cause the same to be inrolled in His Majesty's High Court of  
 20 Chancery within six calendar months next and immediately after the date of the said Letters Patent, that then the said Letters Patent, and all liberties and advantages whatsoever thereby granted, shall utterly

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cease, determine, and become void, as in and by the said Letters Patent, relation being thereunto had, may more fully and at large appear.

**NOW KNOW YE**, that in compliance with the said proviso, I, the said Sir William Congreve, do hereby declare that the nature of my said Invention, and the manner in which the same is to be performed, 5 are particularly described as follows (that is to say):

In the first place, as the due mixture of the ingredients of gunpowder, namely, saltpetrè, sulphur, and charcoal, is of the utmost importance in producing the strength of the compound, and as at present little pains are taken in the first mixture before the com- 10 position is placed under the runners, I have invented a machine for this purpose, to bring the operation to as great perfection and certainty as possible, in the first instance. This machine is thus constructed:—Three hoppers, for the three ingredients, are fixed in a frame close together in a horizontal line, and a cylindrical brush, either 15 of hair, wire, or any other suitable material, about three inches in diameter and six or eight inches long, is then fitted on an axis into an oblong apperture of the same dimensions in the bottom of each hopper. On the cylindrical brush the composition in the hopper rests, so that when the brush is made to revolve on its axis the compo- 20 sition will be drawn out in a fine stream, of the same breadth as the brush, and on the same principle as cotton thread is drawn by the revolutions of the rollers in the cotton mill, the quantity of the stream being adjusted by the closeness with which the cylinder is fitted to the apper- 25 ture of the hopper. With this arrangement it follows, therefore, that the quantity of composition drawn out in a given time depends upon the number of revolutions made by the roller in that time, and consequently any required proportions of the different ingredients may be drawn from each different hopper, according to the proportionate 30 velocities with which the brush rollers are made to revolve; and these being regulated according to the due proportions required for gunpowder, and their motions being sustained by any mechanical action, we have thus the means of keeping up streams of the three ingredients, having the proportionate quantity of each exactly what is required. This, therefore, is the first part of the process. Again, beneath these 35 hoppers and rollers, on the same frame, a broad endless band of leather,

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canvas, or any other suitable material is fixed on rollers, so as to have a continued horizontal motion sustained by the same action as supports the motion of the discharging rollers of the hopper, and on this band so in motion are received the three proportionate streams of composition  
5 above described as issuing from the three hoppers. In proportion, therefore, as the velocity of this band's motion is increased with respect to the velocity of the issuing streams, so will these streams be reduced in thickness, drawn out by this second process, and carried away upon  
10 the band in lamina thinner and more attenuated than as they issue from the hoppers. It follows, therefore, as the band passes with the same velocity under each of the hoppers, that it will be covered with a stratum of composition composed of the three ingredients, uniting upon the band in the due required proportions, and attenuated by a sufficient  
15 velocity in the band, so as to bring the falling particles of each ingredient into a due and almost mathematical juxtaposition with those of the other two, and in the predetermined proportions, regulated by the velocity of the extracting rollers. It is almost needless to add that the combination of particles thus collected is detached from the band where it turns over the end roller, and is there gathered into a single  
20 receiver. In this way every mill charge may be mixed separately, or in greater quantities, according to the size of the apparatus; and although the mixture thus obtained may be considered as nearly perfect, still as a few small lumps will sometimes escape the revolving brushes, I have considered it adviseable to pass the composition from  
25 this receiver through another machine, for the purpose of breaking down any such irregularities, and for the more complete incorporation of the ingredients.

This second machine is somewhat similar, but consists of a single  
30 hopper only, having a large cylindrical brush at the bottom of it, the lower part of which acts against a fine wire sieve embracing half the brush. By this means the contents of the hopper, consisting of the compound of ingredients united as above described, are forceably driven thro' the sieve and reduced to the finest powder, so as by a few repetitions of the process completely to remove any imperfections that may  
35 remain after the first mixture. The repetition of this operation to any desired extent in one continual process I have effected by letting the

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contents of the hopper fall into the inside of a vertical drum fitted with ledges, this drum working round the hopper, so that when revolving it carries the composition received from the hopper at the bottom round to the top, and drops it back into the hopper again from the ledges as fast as it issues, and for as long a time, or as frequent repetitions of its passing through the hopper, brush, and sieve, as may be wished by keeping the machine at work. Such, therefore, is the process of mixing, which I adopt previously to working the powder under the runners; and as the great end of the working under the runners is the due mixture and incorporation of the ingredients, it follows that much of this operation which, from the present imperfect mode of previous mixture, is tedious, laborious, expensive, and dangerous, may be saved by the simple, secure, and easy previous admixture here provided for. Indeed, it is difficult to say with the present experience to what extent the latter of these operations may not ultimately be substituted for the former.

We now proceed to the press house, where, instead of the present mode of throwing the mill cake under the press as it comes from the mill, by which means large intervals are left in the mass, so as to form a very soft and brittle cake in the parts near those intervals, the mill cake is first broken down by passing it through brass rollers with coarse teeth, by which it is brought into such a state that it can be distributed so regularly in the press as cannot fail to produce an equal and thoroughly well pressed cake. Instead, also of being laid between a few copper plates, as at present, so as to turn out from under the press in cakes of two and an half or three inches in thickness, it is laid with much nicety between an increased number of plates at gauged distances, so as to turn out in cakes, the average thickness of which does not much exceed one eighth of an inch. It is needless to say that a much more regular and uniformly pressed cake is thus produced. But the object of this arrangement does not rest here: It anticipates an entire new mode of granulating the powder, by which not only the danger of the corning house is obviated, but many other imperfections attaching to the present system of granulation avoided. The new granulating machine, therefore, for which the pressed cake is thus prepared, is formed as follows:—It consists of three parts, which are placed in three distinct rooms, one prin-

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cipal and two adjoining rooms, having a strong brick wall between them to act as a traverse to each. In the principal or middle room of the three the actual granulating apparatus is placed. In the first of the adjoining rooms is contained a large hopper, in which  
5 the pressed cake is brought and deposited, half or at most a whole barrel at a time, to supply the machine in the second or middle room, while the third room contains a bin, into which the powder passes as fast as it is granulated in the second, and is thence carried away at stated periods to a store magazine to prevent any accumu-  
10 lation.

The general arrangement being thus explained it is now necessary to describe the different parts of the machine. The granulating machine itself, in the middle room, consists of setts or pairs of brass rollers, above two feet six inches in length, and two inches, more or  
15 less, in diameter, supported in the middle, and divided into teeth, as will hereafter be more particularly described, each pair working together by means of a pinion or nut at the end of each roller, so that they draw inwards, like the rollers of a flattening mill or those of a cotton mill. The teeth of these rollers are of different degrees of fineness, and  
20 they are set at different distances, the coarsest so far apart as readily to draw in the thin pressed cake above described. Now these pairs of rollers are set in a strong frame or cast iron or wood, about six feet high and eight or ten feet long, more or less, so that the upper and coarser pair are at the top of the frame about eighteen inches or two  
25 feet higher than the other pair; they are then connected, either by a double crank, or a rod and pinion, or any other way, so that when one pair is set in motion by the principal mover of the machine, whatever it may be, water, or horse, or any other power, the other pair will also move; and they are moreover so arranged, whether in a direct  
30 position over one another or obliquely placed, that whatever passes through the upper or coarser pair shall pass also through the finer or lower pair. Now the teeth of the coarser pair of rollers are so constructed that the thin press cake being brought gradually into a hopper surmounting these rollers, is immediately drawn through them and  
35 broken into irregular fragments or heads, which fragments again passing through the lower or finer rollers are finally and at once reduced

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into the most perfect grains of every different size required, which are separated in one operation by falling from the lower pair of rollers upon a series of wire sieves, calculated according to the different sized grains required. These sieves being of a sufficient length, from four to six feet, more or less, are placed obliquely, and kept in motion by the 5 common mover, so that the different grains pass from top to bottom of the sieves in the act of separation, which at the same time cleans the powder from the dust.

Now these different sorts of powder and their dust, having thus been separated and carried to the bottom of the sieves by their motion and 10 obliquity, are from each respective sieve delivered into flat funnels, which dispose of each sort upon a horizontal endless band of canvas or other material running from the foot of the granulating machine in a flat trunk through the traverse wall into the bin above mentioned, as being provided in one of the adjoining rooms for receiving the powder 15 when granulated, there being as many bands and as many compartments in the bin as sorts of powder, including the dust, and these bands being kept in constant motion by the first mover, so as to carry off every grain of powder and dust as fast as it is formed, and thereby prevent any accumulation about the machine in the act of granulation. 20

It remains now only to describe how the machine is fed with the cake, that also being done by a mechanical process, to prevent the necessity of any person being near the machine when actually at work. This is, in fact, performed by nearly the same operation as that by which the powder is carried off after it is grained, that is to say, by 25 bands of canvas or any other material passing from the hopper into the outer room through the traverse wall into the hopper over the upper set of granulating rollers in the middle room. These bands, however, are stronger, more tightly strained, and have cross straps of leather, or cords, or small rods, sewed flat or otherwise attached upon them, 30 every nine or ten inches, to raise the cake out of the hoppers, the back of which, being placed at an angle of forty-five degrees of inclination, and the band moving up that back, the cake, although thrown indiscriminately into the hopper, is, nevertheless, drawn out of it in single pieces, the surplus not actually raised and supported by the cross straps 35 on the band falling or sliding back from the great inclination at which

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the strap moves in its progress up the back of the hopper ; having surmounted which, however, with its due load, namely, covered with a single layer of cake, it takes a horizontal course through the traverse wall until it reaches the edge of the hopper of the granulating machine, and there falls in regular quantities between the upper set of rollers for granulation, as already specified. It is almost needless to say that these feeding banks are also kept in a constant uniform action by the common moving power, and I believe the only remaining details of the machine necessary to be described is the form of the teeth of the rollers. They are of various sorts, either grooved horizontally, so as to bring the teeth to sharp edges, or in spiral grooves, and either cross cut or not into rings, leaving void spaces between them equal in breadth to the rings of teeth themselves, and so arranged on the reciprocal rollers that the rings of teeth on the one roller shall work into the void spaces of the other, and vice versâ, but no part of the rollers or teeth actually touching in any case. Thus arranged, the teeth never clog. Here, also, it must be stated that the teeth of the large rollers in the press house for breaking down and preparing the mill cake are formed on similar principles to those of the granulating roller, only coarser, in proportion as the mill cake is thicker than the press cake.

The advantages of this granulating machine are numerous. In the first place, the whole operation being, as above described, performed by mechanical means, requiring no person to be present in either of the rooms, except at the moment of the discharging the powder from the bin, and of replacing the cake in the hopper, which is performed at the same time, during which the machine is stopped, and, moreover, as no accumulation can take place in any part, it follows that there is no personal danger to any one, neither can any serious mischief happen to the machine itself with the traverse walls if the quantity of cake put in at each chargè be limited, as above stated, to a barrel at a time. The small quantity which can ever exist in the principal room protects the machine itself, while the adjoining buildings, being of a slight and temporary nature, an explosion with the quantity limited would be of little consequence, no persons being, as before stated, required in the building when the work is going on.

The next great advantage of this machine is, the extraordinary



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quantity of work of which of which it is capable with a very moderate power. From the very nature of the machine working so much by mechanical means, it is evident that very few persons are required to attend it; and when it is stated that a machine of the dimensions above mentioned has been found capable of making upwards of six barrels of 5 powder in an hour, the saving of labour and power, and its consequent economy, must be self evident to all persons at all conversant with the present mode of corning. But the economy does not rest here. The proportion of dust to grain made in this machine is not much above one thirtieth, whereas in the common mode it is full one half; so that 10 independent of the quantity of material absolutely lost in the old mode in dust, such is the great proportion of dust to grain produced, that on an average every barrel of powder manufactured may be said to be pressed twice over, besides which a considerable portion of this dust is obliged to be re-worked under the runners, whereas it is evident 15 that the small quantity of dust produced in the machine is hardly worthy of a consideration as to the pressing, and can leave none to be re-worked under the runners.

But there are other advantages not to be passed over. In the first place, the grain is more uniform and more dense from being made out 20 of the thin cake. In the next place, it contains more smooth and less broken surface, from the same cause, and is, therefore, on both these accounts, less liable to wear into dust; in addition to which the grain must be cleaner and more free from foreign matter, a considerable quantity of which is collected by friction from the soft substances of the 25 parchment sieves, &c., as well as gathered up with the dust, all of which is evidently avoided by the construction, materials, and mode of operation of this machine.

It remains now only to be stated, that as the preservation of gunpowder from the moisture of the atmosphere is as important to its 30 strength as the due mixture and incorporation of its ingredients, or any other process attaching to it, after having stoved and dusted it, I enclose it in wooden barrels lined with thin metallic linings, either of copper, or lead, or pewter, or any other sufficient substance, so as to form one entire barrel of the exterior and lining, and having an 35 aperture at one end so constructed that the enclosure may be made

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perfect by a luting of bees wax and tallow, or a mixture of rosin and tallow, or any other sufficient luting, this aperture and luting being further secured by a false head to the wooden barrel, so that the powder is thus enclosed in a case perfectly air and water tight,  
 5 the interior of which is compleatly supported and protected by the exterior from being bruised or otherwise injured; and this mode I have found to be much less expensive than any system of barrel made wholly of metal without an exterior of wood, on account of the difference of the quantity and nature of the metallic substances required, while  
 10 the slight lining, as a preservation, is equally efficient as the most expensive metallic case alone can be. For the greater convenience of stowage in particular situations I have substituted rectangular cases, lined with different materials, on the same principle as the barrels. In conclusion, I have but to observe that the different sorts of machines  
 15 here specified may be applicable in a variety of other processes as well as those above specified, and that, whatever these processes may be, the operations and actions of the machines themselves must still be the same as those specified for this Patent.

In witness whereof, I, the said Sir William Congreve, have here-  
 20 unto set my hand and seal, this Second day of January, in the year of our Lord One thousand eight hundred and sixteen.

WILLIAM (L.S.) CONGREVE.

**AND BE IT REMEMBERED**, that on the Second day of January, in the year of our Lord 1816, the aforesaid Colonel Sir William  
 25 Congreve, Baronet, came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of Statute made for that purpose.

30 Inrolled the Second day of January, in the year of our Lord One thousand eight hundred and sixteen.

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JEXILL.