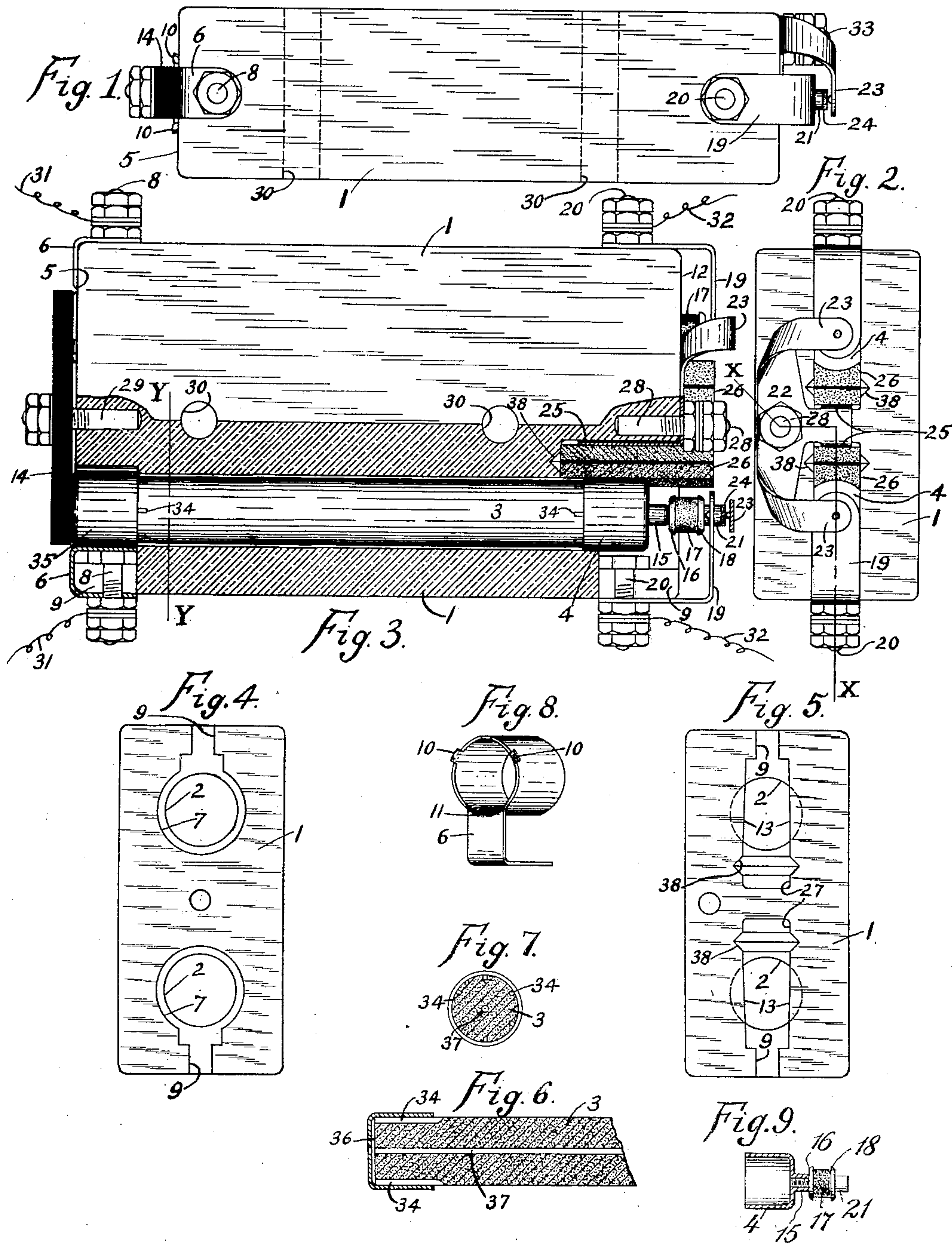


No. 860,016.

PATENTED JULY 16, 1907.

F. B. COOK.  
SUBSTATION PROTECTOR.  
APPLICATION FILED MAY 7, 1906.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## SUBSTATION-PROTECTOR.

No. 860,016.

Specification of Letters Patent.

Patented July 16, 1907.

Application filed May 7, 1906. Serial No. 315,618.

*To all whom it may concern:*

Be it known that I, FRANK B. COOK, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Substation-Protector, of which the following is a specification, reference being had to the accompanying drawings, illustrating same.

My invention relates to protectors for electrical circuits and apparatus, and more particularly to protectors for subscribers' telephone stations, or for use in connection with telephone systems.

The principal objects of my invention are to provide an improved protector comprising a combination of protective devices of distinctly different types; to provide improved means for mounting the several different types of protective devices in the combination; to provide improved means for protecting the protective devices against injury and for confining any injurious effects which may be produced by any of the devices of the combination in their operation; to simplify such a protector by greatly reducing the number of parts; and to provide durability and accessibility in such a protector.

Other objects will be apparent from the following specification.

The protector of this invention comprises a combination of inclosed fuses, thermal protectors, and lightning arresters, adapted and arranged to protect electrical circuits and the apparatus therein from all forms of injurious electricity.

For carrying out this invention I provide a substantial mounting block for carrying the several protective devices, in which they are suitably mounted so as to be nearly entirely inclosed thereby and thus protected from external objects. This arrangement of mounting the several protective devices within the mounting block, which forms a casing for the said devices, gives a very compact protector and one which is very durable and efficient in its operation.

Referring to the accompanying drawings illustrating the preferred form of my invention, Figure 1 is a side elevation of the protector of the invention; Fig. 2 is a right end elevation of Fig. 1; Fig. 3 is a plan view of Fig. 1, with portions shown in cross-section taken on line X X of Fig. 2; Fig. 4 is a left end view of Fig. 1, showing the mounting block only; Fig. 5 is a right end view of Fig. 1, showing the mounting block only; Fig. 6 is a longitudinal cross-sectional view of a portion of the inclosed fuse, showing the vents therein; Fig. 7 is a transverse cross-sectional view of the inclosed fuse, taken on line Y Y of Fig. 3; Fig. 8 is a perspective view of a connection terminal for the inclosed fuse; and Fig. 9 is a cross-sectional view showing the screw connection between a thermal protector and a fuse terminal.

Like characters refer to like parts in the several figures.

The mounting block 1 is made of a heavy piece of insulating material, preferably porcelain. This block 1 is provided with longitudinal bores or openings 2 2 60 therethrough in which are mounted the inclosed fuses 3 3. The bores 2 2 are preferably just large enough to admit the end cap 4 of a fuse 3, the latter being inserted into the block 1 from end 5 thereof. The connection terminals 6 6 are held in the enlarged portions 65 7 7 of the bores 2 2, by suitable mounting bolts 8 8 which are suitably inserted into the slots 9 9. The slots 9 9 are preferably formed to fit the heads of bolts 8 8 and thereby prevent same from turning. Each connection terminal 6 is preferably provided with 70 ears 10 10, slightly bent out, which, with the shoulder portion 11 form suitable guides for the terminal cap 4 when the fuse is inserted into block 1. At end 12 of block 1 there are provided portions 13 13 which extend 75 over portions of each bore 2 to form shoulders adapted to limit the insertion of each fuse 3, by bearing against the end of cap 4, when the fuse is fully inserted. An insulating strip 14 is provided at end 5 of the protector to firmly hold the fuses 3 3 in place within block 1 80 against the shoulder portions 13 13. This arrangement gives a definite position to each end cap 4 of the fuses, relatively to the mounting block 1. Each end cap 4 is provided with a central projecting portion 15 which is threaded internally and adapted to receive the threaded terminal 16 of the thermal protector 17. 85 This screw connection between the thermal protector 17 and the fuse terminal 4 securely holds the thermal protector 17 in a fixed position. The thermal protector 17 comprises a suitable heating element connected in circuit with terminals 16 and 18. Each 90 spring member 19 is preferably mounted to block 1 by a bolt 20, in a manner similar to that described for connection terminals 6 6. The free end of spring 19 is preferably provided with contacts which are adapted and arranged to engage terminal 18 of thermal pro- 95 tector 17. A portion 21 of terminal 18 extends through a hole in the free end of spring 19. Spring 22, which is to be connected to ground when the protector is in use, is provided with portions 23 23 extending over the outer ends of terminals 21 21, respectively. Be- 100 tween each free end portion 23 and its terminal 21 is placed a piece of heat-susceptible insulating material 24 against which the free end portion 23 normally bears. Spring 22 is also provided with portions 25 extending into block 1 preferably as shown, to form 105 ground connections for lightning arresters 26 26. Each lightning arrester 26, preferably comprising the usual carbon blocks with an interposed dielectric, is inserted into slot 27 in block 1 between its ground connection spring 25 and terminal 4 of its adjacent in- 110



closed fuse. One of the carbon blocks makes direct electrical connection with terminal 4 of the fuse. Spring 25 firmly holds the lightning arrester in connection with terminal 4. Along the sides of, and across the inner end of each lightning arrester is provided a V-shaped groove 38 which gives a clearance along the adjacent edges of the carbon blocks to prevent a leakage or short-circuit therebetween, which might be occasioned if the material of block 1 were adapted to snugly fit the adjacent sides of the carbon blocks. The bottom portions of slots 27 27 are formed as suitable stops to limit the insertion of the lightning arresters. Spring 22 is suitably mounted to the porcelain block 1 by bolt 28. Bolts 28 and 29 are preferably cemented in suitable holes in mounting block 1. The mounting block 1 is preferably provided with suitable holes 30 30 therein for mounting same in place. When it is desired to remove the inclosed fuses 3 3 and the thermal protectors 17 17, the insulating strip 14 at end 5 of block 1 is removed and the fuses and thermal protectors pulled from the bores 2 2 at end 5. The lightning arresters 26 26 may be readily removed from end 12 of the protector when desired. The line circuit conductors 31 31 32 32 are preferably connected to the binding posts 8 8 and 20 20 respectively. The main circuit through either side of the protector is from conductor 31, through connection terminal 6, inclosed fuse 3, end cap 4, thermal protector 17, and spring 19, to conductor 32. The lightning arrester 26 is connected from this circuit at end cap 4, through spring 25 22, to earth at binding post 28.

In Figs. 4 and 5 it can be readily seen how the porcelain block is cut away to accommodate the different parts of the apparatus. This construction seems to be perfectly clear without further detailed description.

The fuse 3 is preferably provided with vents 34 34 at each end thereof, as shown in Figs. 6 and 7. The end cap 35, or 4, is tightly secured upon the casing of fuse 3, preferably as shown in Fig. 6, so as to leave a slight air space 36 between the cap and the end of the casing of fuse 3. This air space 36 is connected with the several vents 34 34 which lead to the exterior of the casing 3. The fuse wire is contained in the passage 37.

The casing of fuse 3 is preferably made of a porous material which is adapted to absorb some of the gases formed in the passage 37 when the fuse blows. This form of casing or tube for fuse 3 is described and claimed in my copending application for Letters Patent on non-explosive fuse, Serial No. 315,016, filed May 3, 1906.

When the fuse 3 blows, part of the gases formed in passage 37 are forced through the porous material of the tube or casing, and part are forced out through the space 36 and the several vents 34 34 into the bore 2. In order for these gases to escape from the bore 2 they must pass out around the end caps of fuse 3. Thus it will be seen that the gases which are forced through the vents 34 34 traverse an S-shaped path to get to the exterior of block 1. This winding path for the escaping gases kills any flame which might be emitted from the fuse and allows only a small amount of smoke to pass from the bore 2. In case the casing of fuse 3 should break when the fuse blows, the broken portions

will be held within the bore 2 by the strong block 1. This is quite an advantage in such protectors where inclosed fuses of types which may explode when blown under extremely high voltages, are used.

When a current of electricity above the normal traverses the heat producing member of thermal protector 17 for a sufficient length of time, it produces heat therein which is conducted to the heat-susceptible material 24 by the portion 21. When this heat is sufficient, the heat-susceptible material 24 softens and allows spring 23 to press therethrough and come into electrical connection with the portion 21, thereby connecting the portion 21 to ground. This grounds the line circuit from conductor 31 through fuse 3 and thermal protector 17, and thereby protects the circuit 32 leading from the protector, from the injurious sneak current. When the thermal protector 17 operates as just described, and thereby switches the objectionable current to earth, the abnormal current may increase sufficiently to blow fuse 3 and thereby entirely open the circuit between the line 31 and the apparatus in 32 to be protected. In order to reset the thermal protector for another operation it is only necessary to insert a new piece of heat-susceptible material 24 between spring 23 and portion 21.

In case a high voltage current of electricity, such as lightning, comes in over the line circuit 31, it will pass through the fuse and then through the carbon lightning arrester 26 to ground, generally without blowing fuse 3.

When it is desired to use this protector without the thermal protectors 17 17, the latter may be replaced by blanks or the ends 4 4 of the inclosed fuses may be extended so as to engage the spring members 19 19. In this case spring members 23 23 may be held out of electrical connection with other conducting portions by suitable pieces of insulation.

I do not wish to limit this invention to the particular details of construction as herein shown, as many modifications may be made therein without departing from the principles involved.

What I claim as my invention and desire to secure by Letters Patent is:

1. In a protector of the character described, the combination of a block of insulating material, inclosed fuses contained within the said block, thermal protectors connected in circuit with the respective fuses, lightning arresters inserted into the said block and connected in branches of the respective fuse and thermal protector circuits, and suitable connection terminals for the said apparatus.

2. A single piece of insulating material provided with a bore an inclosed fuse carried within the said bore and provided with suitable connection terminals, a thermal protector electrically connected with and carried by one terminal of the fuse, and means for connecting the said fuse and thermal protector in circuit.

3. A single piece of insulating material provided with a bore an inclosed fuse carried within the said bore and provided with suitable terminals, and a lightning arrester inserted into the said piece of insulating material and electrically connected with one terminal of the fuse.

4. A block of insulating material adapted to be suitably mounted, a bore therein, an inclosed fuse contained in the said bore and provided with suitable terminals, a thermal protector and a lightning arrester electrically engaging one terminal of the fuse, and suitable circuit connections for the apparatus.

5. A block of insulating material, an inclosed fuse mounted within same and provided with suitable terminals, a thermal protector secured to one of the fuse terminals by



screw connection therewith, and a lightning arrester inserted into the said block along side the fuse and engaging a terminal thereof.

5 6. A block of insulating material, an inclosed fuse mounted inside of the said block, a thermal protector mounted in line with the said fuse and electrically engaging a terminal of the latter by screw connection therewith, a lightning arrester inserted into a slot in the said block along side the fuse and electrically engaging a terminal of same, and a V-shaped groove in the said block extending around the lightning arrester.

10 7. A block of insulating material, an inclosed fuse mounted therein, a lightning arrester inserted into the said block and engaging a terminal of the fuse, and a V-shaped groove in the said block extending around the lightning arrester.

15 8. A porcelain block, a bore extending therethrough, an inclosed fuse contained within the said bore, a lightning arrester inserted into the said block and electrically connected with a terminal of the fuse, and a V-shaped groove in the said block extending around the lightning arrester in a plane with the dielectric thereof.

20 9. A protector comprising a block of insulating material, suitable passages in the said block, inclosed fuses and lightning arresters suitably mounted within the said passages, and suitable connection terminals on the exterior surfaces of the said block.

25 10. A block of insulating material, suitable passages therein, inclosed fuses held within the said passages, means for rigidly holding the said fuses in a definite position relatively to the said block, and electro-thermal protectors suitably mounted on portions of the said fuses and electrically connected in circuit therewith.

30 11. A porcelain block adapted to be suitably mounted,

suitable passages extending through same endwise, inclosed 35 fuses within the said passages, means for rigidly holding the fuses in a definite position relatively to the said block, thermal protectors mounted in line with the said respective fuses and electrically connected therewith by screw connection with same, lightning arresters inserted into the 40 said block at one end thereof, between the said fuses and electrically engaging respective terminals thereof, portions of the lightning arresters projecting from the said block, suitable means for switching circuits upon the operation of the thermal protectors, suitable spring engaging means for 45 the several parts of the apparatus, and suitable connection terminals near the ends of the said block, secured within slotted portions of the latter and adapted to receive the circuit conductors.

12. A parallelopipedically-shaped piece of porcelain having two bores therethrough, a pair of inclosed fuses carried within the said bores, suitable connection terminals carried by the porcelain to receive circuit conductors for connecting the fuses in circuit, and holes through the porcelain for mounting the whole to a suitable support. 50

13. An inclosed fuse having a tubular casing and suitable terminals carried by the casing, a lightning arrester arranged so that an electrode thereof engages one of the fuse terminals to make electrical connection therewith, and means for suitably connecting the fuse and lightning arrester as protectors for an electric circuit. 55 60

As inventor of the foregoing I hereunto subscribe my name in the presence of two subscribing witnesses, this 3rd day of May, 1906.

FRANK B. COOK.

Witnesses:

FREDERICK R. PARKER,  
F. W. PARDEE.