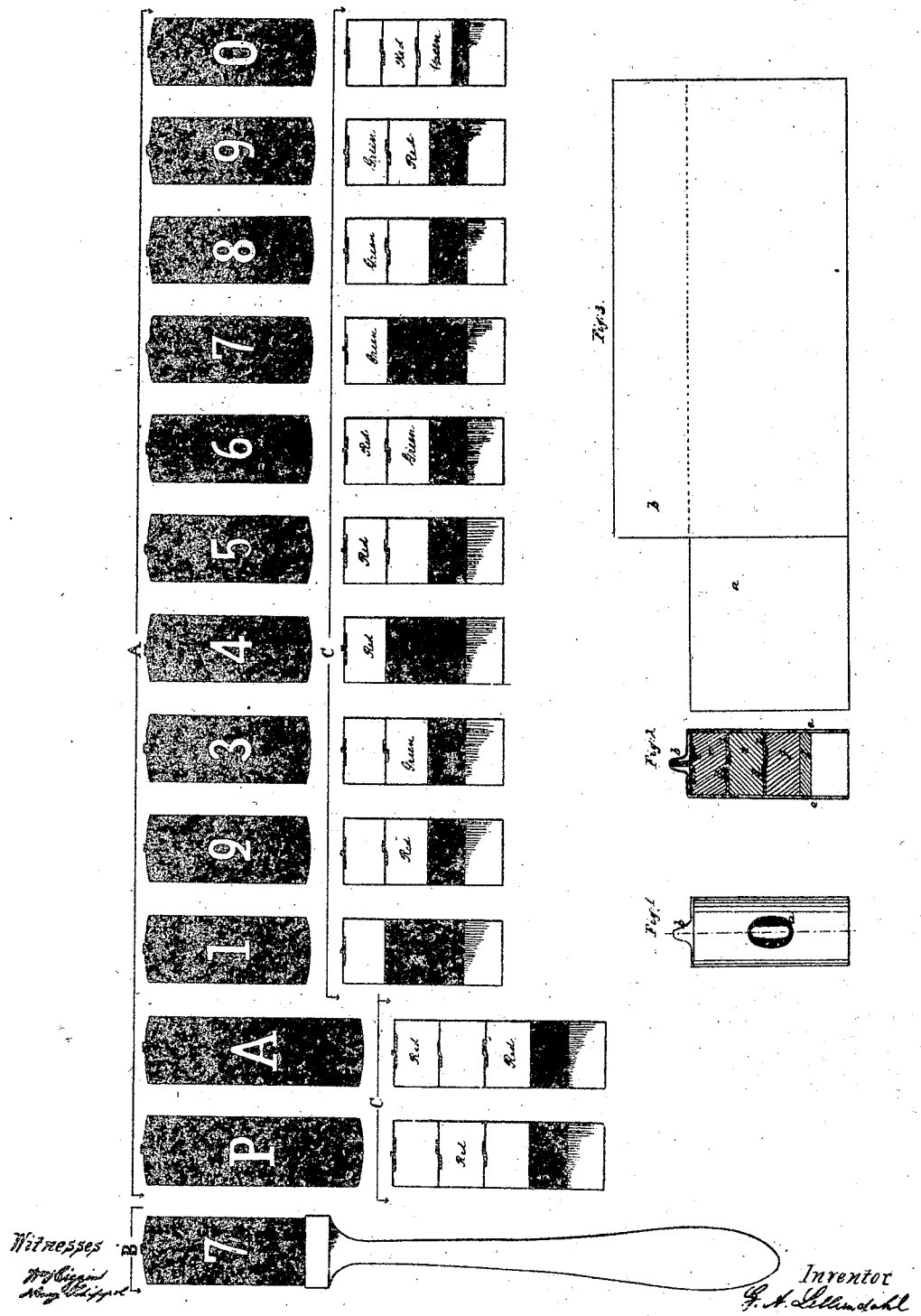
G. A. LILLIENDAHL.

Pyrotechnic Signal.

No. 23,529. Patented Apr. 5, 1859.



UNITED STATES PATENT OFFICE.

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IMPROVED PYROTECHNIC NIGHT-SIGNALS.

Specification forming part of Letters Patent No. 23,529, dated April 5, 1859.

To all whom it may concern:

Be it known that I, GUSTAVUS A. LILLIENDAHL, of the city, county, and State of New York, have invented certain new and useful Improvements in B. Franklin Coston's System of Pyrotechnic Night-Signals, and also in the means and appliances of producing said signals; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings on Sheets 1 and 2, which constitute a portion of this specification.

Figure 1 on Sheet 1 represents the external appearance of one of my improved cases of pyrotechnic composition. Fig. 2 on said sheet is a longitudinal section representing the interior structure of the particular case that bears the mark of the character "O;" and Fig. 3 on the said sheet is a representation of the size and shape of a sheet of tin-foil and a sheet of thin paper placed in the proper relative positions with each other to be rolled upon a mandrel and united by paste into one of my improved tubular cases for the reception of pyrotechnic composition, the in-foil to project above the paper portion of said case a sufficient distance to form when bent inward a protecting water-proof covering for the upper stratum of the aforesaid co osition. Sheet 2 reveals at a glance the meaning of each signal-fire or succession of fires that can be produced by the burning of the contents of any one of my improved cases of pyr technic composition.

Practical tests have demonstrated that the method of putting up the pyrotechnic materials employed in the Coston system of making night-signals is liable to the following objections, viz: First, considerable time is not unfrequently required for the removal of the covers from the stiff boxes which contain the aforesaid pyrotechnic materials; second, the combustion of the thick sides of the aforesaid boxes produces a smoky atmosphere that partially obscures the brilliancy of the flames produced by the burning contents of said boxes; third, there being no separating-partitions between the different layers of pyrotechnic composition in the above-mentioned (Coston) boxes, the different-colored fires produced by the combustion of said layers of composition do not change quickly and distinctly from one to another; and it not unfrequently happens that the direct contact of different layers of pyrotechnic composition exerts an injurious chemical influence upon one or both of said layers.

My improved method of putting up the materials for producing pyrotechnic signal-fires perfectly remedies all of the above-mentioned imperfections in the Coston method of putting up said materials.

The tubular cases *a b* employed by me are all made of the same length—viz., a length that enables three layers *w r g* of pyrotechnic composition, and a bottom layer *f* of some non-combustible composition to be compressed into each case and then leave an open socket in the bottom thereof. Therefore all those cases which are to be respectively charged with but one or two layers of pyrotechnic composition must in the first place have varying quantities of non-combustible composition pressed into them for the purpose of leaving the proper amount of space in the upper portion of each case for the reception of its respective charge of pyrotechnic composition.

The sectional drawings C on Sheet 2 clearly represent the proportions of combustible and non-combustible materials that compose the respective charges of the aforesaid cases, and also the color of the particular fire or fires which will be produced by the combustion of the layer or respective layers of the pyrotechnic composition in each of said cases. The non-combustible portion of the contents of the cases is painted black.

A thin disk of paper *c*, which has a short strip *d* of quick-match inserted in a central aperture therein, is placed between the respective layers of pyrotechnic composition in each case that is charged with two or three layers of said composition, and over the layer of pyrotechnic composition in the upper end of every one of the cases a disk is placed which has a quick-match *e* passing up through an aperture therein, that is protected by the portion of tin-foil *b*, which rises above the paper portion of the sides of each of said cases and is pressed inward upon the said upper disk thereof, substantially as repre-

sented in the drawings on Sheet 1. A strong protecting-socket of suitable size, which has a short mandrel at the bottom of the same, receives each tubular case *a b* during the operation of charging the same beneath a follower, which is operated by means of powerful leverage.

My improved cases of pyrotechnic composition may be painted and varnished for the purpose of preserving the paper portion of each case.

The socket at the bottom of each of my improved cases of pyrotechnic composition enables them to be readily placed upon the end of a handle, by which the said cases can be held in any desired position at the time of firing the contents of the same.

The aforesaid improved cases (for the reception of various pyrotechnic compositions for the production of signal-fires) being composed of thin paper and tin-foil, no one of said cases contains a sufficient quantity of paper to produce any perceptible discoloration of the atmosphere about the same while the said case and its contents are being consumed. The tin-foil portion of said cases will of course melt down out of the way as rapidly as the contents of the cases are reduced by combustion. The case to be fired having been placed upon a suitable handle or holder, the tin-foil can be easily removed from the match *e* of said case for the purpose of applying fire thereto. The instant that the fire reaches the pyrotechnic composition the combustion which will ensue will instantly throw off the disk and the tin-foil covering from said composition and allow it to burn freely. In those cases which are charged with two and three separated layers of composition the fire will communicate from an upper to a lower layer thereof by means of the match *d*, which descends through the separating-disk *c*, and the instant that the said lower stratum of composition is fired the aforesaid disk *c* and everything above it will be thrown off, thereby producing a clear, distinct, and palpable transition from the fire produced by an upper stratum of composition in a case to that which succeeds it, and so on to the fire produced by the last stratum of composition in a case.

Having discovered by my experiments that a green pyrotechnic fire can be seen more distinctly at a great distance than a blue fire, I have substituted a green fire for the blue fire which is employed in the Coston system of night-signals. I have also made a more systematic arrangement of the materials in the several cases for the three signal-fires employed in my improved system of displaying night-signals—viz., in such a manner that the first color of a signal-fire will direct the attention of the observer to a particular portion of the signal-chart for the signification of said fire, either by itself or when taken in connection with the fire or fires that may immediately succeed the same.

The three first numerals 1 2 3 are expressed as follows: No. 1, by a single white fire; No. 2, by a white fire changing to a red fire; No. 3, by a white fire changing to a green fire. The three succeeding numerals 4 5 6 are expressed in the following manner: No. 4, by a single red fire; No. 5, by a red fire changing to a white fire; No. 6, by a red fire changing to a green fire. The three succeeding numerals 7 8 9 are expressed as follows: No. 7, by a single green fire; No. 8, by a green fire changing to a white fire; No. 9, by a green fire changing to a red fire. The character 0 is expressed by a white fire followed in immediate succession by a red fire and then a green fire. A white fire followed in immediate succession by a red fire and then a white fire, produced by burning the contents of the case which is marked P, indicates that the vessel or person exhibiting said signal is desirous to communicate with some other vessel or person by signals, and a red fire followed in immediate succession by a white fire and then a red fire, produced by burning the case marked A, is the answer to the aforesaid signal, expressing a readiness to answer signal by signal.

Having thus fully described my improvements on B. Franklin Coston's system of pyrotechnic night-signals, and also in the means and appliances for producing the same, what I claim therein as my invention, and desire to secure by Letters Patent, is—

1. Inclosing the necessary charges of pyrotechnic composition for producing signal-fires within cases whose sides are composed of thin paper and tin-foil, substantially as herein set forth.

2. Separating the respective layers of composition in the above-mentioned cases by means of thin partitions or disks, substantially as herein set forth.

3. Charging the aforesaid cases with such proportions of combustible and non-combustible materials as will allow the cases to be all made of the same length, and also enable a socket to be formed at the lower end of each of said cases, substantially as herein set forth.

4. So proportioning the paper and tin-foil portions of the aforesaid cases that a sufficient portion of the tin-foil will project above the stiff sides of each of said cases to form when bent inward a metallic covering for the top of the same, substantially as herein set forth.

The above specification of my improvements in pyrotechnic night-signals signed and witnessed this 1st day of February, 1859.

G. A. LILLIENDAHL.

Witnesses:
Z. C. ROBBINS,
J. QUINCY ADAMS.