(No Model.) 2 Sheets—Sheet 1.

W. L. VOELKER.

PROCESS OF MANUFACTURING FILAMENTS AND MANTLES FOR INCANDESCENT GAS LIGHTING.

No. 587,026. Patented July 27, 1897.

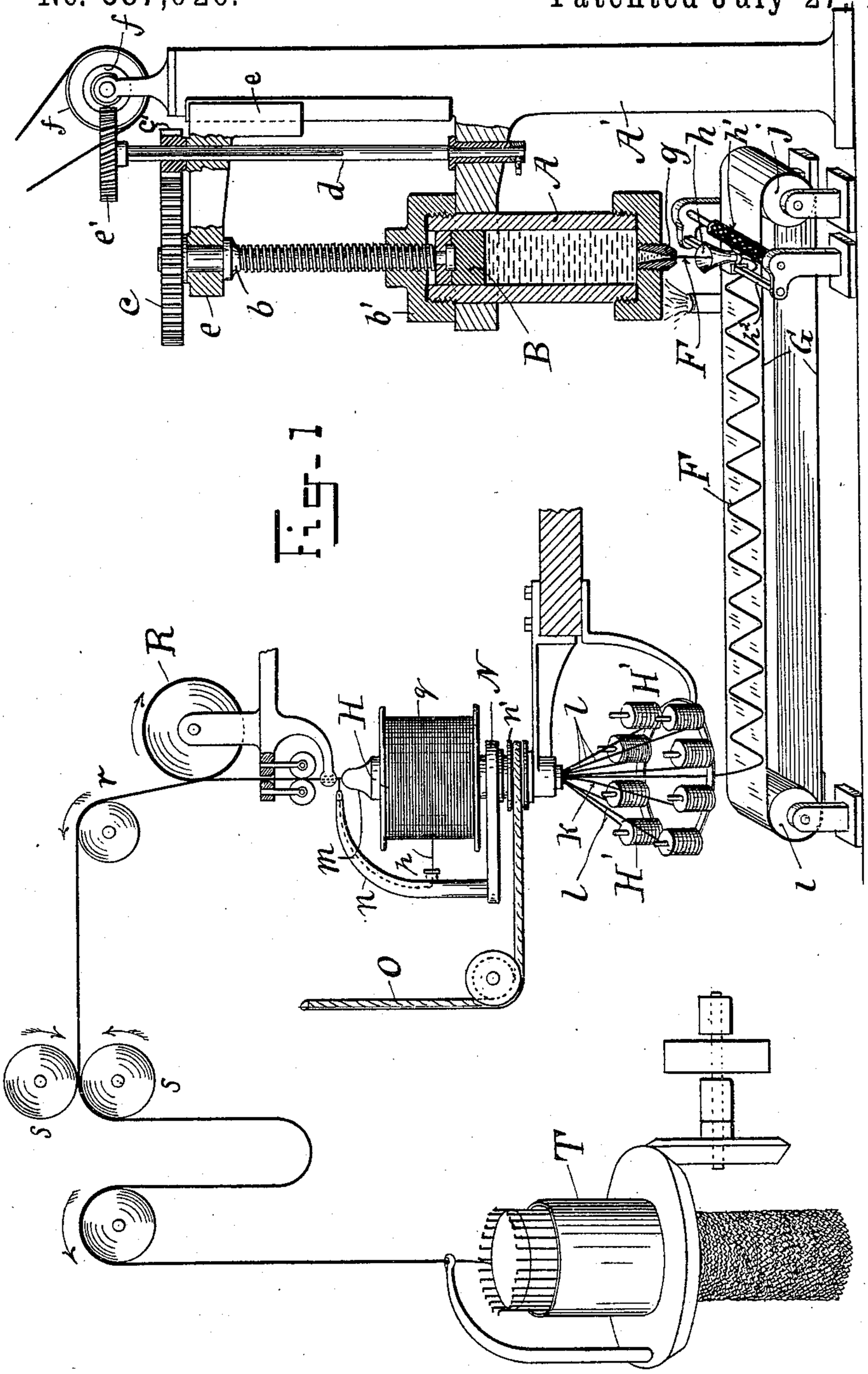

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

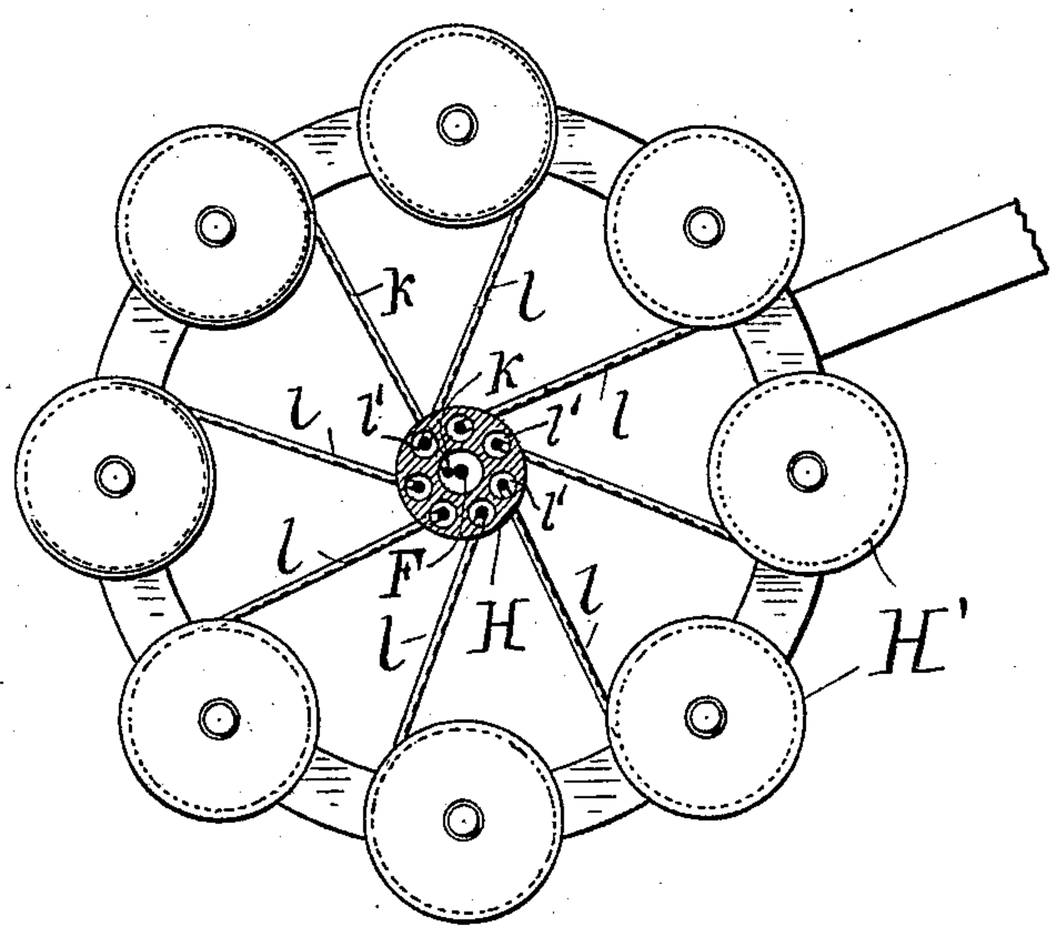
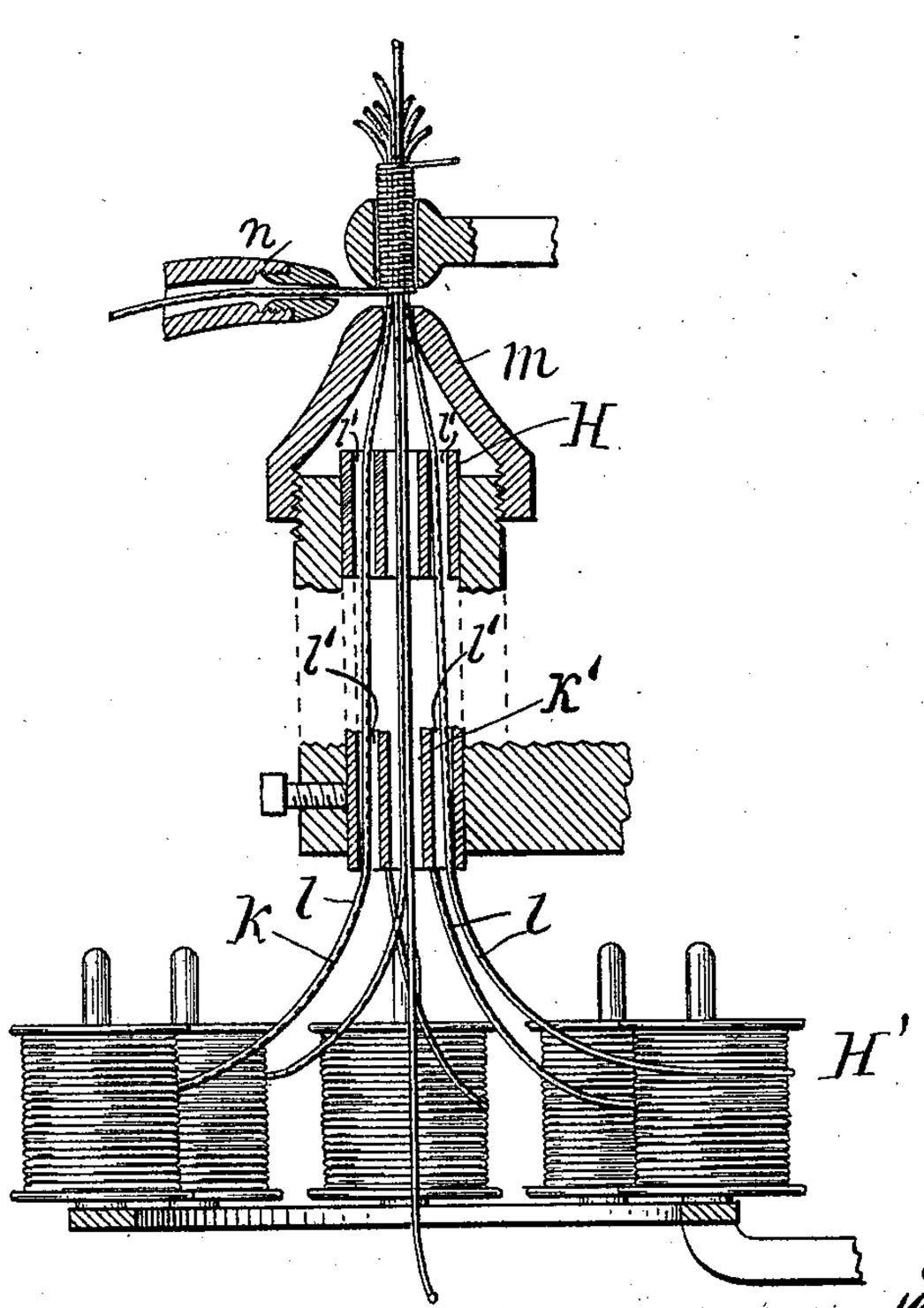


Fig. 3.



Witnesses
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UNITED STATES PATENT OFFICE.

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PROCESS OF MANUFACTURING FILAMENTS AND MANTLES FOR INCANDESCENT GAS-LIGHTING.

SPECIFICATION forming part of Letters Patent No. 587,026, dated July 27, 1897.

Application filed November 25, 1896. Serial No. 613,449. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM L. VOELKER, a citizen of the United States, and a resident of Elizabeth, Union county, State of New Jersey, have invented a certain new and useful Improvement in Processes of Manufacturing Filaments and Mantles for Incandescent Gas-Lighting, of which the following is a specification.

This invention relates to improvements in processes of manufacturing filaments and mantles for incandescent gas-lighting.

More particularly the invention relates to a continuous process of forming the filament of incandescible materials, covering that with a sheath of combustible fibrous material, which adds the necessary tensile strength to the filament to permit of the subsequent operations, then continuously feeding the cord thus produced to a knitting-machine, and there continuously knitting the cord into a stocking from which pieces can be cut for mantles. The invention is thus a continuous process of manufacture, whereof the several steps are going on simultaneously and in such a manner that, starting with a mass of suitable incandescible material, it terminates in a stocking ready to be converted into mantles by simply cutting off short pieces and tying up one end with an asbestos thread in the well-known manner. Such a continuous process has long been needed in the art of incandescent lighting, because it so greatly reduces the cost of the mantles as to render their general use possible in places where the present high cost of manufacture excludes them from use; but a continuous process has not been heretofore practicable because of the delicate and tender nature of the incandescible filament, which would not sustain the tensions inseparable from present modes of manufacture. My invention, however, on the one hand so reduces those tensions that they are not injurious to the filament, and on the other hand strengthens the filament to withstand much greater strains than it is subjected to at any part of the process.

The essential steps of the process, after the mass of incandescible material has been produced in any suitable manner, as from the oxids of magnesium and calcium in the manner described in United States Letters Patent No. 568,184, dated September 22, 1896, are the following: First, the mass of incandescible material is heated to render it sufficiently ductile—say, to about 125° Fahrenheit. Next the mass is formed into a continuous filament by pressure applied to the mass in a suitable die and continued during the process of manufacture, so that this step results in the continuous feeding of a filament from a die, while at the same time the filament is being drawn along and subjected to the subsequent operations. Third, the filament, as it is fed from the die, is spread on a suitable carrier in coils or zigzag lines, which are extended practically all the way from the die to the devices which cover the filament. Thus these zigzag lines provide a great length of filament between the die and the covering devices and prevent the latter from putting any tension on the filament. This zigzagging of the filament is an important part of the process, for without it the necessary feeding of the filament through the covering devices and to the knitting-machine would break the tender filament between the die and the covering devices. Fourth, the filament, after being zigzagged, as described, is carried continuously along and continuously covered with a sheath of combustible fibers, preferably cotton threads, which greatly strengthens it to stand the knitting into stockings, and also prevents it from sticking to the parts of the devices which manipulate it. Finally, the "cord," as I term the covered product to distinguish it on the one hand from the filament and on the other from the threads of the sheath, is fed to a knitting-machine and there knit continuously into a stocking or tube, which is wound on a reel and used as wanted.

The process is not dependent upon any special machines, but is successfully operated by those illustrated in the accompanying drawings. Said machines are not herein claimed, being the subject of another of my applications for United States Letters Patent, and are hereinafter only so far described as is necessary to explain the working of the process.

Referring to said drawings, Figure 1 is a

perspective view illustrating the preferred means for operating the process. Fig. 2 is a horizontal section illustrating the arrangement of the bobbins of the covering-thread with reference to the filament, and Fig. 3 a vertical section illustrating the same arrangement.

I premise that a mass of suitable incandescible material has been formed. This mass may consist of the combined oxids of magnesium and calcium ground fine and mixed with a solution composed, essentially, of camphor, guncotton, and oil of cassia, the whole being brought to a putty-like condition, as described in said United States Letters Patent No. 568,184.

A suitable quantity of this material is put into a die A, the plunger B of which has a working fit on the end of the long screw *b*, which threads through a nut *b'* on the top of the die A. Said screw *b* is continuously driven, so as to produce continuous pressure on the material, by a gear *c*, fixed on screw *b* and meshing with pinion *c'*, which is feathered on vertical shaft *d*, so as to revolve with said shaft *d*, and said shaft passes down loosely through the arm *e* to a box formed in the standard A', which carries the die A. Said arm *e* works up and down guides on the standard A', according to the revolution of screw *b*. A worm-gear *e'*, fixed on shaft *d*, meshes with a worm *f*, on the shaft of which is a pulley *f'*, driven by a belt from a suitable motor. Said pulley *f'* is driven at proper speed to cause plunger B to continuously exert the proper pressure on the material and thereby expel a continuous filament F from the small jet *g* at the bottom of the die. The material in the die A is kept at the proper temperature for drawing out the filament by heating said die by a gas-jet. The said filament F, which is in a soft and sticky condition and with little tensile strength, passes through a cup *h*, which has a hole in its bottom and is reciprocated horizontally by being equipped with a pivoted finger which engages the threads of a right and left hand screw *h'*. This screw, which, in combination with the finger, is a well-known device for producing a reciprocal motion and is not any part of the present invention, is revolved at suitable speed, the cup *h* being guided on rod h^2, which is parallel with the screw *h'*. Thus the cup *h* is horizontally reciprocated, and the filament F acquires a similar motion. From said cup *h* the filament descends to a carrier G, which consists of a wide endless belt or apron stretched around rollers *i j*, one of which is driven at suitable speed. The carrier G moves at right angles to the reciprocation of the cup *h*, and its surface may be sprinkled with wheat-flour to prevent the filament from sticking to the carrier. The result of the two aforesaid motions of the cup *h* and carrier G is that the filament F begins to coil or zigzag on the carrier G immediately below the die A, and these zigzags soon cover the whole upper surface of the carrier to the point where the filament goes to the covering devices. Thus there is a relatively great length of slack filament between the die and the covering devices, which prevents the operation of the latter from bringing injurious tension on the filament.

Near the front or left end of carrier G the free end of the filament is stuck to a fine cotton thread *k*, which rises through the central hole of a guide-tube H. A number of bobbins H', of rather coarser thread, are arranged around said guide-tube H, and the thread *l* from each of these bobbins is led through its proper hole or channel up through said tube H. Thus there are in said tube a central hole or channel *k'* for the filament F and its thread *k* and a number of parallel holes or channels *l' l'* around said hole *k'* for the threads from the bobbins H'.

Near the top of the guide-tube H the filament F and all the threads *l l* come together side by side and go through the same hole in the cap *m* of said tube H. At this point the filament is surrounded by the longitudinal threads, and here the whole is wound by thread delivered from the gooseneck tube *n*, which is supported on the rapidly-revolving disk N, the hub of which turns on said tube H as a center. The disk N is driven by the high-speed pulley *n'*, fixed on the hub of the disk N, and the belt *o* from a suitable motor. The winding thread *p* is led from the bobbin *q*, which turns easily on the hub of the disk N, up through the gooseneck *n*, and (originally) up with the filament and other threads and around the take-up R, over the guide-roller *r*, and between the driven feed-rollers *s s*. Thus before the winding begins the filament F, the threads *l l*, and the winding thread *p* all feed along together. When the disk N is started, the gooseneck tube *n* whirls rapidly around the filament F and threads *l l*, winding a continuous covering around them and binding all into a strong cord. Now this cord is fed continuously along at the proper speed by the aforesaid rollers *s s*, which are driven at the proper speed, according to the winding devices and spinning-machine T, by suitable connections with the motor. Finally, this cord goes to the said knitting-machine T, which is of the same general type as is used in knitting stockings, and is there continuously knit into a stocking or tube. This tube is, if desired, coiled on a reel and pieces cut therefrom as needed for mantles.

Now, having described my improvements, I claim as my invention—

1. The process of manufacturing filaments for incandescent mantles hereinbefore described, and consisting in softening a mass composed of incandescible minerals and viscous binding materials, to a ductile condition; continuously expressing a filament from said mass; continuously forming said filament, as it comes from the die, into coils or zigzags; drawing the free end of the filament continu-

ously from the foremost coil or zigzag; drawing threads of combustible fibrous material along with the filament, and while the filament and threads are moving, winding them around with a combustible thread which binds them all into a cord, substantially as described.

2. The continuous process of manufacturing stockings for incandescent gas-lights, hereinbefore described consisting in reducing a mass composed of incandescible minerals and viscous binding materials to a ductile condition; continuously expressing a filament from said mass; continuously forming said filament, as it comes from the die, into coils or zigzags; drawing the free end of the filament continuously from the foremost coil or zigzag; drawing threads of combustible fibrous material along with the filament, and while the filament and threads are moving along winding them around with a combustible fibrous material which binds them all into a cord; feeding said cord continuously along; and continuously knitting it into a stocking, whereby there is a continuous process from the die to the delivery of the knitted product.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 30th day of October, 1896.

WILLIAM L. VOELKER.

Witnesses:
BERNARD J. ISECKE,
FREDERICK B. KING.