No. 889,209. PATENTED JUNE 2, 1908.

G. A. CUTTER.

DRYING APPARATUS.

APPLICATION FILED MAY 21, 1906.

2 SHEETS—SHEET 1.

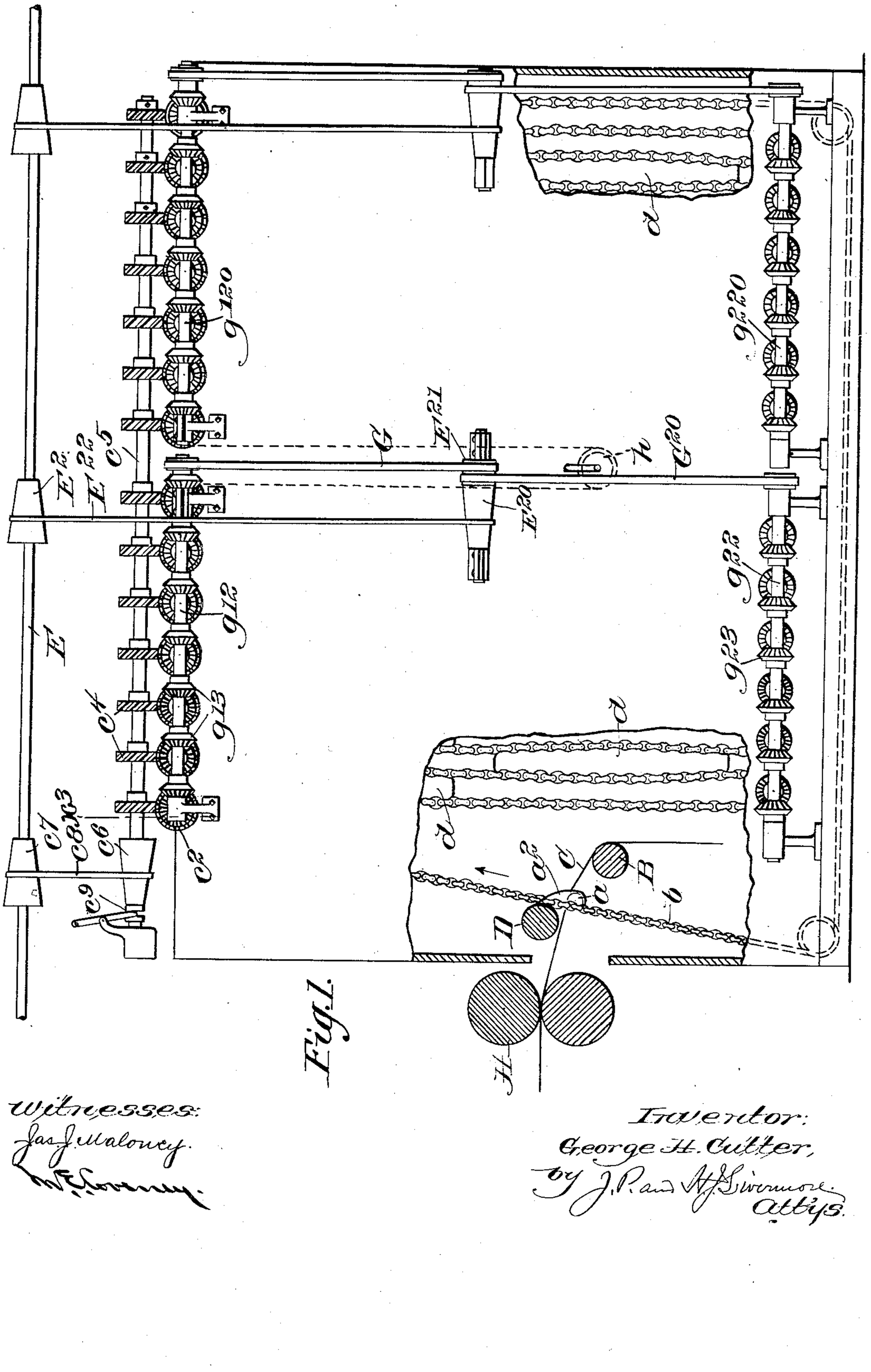


Fig. 1.

Witnesses:
Jas. J. Maloney.
E. E. Storey.

Inventor:
George H. Cutter,
by J. P. and A. J. Livermore.
Attys.

No. 889,209. PATENTED JUNE 2, 1908

G. A. CUTTER.

DRYING APPARATUS.

APPLICATION FILED MAY 21, 1906.

2 SHEETS—SHEET 2

Fig 2.

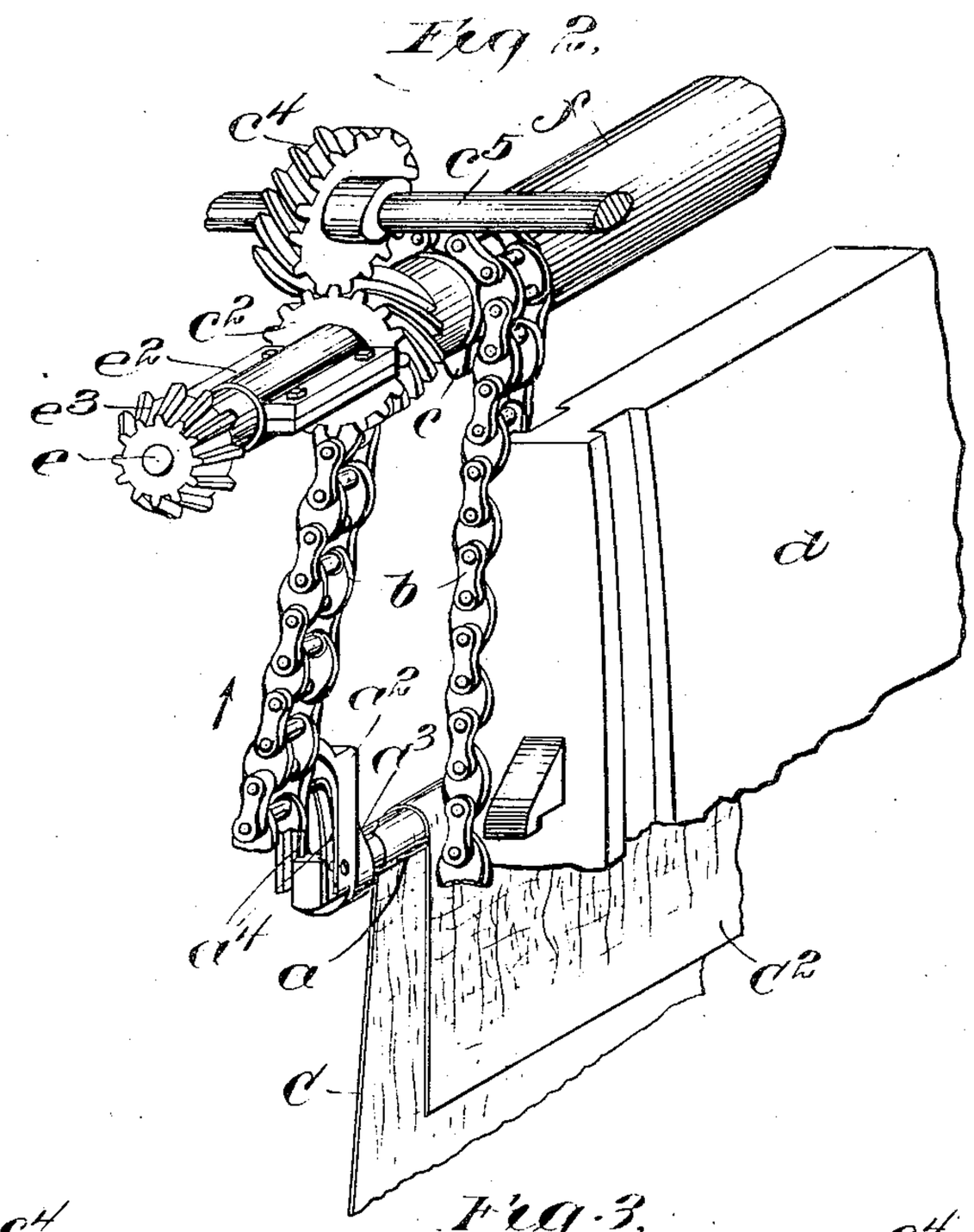
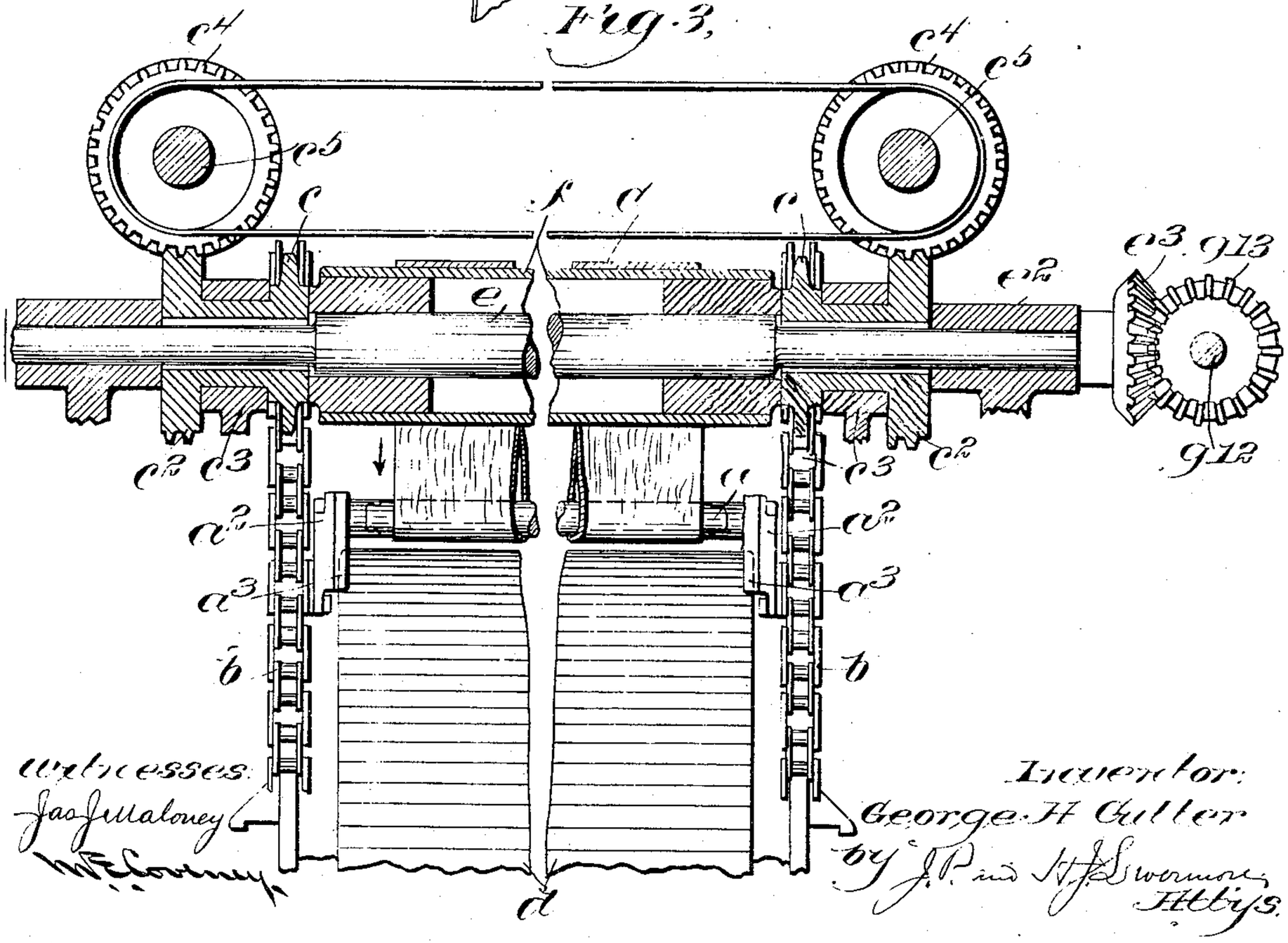


Fig. 3.



UNITED STATES PATENT OFFICE.

GEORGE A. CUTTER, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO VACUUM PROCESS COMPANY, A CORPORATION OF WEST VIRGINIA.

DRYING APPARATUS.

No. 889,209. Specification of Letters Patent. Patented June 2, 1908.

Application filed May 21, 1906. Serial No. 317,969.

To all whom it may concern:

Be it known that I, GEORGE A. CUTTER, a citizen of the United States, residing in Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Drying Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The present invention relates to a drying apparatus and is embodied in an apparatus especially intended for drying paper pulp, the purpose being to cause the wet pulp to travel back and forth over heated surfaces until it is thoroughly dried upon issuing from the machine.

The main difficulty in carrying out this drying process, especially with pulp which, when moist, has very slight tensile strength, is in introducing the pulp to the machine in the first place, it being obvious that if a web of pulp is to be carried back and forth over a large number of drying members, it would be a very difficult, if not impossible, task to carry the pulp through the machine in the beginning by hand, without tearing the pulp or varying the direction, so that, in the further process, the pulp would travel to one side or the other and become torn. A further difficulty to be overcome is due to the natural shrinkage of the material in drying, which might result in tearing the web, if not compensated for in some way.

One of the features of this invention consists in a device for starting the operation, that is, mechanically carrying the web of pulp entirely through the machine, so that it will travel over feed rollers and interposed stationary drying surfaces, the feed rollers, after the pulp has once been started, serving to continue the feeding operation without further use of the starting device. It is necessary, furthermore, to utilize a large number of drying surfaces in order thoroughly to dry the pulp before it issues from the machine, and as the pulp shrinks in drying, the feed movement, in accordance with the invention, is arranged to compensate for the shrinkage, being retarded as the pulp progresses, the feed at the end of the machine being slower than that at the beginning. This regulation of the feed may be accomplished by dividing the machine into sections, each section containing a certain number of feed rolls and drying surfaces, and the feed rolls in consecutive sections are provided with means for varying their velocity, there being also tension devices between adjacent sections, which also operate as indicators, so that the operator can tell if any readjustment of the consecutive parts is necessary. The initial feeding or introducing device consists of a positively driven transverse member or bar which is arranged to engage the under side of a sheet or web of pulp as it comes from the final pulp rolls of the pulp making machine, this member being positively driven so that it will pick up a loop of the web, the fold of which is transverse to the line of travel of the web, so that the web carried by the transverse member will be drawn through the machine over the web feed rolls and heating surfaces in a straight line.

In the construction shown, the transverse feed member is carried by one or more endless sprocket chains, there being preferably a chain at each side of the machine, the transverse member extending across from one chain to the other, and the chains being positively driven and provided with speed-varying means.

It is not necessary to attempt to automatically vary the speed of the chain as it travels through the machine, since the chain is only used in the initial process of starting the pulp. It is sufficient, therefore, to provide the chain, or other driving device, with a speed-varying mechanism, such, for example, as cone pulleys, which can be manipulated by the operator during this initial step. In order to compensate for the shrinkage, however, after the operation has been actually started, the various sections of the machine, as above mentioned, are provided with separate driving devices for the feed rolls, and each of these driving devices is provided with speed varying means, such as cone pulleys. Between the sections, moreover, the pulp is caused to travel over a tension roll which may be acted upon by its own weight or by a spring, this roll lying in a loop of the pulp, so as to take up slack automatically, and, at the same time, indicate by its rise or fall the amount of variation in speed which is necessary in the consecutive sections. As a matter of fact, the shrinkage will vary but little, so that an operator will soon learn by expe-

rience about what the necessary consecutive speeds are; and very little adjustment or variation will be necessary in practice.

The transverse member which carries the pulp through, in its initial movement, is provided with means for preventing the pulp at the point where it is folded over said member, from coming in contact with the heated surface, so that the looped portion will not be rubbed or torn off.

Figure 1 is a side elevation of a machine embodying the invention with part of the casing broken out to show the mechanism; Fig. 2 is a detail in perspective, on an enlarged scale, showing the driving mechanism for the chains and for the feed rolls; Fig. 3 is a transverse section, on an enlarged scale, on the line x^3 of Fig. 1, the carrier member being shown in a different position, and the middle part of the machine being broken out.

Without referring at first to the specific construction and arrangement of the driving mechanism, the pulp-carrying member *a*, which initially starts the pulp through the machine, is shown as a rod or bar which extends far enough in a direction transverse to the direction of travel of the web of pulp to engage the under side thereof. In the construction shown, the member is extended completely across the machine and is connected at its opposite ends with driving chains *b*, the means for driving which will be hereinafter described.

In its initial position, the bar *a* lies below a pair of pulp rolls A which deliver the pulp in web shape, the outer edge of the web being carried over a guide roll B, so that at the beginning of the operation, a web of pulp, indicated by the letter C, extends from the rolls A to and over the supporting roll B. This web of pulp projects across the path of the member *a*, it being obvious, therefore, that since the chains will produce an upward movement of the member *a*, a loop of pulp will be picked up and will hang over the member *a*, which will then carry the pulp guided by the supplemental guide roll D in the direction of travel of the member *a*.

As best shown in Fig. 1, the member *a* carried by the chains *b* travels back and forth over sprockets in a path adjacent to the heated drying surfaces *d* which may be of any suitable shape, but which are herein shown as slightly convex, so that the pulp, when once started to travel through the machine, will lie snugly against the heated surfaces, without, however, pressing so firmly against these surfaces as to produce objectionable friction.

It is necessary, in the initial feed movement of the pulp that the loop of the web C which hangs over the member *a* should be kept out of contact with the rolls and the drying surfaces, in order to prevent the pulp from being chafed by frictional contact with these surfaces, which, of course, would result in releasing the pulp from the member *a*, and preventing the complete operation of carrying the pulp through the machine. For this purpose, the member, *a*, is provided with means for keeping it at a distance from the drying surfaces as it travels past them. In the construction shown, the member *a* is connected with hangers a^2 which are pivotally connected with the chains, and provided with inclined engaging surfaces a^3 at opposite sides which engage the surface of the rolls and drying cells, as best shown in Fig. 3, thereby swinging the member or bar *a* away from said surface, so that the loose or hanging portion of the web, which is indicated by the letter C^2 in Fig. 2, is held out of contact with the surfaces over which the main portion of the web is to travel.

In order to prevent vibration of the bar *a*, the member a^2 is provided with springs a^4 which bear against a lug or projection on the chain so as to keep the part a^2 substantially centered, except when it is pushed aside by contact with the rolls or the drying surfaces.

In order to drive the chains *b*, the sprockets *c* are shown as connected with spiral gears c^2, the sprockets and gears, as best indicated in Fig. 3, being supported in bearings c^3, and being hollow to receive the shafts *e* which carry the feed rolls *f* which feed the pulp during the regular operation of the machine.

The gears c^2 are acted upon by coöperating gears c^4 which are arranged along a shaft c^5 which is capable of speed regulation, the said shaft being herein shown as driven by cone pulleys c^6 and c^7 on the shaft c^5 and the main driving shaft E, as best shown in Fig. 1.

It is to be understood that any speed regulating device may be utilized, the cone pulley having been chosen as a practicable expedient and one easy of illustration.

The cones c^6 and c^7 are connected by means of a belt c^8, and the cone c^6 is shown as provided with a clutch c^9, so that it can be clutched to the shaft c^5.

Since the driving chains *b* for the bar or feed member *a* are utilized only during the operation of carrying the pulp once through the machine, it is obvious that a skilful attendant can manipulate the speed of the chain to correspond to the shrinkage of the pulp in drying, and thereby prevent the same from being ruptured, or pulled off of the feed bar during its travel.

As soon as the web of pulp has been carried completely through the machine, the chains may be stopped, leaving the feed member *a* at a point somewhat below the position shown in Fig. 1, ready for a subsequent operation, if it is necessary to start up when there is no line of pulp extending through the machine. After the pulp has once been carried completely through the

machine, the movement thereof is controlled by the feed rolls *f* which are arranged above and below the drying members *d*, the said feed rolls being located between the adjacent members, so that the feed movement is imparted to the web at regular intervals.

In order to take care of the natural shrinkage of the pulp in drying, it is desirable to reduce the speed of the feed as the pulp approaches the end of the machine from which it is delivered after being fully dried. For this purpose, the machine is divided into a plurality of sections, two only being herein shown, and the rolls in the different sections are driven by different mechanism.

Referring to Fig. 1, the rolls of the first section of the machine are driven by means of a cone pulley E^2 on the driving shaft E, and a corresponding cone pulley E^{20} which is shown as having bearings near the middle of the machine, the said pulley having a cylindrical driving surface E^{21} which connects by means of belts G and G^{20} with shafts g^{12} and g^{22} which, in turn, drive a series of the rolls *f* to feed the pulp through that section of the machine.

As previously stated, the rolls *f* are carried by the shafts *e*, which are mounted in bearings e^2 and provided with bevel gears e^3 which mesh with a series of bevel gears g^{13} on the upper shaft g^{12}, and g^{23} on the lower shaft g^{22}, it being obvious that the rolls *f* in a given section arc driven at a given rate of speed which can be governed by shifting the belt E^{22} which connects the cone pulleys E^2 and E^{20}.

As shown in Fig. 1, the next section of the machine is driven in a similar way through the agency of the shafts g^{120} and g^{220}, it being deemed unnecessary to repeat the description and the reference letters, since it is obvious from the previous description that the speed of the feed rolls *f* of the two sections can be independently governed by a similar means. This dividing of the machine into sections can be carried on to whatever extent may be necessary for the effectual drying of the pulp, as a matter of fact there usually being a number of sections, as the pulp must necessarily travel a considerable distance along the heated surfaces before it is thoroughly dried. The variation in the length of the web due to shrinkage is further compensated for to a certain extent by means of any suitable take-up device such as the gravity roll *h* which is arranged to hang in a loop of the web between adjacent sections.

As an illustration, the simplest form, viz., that of an idle roll *h*, hanging in a loop of the pulp, is indicated, it being obvious that the roll will be lifted as the pulp shrinks, thereby serving as an indicator to the attendant who can govern the speeds of the successive sections of feed rolls accordingly. In other words, if the roll *h* continues to rise in the operation of the machine between adjacent sections, the attendant can adjust the speeds until the roll remains substantially stationary, the said roll, at the same time, serving as a compensating device for minor variations.

What I claim is:

1. In a drying apparatus, the combination with a series of drying surfaces; of feed rolls for carrying the web of material to be dried back and forth in a path adjacent to said surfaces; a feed member to engage the front portion of a web of material; and means for carrying said feed member through the machine in the path which the material is to follow in the operation.

2. In a drying apparatus, the combination with a series of drying surfaces; of feed rolls for carrying the web of material to be dried back and forth in a path adjacent to said surfaces; a feed member to engage the front portion of a web of material; means for carrying said feed member through the machine in the path which the material is to follow in the operation; and means for varying the speed of movement of said feed member during its travel through the machine.

3. In a drying apparatus, the combination with a series of drying surfaces; of feed rolls to carry the web of material to be dried; a feed member to engage the front portion of said web; and means for carrying said feed member through the apparatus.

4. In a drying apparatus, the combination with a series of drying surfaces; of feed rolls for feeding the web of material through the apparatus; a feed member to engage the front portion of the said web; means for carrying said feed member through the apparatus; and means for varying the speed of movement of said feed member during its travel.

5. In a drying apparatus, the combination with a series of drying surfaces; of feed rolls for guiding the material to be dried; a feed member to engage a loop formed in the front portion of the material; and means for carrying said feed member through the apparatus.

6. In a machine for drying pulp, the combination with a feeding member provided with driving chains at opposite sides of the machine, said feeding member being arranged to engage a web of pulp so as to carry a loop thereof; feed rolls arranged to act upon the pulp after it has been carried through the machine; and independent driving devices for said feed member and said feed rolls.

7. In a machine for drying pulp, the combination with a series of stationary drying surfaces; of a feed member comprising a transverse bar arranged to engage a loop of pulp; means for causing said feed member to travel through the machine adjacent to the

heating surfaces; and guides for said feed member adapted to engage each heating surface and hold the feed member out of contact therewith to prevent the loop of pulp on the feed member from being rubbed or chafed.

8. In a drying apparatus, the combination with a series of drying surfaces; of feed rolls for carrying the material to be dried back and forth in a path adjacent to said surfaces; a feed member to engage a loop formed in the front portion of the material; means for carrying said feed member through the machine; and means for holding said feed member and the material thereon out of engagement with the drying surfaces.

9. In a drying apparatus, the combination with a series of drying surfaces; of a feed member to engage the material to be dried and carry the same past said drying surfaces; and an endless chain to operate said member, substantially as described.

10. In a drying apparatus, the combination with a series of drying surfaces; of feed rolls for carrying a web of material past said surfaces; a feeding device to engage the front edge of a web of material to carry the same over said feed rolls in starting the operation; and means for controlling the operation of said feeding device.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE A. CUTTER.

Witnesses:

W. E. COVENEY,

H. J. LIVERMORE.