

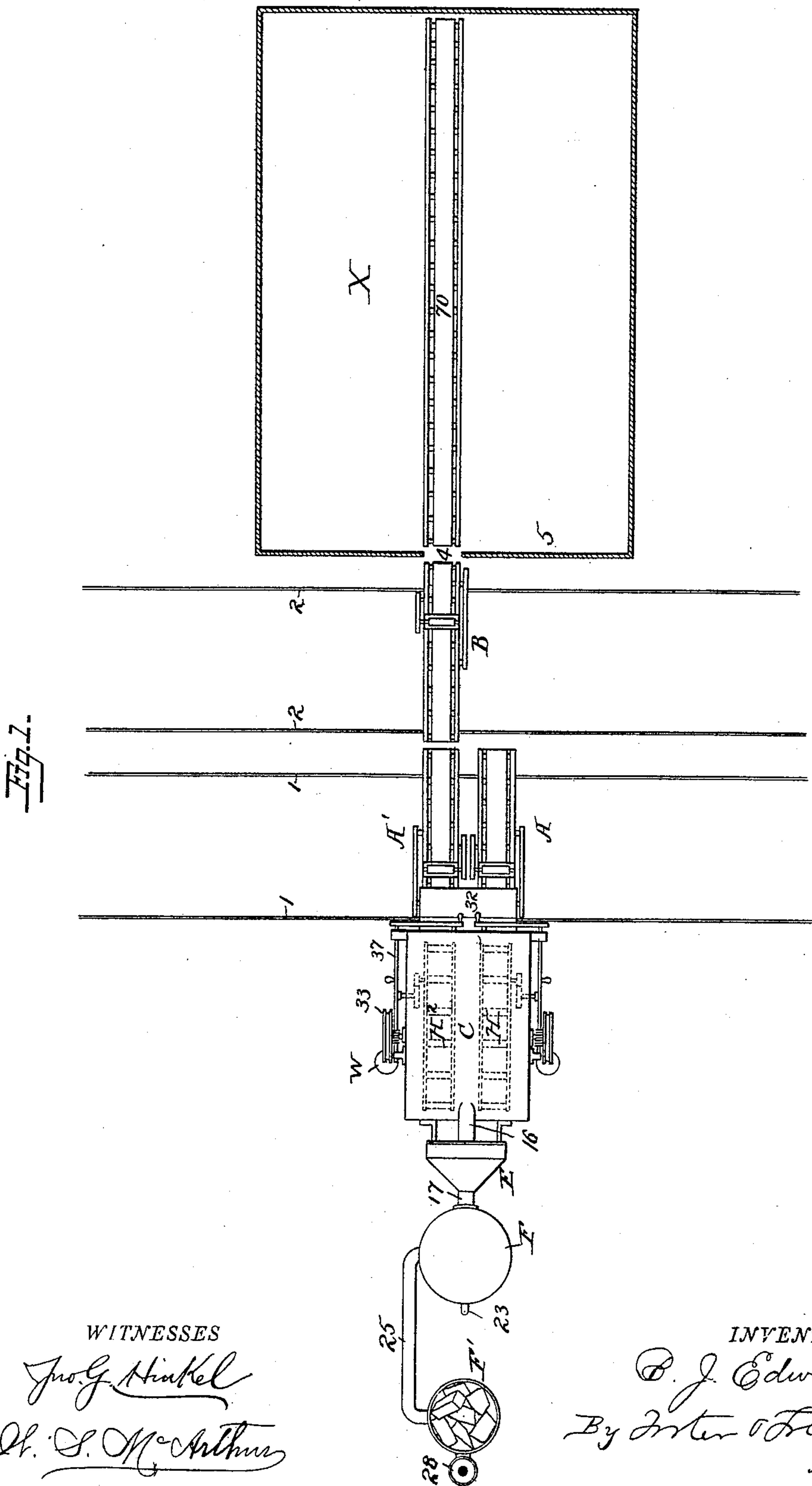
(No Model.)

3 Sheets—Sheet 1.

B. J. EDWARDS.
MANUFACTURE OF PHOTOGRAPHIC FILMS.

No. 460,570.

Patented Oct. 6, 1891.



WITNESSES

Geo. G. Hinkel
Ch. S. McArthur

INVENTOR

B. J. Edwards
By Arthur Freeman
Attorneys

(No Model.)

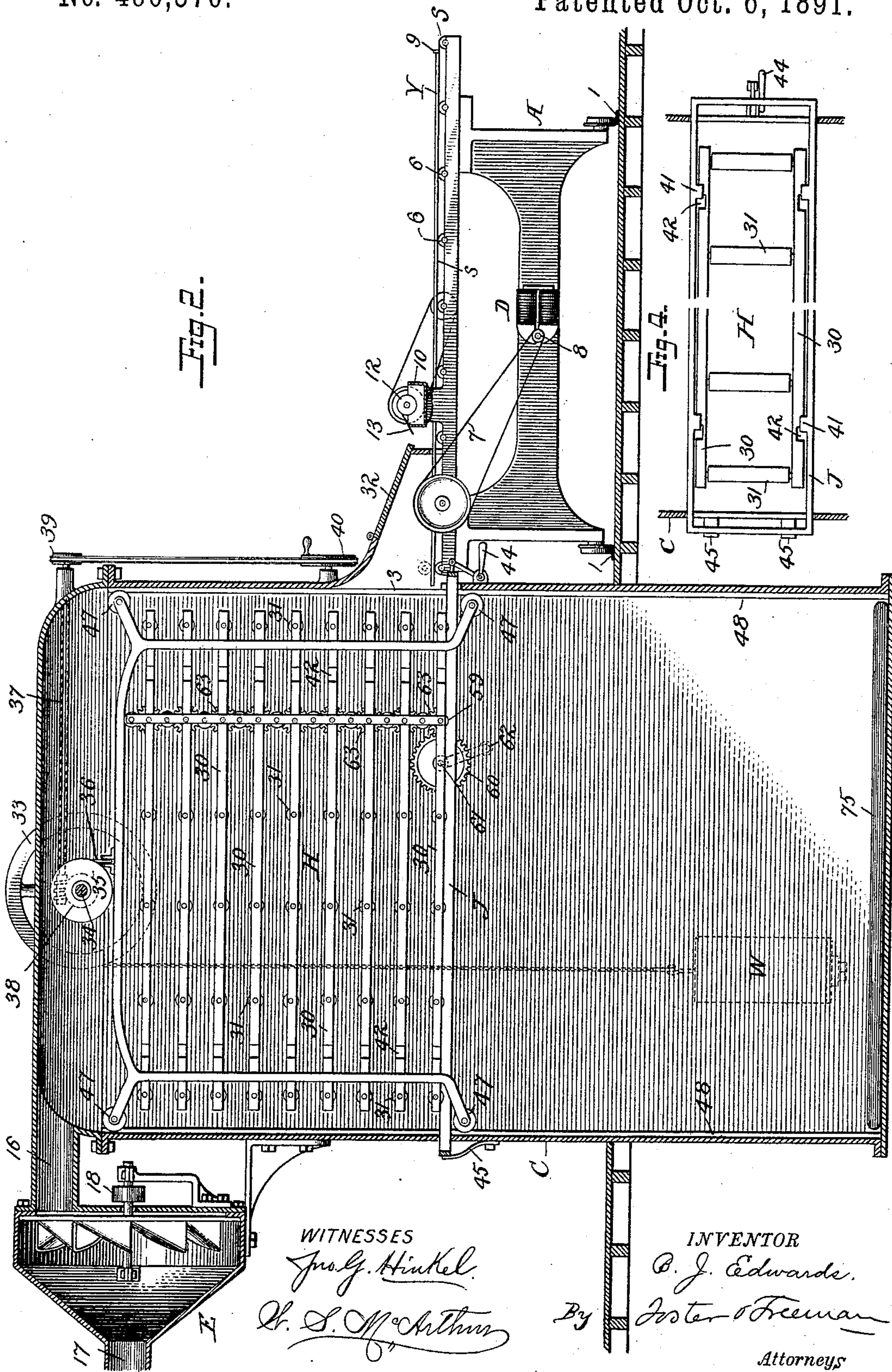
3 Sheets—Sheet 2.

B. J. EDWARDS.

MANUFACTURE OF PHOTOGRAPHIC FILMS.

No. 460,570.

Patented Oct. 6, 1891.



WITNESSES

Geo. G. Hinkel.

Ch. S. McArthur

INVENTOR

B. J. Edwards.

By

Foster & Freeman

Attorneys

(No Model.)

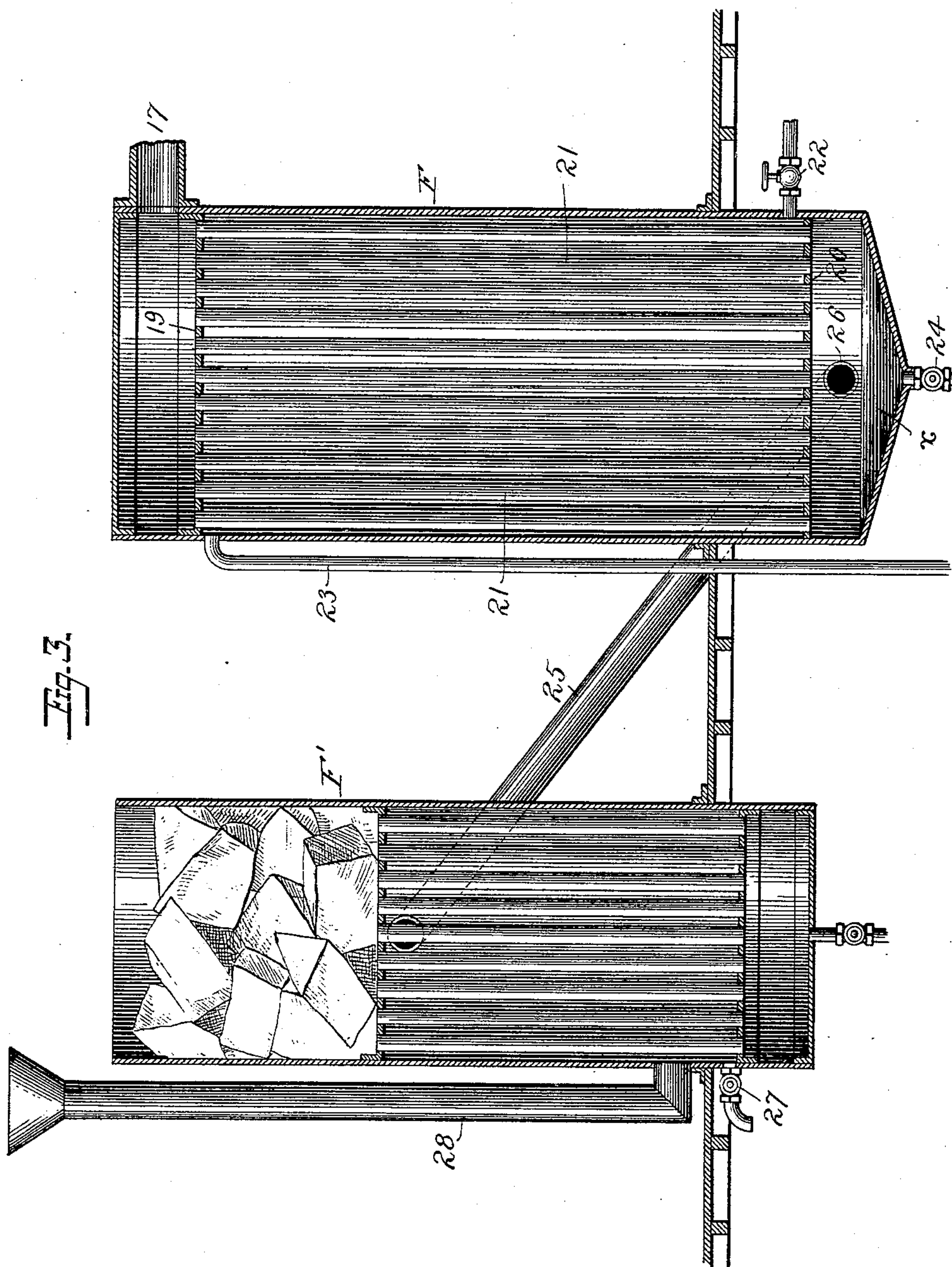
3 Sheets—Sheet 3.

B. J. EDWARDS.

MANUFACTURE OF PHOTOGRAPHIC FILMS.

No. 460,570.

Patented Oct. 6, 1891.



WITNESSES

Geo. G. Hinkel
Ch. S. McArthur

INVENTOR

B. J. Edwards
By Foster & Freeman
Attorneys

UNITED STATES PATENT OFFICE.

BENJAMIN J. EDWARDS, OF LONDON, ENGLAND.

MANUFACTURE OF PHOTOGRAPHIC FILMS.

SPECIFICATION forming part of Letters Patent No. 460,570, dated October 6, 1891.

Application filed November 3, 1890. Serial No. 370,134. (No model.) Patented in England July 30, 1890, No. 11,945.

To all whom it may concern:

Be it known that I, BENJAMIN JOS. EDWARDS, a subject of the Queen of Great Britain, residing at The Grove, Hackney, county of Middlesex, England, have invented certain new and useful Improvements in the Manufacture of Photographic Films, (for which I have received a patent in Great Britain, No. 11,945, dated July 30, 1890,) of which the following is a specification.

My invention relates to the manufacture of the films used for photographic and other purposes; and my invention consists of apparatus fully set forth hereinafter, whereby the said films may be produced with facility and rapidity without the loss of material and the danger of explosion resulting from the ordinary methods of manufacture.

In the accompanying drawings, Figure 1 is a plan view of my improved apparatus. Fig. 2 is a sectional elevation of the coating and drying devices of the apparatus. Fig. 3 is a section of the condenser. Fig. 4 is a sectional plan showing the stop device for the rack employed in the drying-room.

Before describing in detail the construction of the various parts of the apparatus employed in the manufacture of films for photographic purposes I will refer to the general plan, Fig. 1, which illustrates the main general features of the entire apparatus, that has for its purpose to apply to long strips of glass or other suitable material, hereinafter termed "strips," a liquid solution or substance to dry the same on said strips, recover the solvents used in making the solution, and also, if desired, to coat the film formed by drying the solution upon the strips with a suitable emulsion, so as to form a sensitive surface for photographic purposes, and to effect these results with absolute certainty and equality and with a minimum amount of labor and superintendence. For this purpose I make use of one or more strip-tables A A' B, the carriers or tables A A' traveling upon rails 1 1 and the tables B upon parallel rails 2 2, the rails 1 1 passing an evaporating or drying chamber within a box C, having suitable apertures 3 for the passage of the strips, and the rails 2 passing an aperture 4 in the wall 5 of a cooling-chamber X. Each of the tables is provided with a series of rollers 6 6, arranged

close enough together to constitute a frictionless bed for the strip Y of glass or other suitable material which is to receive the film. This strip in practice is of heavy plate-glass of suitable width, from six to twenty-four inches, say, and about sixteen feet in length, and is consequently quite heavy to handle, and must be so supported as to prevent the fractures that would otherwise likely occur. The strips may be fed from the tables in different ways; but in order to mechanically feed the strip from each carrier into the drying-chamber I make use of feed-rolls 6 6 or other suitable devices. For instance, a band S of rubber, leather, or other material, extended around all of the rollers 6, and one of the latter is driven by means of a belt 7 and pulleys from a driving shaft 8, turning in bearing on the table A. In order to best rotate the driving-shaft upon a traveling table, I prefer to connect said shaft with the armature of an electromotor D, to which a current is conducted through suitable flexible conductors. If desired, the band S may be provided with one or more cross-bars 9, which when brought against the outer end of the strip Y insures the propulsion of the latter with the band and the complete delivery of the strip into the drying-chamber. Each plate passes beneath a trough 10, containing the solution with which the plate is coated, from which trough the solution is deposited upon the strip to form a film of any desired thickness in any suitable manner—as, for instance, by a roller 12, turning in the trough and scraping the adherent matter onto a scraper 13, from which it flows onto the strip, as in the structure constituting the subject-matter of Letters Patent No. 314,811, issued to me March 31, 1885.

In the manufacture of photographic films it has been common to employ a solution of pyroxyline, soluble cotton, camphor, and castor-oil in different solvents, as acetate of amyl, ether, alcohol, &c., or a mixture of such solvents, the vaporized solvent escaping into the atmosphere as the films dry. As these solvents are expensive, there is considerable loss involved in this method of manufacture, the admixture of the vapors with the air is liable to form explosive dangerous gases, which are also sometimes noxious or constitute a nuisance.

sance in the neighborhood of the factory, as is the case when amyl acetate is used. For these reasons I dry or harden the films in the chamber C and pump or exhaust the air and vapors from said chamber and thereafter condense the vapors or concentrate them in any suitable manner, so as to recover the same while permitting the air from which the vapors have been condensed to escape. Any suitable pumping or exhausting apparatus may be employed for this purpose—as, for instance, a Blackman fan E in a suitable passage between the outlet-port 16 at the top of the chamber C and the inlet-port 17 at the top of the condenser F. The fan is driven by means of a band passing around the wheel 18 upon the fan-shaft, and exhausts the air and vapors from the chamber C and discharges them into the condenser F, which, as shown, has two inside partitions 19 20 and condensing-tubes 21, surrounded by water admitted by a pipe 22 and discharged by an overflow-pipe 23. The moisture that is precipitated or condensed in the pipes 21 flows into the bottom receptacle x, from which it is drawn through a suitable cock 24. In many cases where the temperature of the water admitted through the pipe 22 is not sufficiently low to insure a total condensation of all the vapors I prefer to use a second condenser F', arranged in series with the first and provided with partitions and condensing-tubes, the upper portion open for the admission of ice, the drip from which passes through the tubes and outward through a cock at the bottom of the condenser, while the vapors that escape through the outlet-opening 26 of the condenser F pass through a pipe 25 to the space around the ice-cooled tubes of the condenser F' and are then condensed and withdrawn through a cock 27, the air escaping through an outlet-pipe 28. By this means the greater proportion of the solvent material heretofore wasted is recovered and saved, while danger from explosive gases is avoided and the escape of noxious or disagreeable odors almost wholly prevented.

Various means may be employed for receiving and holding the strips that are to be supported when passed into the drying-chamber. A preferable means is illustrated in the drawings and consists of a movable holder hereinafter termed and shown as a "rack" having roller beds or supports for the strips and successively adjusted to bring said beds successively into line with the supporting-bed of the table A or A'. Thus I make use of a rack H in the form of an iron frame having side bars 30 a suitable distance apart, constituting bearings upon each side of the frame for the journals of bed-rollers 31, onto which the strip is received as it passes through the opening 3 in the side of the chamber, a hinged hood 32 covering the said opening and extending down over the strip so as to permit the air to enter and pass over the strips in the chamber and prevent the escape of fumes

from the latter. The hood is hinged so that it may be lifted to inspect the plates as or after they pass into the chamber.

The rack H is preferably counterbalanced so as to facilitate its adjustment, and this may be effected by means of a chain supporting a weight W at one end and connected to or passing around a pulley 33 upon a shaft 34, having a drum 35, upon which is wound the cable 36, that is connected to the rack. In order to raise and lower the rack within the chamber the worm upon the shaft 37 gears with the worm-wheel 38 upon the shaft 34, and a chain passes around a sprocket-wheel 39 on the shaft 37 and around a hand-sprocket wheel 40 in a position accessible to the operator, so that by turning the hand-wheel the worm may be revolved to raise or lower the rack, which will be held in the position in which it is adjusted by the worm.

It is important that the rack shall be brought at each movement to a position with one of the beds as nearly as possible directly in line with the bed of the table A, and I therefore provide means by which the rack may be brought against a stop or bearing at each adjustment. Different means may be employed for this purpose, one which is effective being illustrated in the drawings, Figs. 1 and 4, and consisting of a frame J, side pieces of which have lugs 41, normally in position to be struck by the side bars 30 and serve as stops upon opposite sides of the rack, limiting its downward movement when one of the roller-beds is in proper position. To release the rack when it has to descend a step lower, the frame is shifted by means of an operating-lever 44, connected with the frame, so as to bring the lugs 41 in line below notches 42 in the side bars 30. As soon as the side bars have passed below the lugs and the lever 44 is released, springs 45 throw forward the frame into position for its lugs to be struck by the next pair of cross-bars. To secure increased steadiness, I prefer to provide the rack with roller or other bearings 47, running upon guides 48 within the chamber. When the rack has been filled with the successively-coated strips and the volatile matter has all evaporated from the strips, leaving the films thereon, the strips are removed by bringing the beds of the rack successively opposite the opening 3 and pushing the strips onto the table outside the box. Different means may be employed for moving the strips from the rack to the table; but I prefer to employ one or more friction-rollers, which may be part of the bed-rollers of each bed, and means for driving the same positively to move the strips outward. Each friction roller or rollers when in position opposite the bed of the table is in operative relation to a driving-wheel 60 upon a shaft 61, turned by means of an outside handle 62. Thus the wheel 60 may be a toothed wheel, and a pinion 63 upon the shaft of each roller 59 engages with the wheel 60 as the rack is raised, so that by turning the wheel 60 by means of

the handle 62 the roller or rollers 59 will be turned so as to move outward the strip until it has sufficient bearing upon the bed of the carrier B, to be moved by the movement of the latter under the action of the driving-shaft 8.

While a single table A and rack H or equivalent holder may be employed, the operations are facilitated by constructing the apparatus with two independent racks, as shown in dotted lines, Fig. 1, so that while one table A is used for coating and placing the strips upon one of the racks H the other table A' may be used for withdrawing the strips that have been dried from the second rack H². In such case it is preferable to place both racks in a single chamber C, so that a single exhausting apparatus E may serve to exhaust the vapors from either series of strips.

After the strips have been coated and dried, as described, it is desirable to apply to the films upon the strips an emulsion-coating, for which purpose I make use of the other table or carriers B, preferably constructed in the same manner as the table A and provided with a trough carrying the emulsion, which is spread successively upon the strips as they are transferred from the table A to the table B. For this purpose a table A and a table B are brought in line with each other and the proper transfer is made, after which the table B is brought opposite the opening 4 in the wall 5 of the cooling-room, and the strip is transferred through the opening onto a roller-bed 70 with a traveling band, and the coating is cooled or set in any suitable manner—as, for instance, in the manner set forth in my aforesaid patent—and the films are then dried and then slipped from the strips.

While I have described certain details of this apparatus for the purpose of illustrating my invention, it will be evident to those skilled in the art that the details may be changed without departing from the main features of my invention. Thus the tables or carriers may be differently constructed to support, coat, and feed the strips, the latter may be successively received in the heating-chamber by racks or holders of a different character from those set forth, and different pumping or exhausting and condensing apparatus may be employed to effect the same results as those described.

If desired, the table A may be stationary instead of traveling on rails 1; but I prefer to employ a traveling table, as set forth.

I have referred to the chamber C as a "drying-chamber;" but in making some classes of

films it may be a cooling-chamber. The heater of the chamber may supply the same with hot air, or it may be in the form of a coil of pipe 75, through which hot air or steam passes.

Without therefore limiting myself to the precise construction and arrangement of parts shown, I claim—

1. The combination of a feeding-table constructed to support and feed a succession of strips, means for coating each strip, a chamber provided with means for heating the same, and a rack in the chamber constructed to receive the successive strips, substantially as set forth.

2. The combination of a feeding-table and means for coating a succession of strips, a chamber provided with means for heating and exhausting air from the same, and a rack in the chamber constructed to receive the successively-coated strips, substantially as described.

3. The combination, with the device for coating and feeding the strips, of a chamber provided with a rack for receiving the successive strips, with an exhausting device and an opening in the wall for the passage of the strips into the chamber, substantially as described.

4. The combination, with the chamber, of the movable racks provided with beds and a device for moving the strips upon said bed outward, arranged to operate in conjunction with each bed in succession, substantially as set forth.

5. The combination, with the chamber having an opening 3, of a movable rack having a series of beds and a series of feed-rolls provided with pinions, a driving-wheel, and means for rotating the same from outside the chamber, said wheel being arranged in position to gear with a pinion of each feed-roll as the latter is brought opposite to it, for the purpose set forth.

6. The combination, with the chamber and the movable rack within the chamber, having cross-bars and notches, of a frame J, having stops, and means for shifting the frame upon the outside of the chamber, for the purpose described.

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

B. J. EDWARDS.

Witnesses:

J. S. BARKER,
CHARLES E. FOSTER.