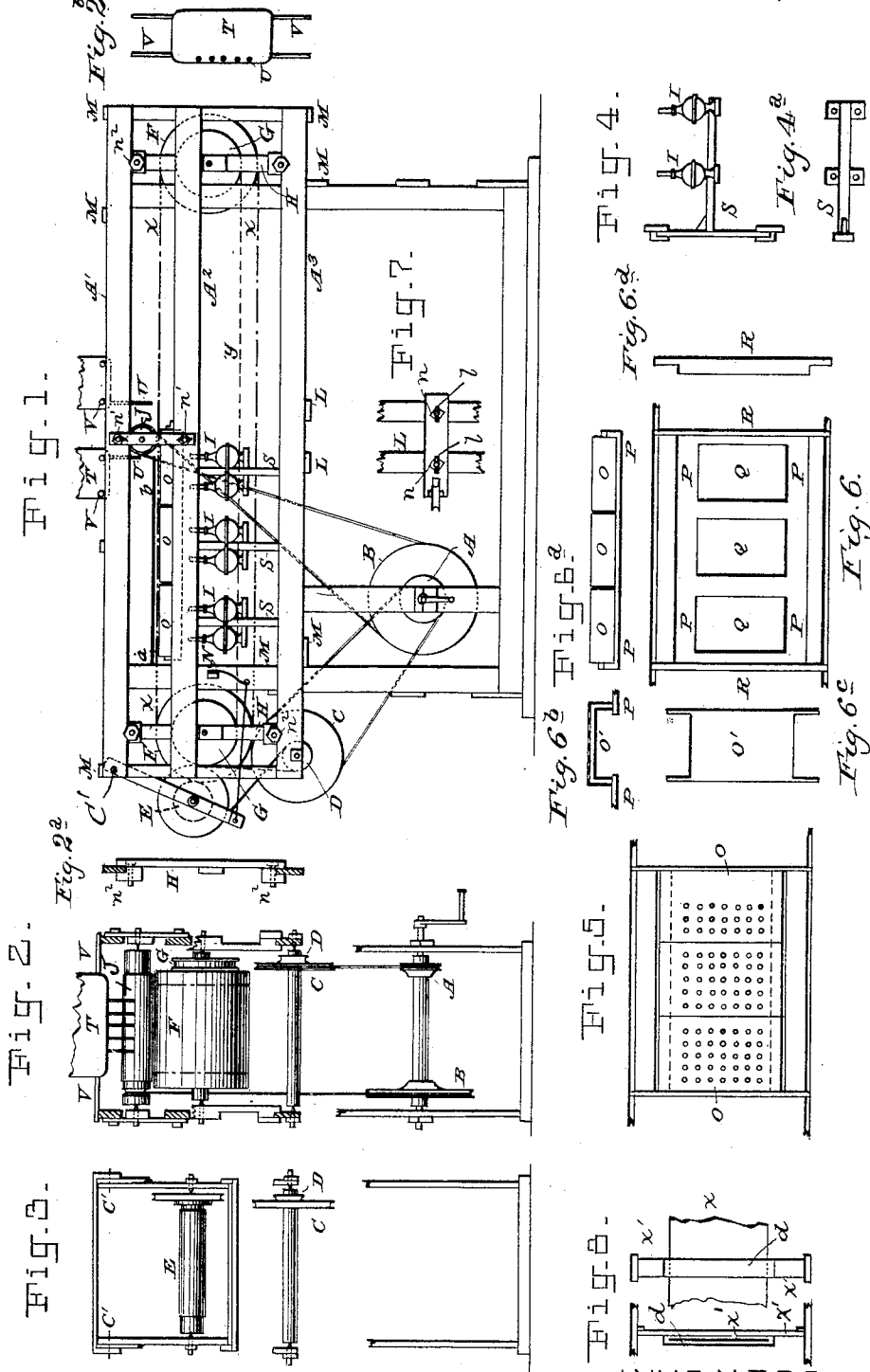


V. HIRBEC.
ELECTRICAL GENERATOR.

No. 464,156.

Patented Dec. 1, 1891.



WITNESSES:

E. P. Bolton
test.

By

INVENTOR:

Victor Hirbec
Picard & Co.
his Attorneys.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 10.

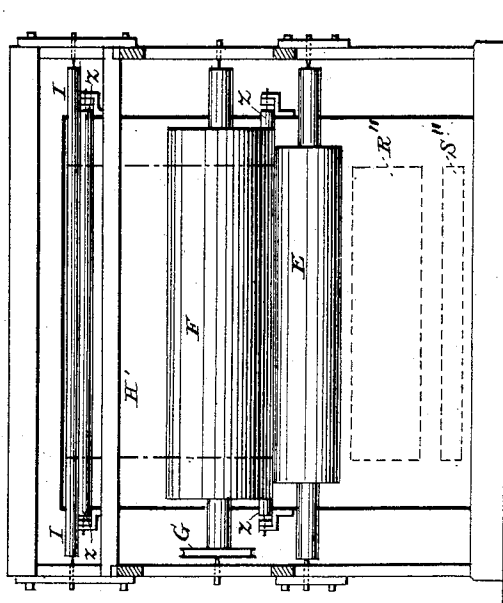


Fig. 14.

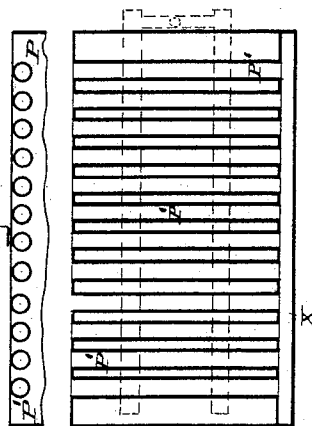
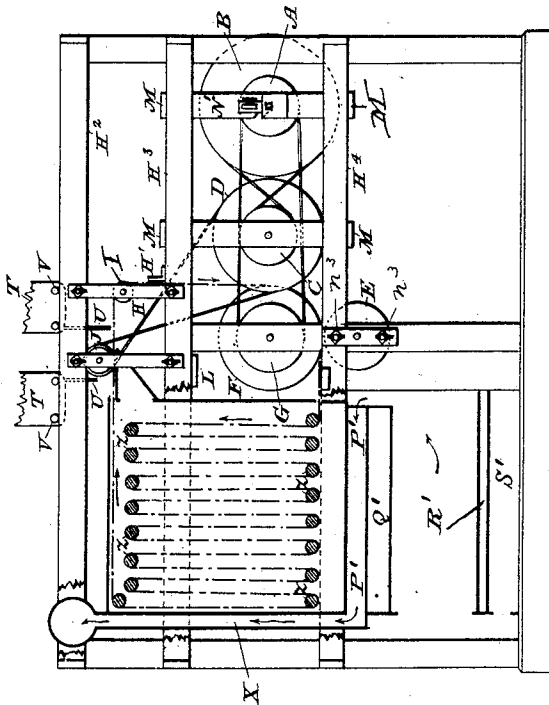


Fig. 8.



WITNESSES:

E. B. Bolton
L. E. Keale

By

INVENTOR:
Victor Hirbec
Richardson
his Attorneys.

Fig. 11.

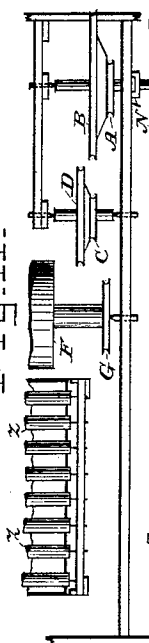


Fig. 12.

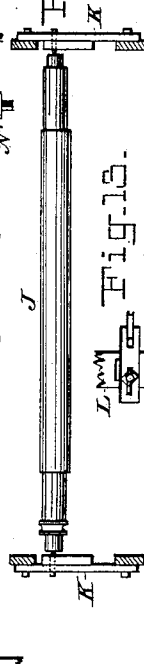
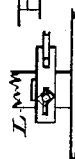


Fig. 13.



UNITED STATES PATENT OFFICE.

VICTOR HIRBEC, OF PARIS, FRANCE.

ELECTRICAL GENERATOR.

SPECIFICATION forming part of Letters Patent No. 464,156, dated December 1, 1891.

Application filed November 6, 1890. Serial No. 370,476. (No model.) Patented in Belgium August 18, 1890, No. 91,671; in Spain August 27, 1890, No. 11,180; in France October 2, 1890, No. 208,594; in Italy October 6, 1890, No. 28,308; in Sweden October 10, 1890, No. 2,918, and in Norway October 18, 1890, No. 2,000.

To all whom it may concern:

Be it known that I, VICTOR HIRBEC, engineer, a citizen of the Republic of France, residing at No. 48 Rue de Malte, Paris, in said Republic, have invented certain new and useful Improvements in an Apparatus for Showing the Principle of the Utilization of Heat as a Source of Electricity, (patented in Belgium August 18, 1890, No. 91,671; in Spain August 27, 1890, No. 11,180; in France October 2, 1890, No. 208,594; in Italy October 6, 1890, No. 28,308; in Sweden October 10, 1890, No. 2,918, and in Norway October 18, 1890, No. 2,000;) and I declare the following to be a full, clear, and exact description of the same.

The different forms of apparatus embodying my invention are designed one for the teaching of physics, the other for industrial use.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side elevation of a machine for educational purposes embodying my improvements. Fig. 2 is an end elevation thereof. Figs. 2^a and 2^b are respectively a sectional view showing one of the cylinder-supports and a bottom view of one of the collectors. Fig. 3 is an elevation of the power-transmitting roll, showing in detail the manner of mounting the rolls and cylinders. Figs. 4 and 4^a are respectively an elevation and plan of one of the lamp-holders. Fig. 5 is a top plan of the heating-boxes. Figs. 6, 6^a, and 6^b illustrate in plan, elevation, and section the relative arrangement of the heating-boxes and their supporting-frame. Fig. 6^c is a plan of one of the protecting-plates. Fig. 6^d is a side view of one of the transverse bars. Fig. 7 is a detail of an adjustable belt-tightening device. Fig. 8 shows in side and bottom plan the arrangement of the belt-guide. Fig. 9 is a side elevation of a machine adapted for industrial use. Fig. 10 is an end elevation thereof. Figs. 11, 12, 13, and 14 are details of some of the parts.

The arrangement of mechanism designed for educational purposes is shown in its entirety in Fig. 1. The apparatus shown in

said figure comprises a ribbon of paper x in the form of a belt, which is mounted on two wooden cylinders $F F$, as shown. At its upper part, where it moves from left to right, this ribbon travels in contact with the upper surface of three tin boxes O , which communicate the heat to it. In the part above these three boxes and extending back to the rubber J , of which we will speak later on, this ribbon is covered with a band $a b$, of flannel, under which it moves, and which has the object of retaining its heat. A roller-rubber J bears on this paper ribbon near the rear end of the third box, turning at its circumference with the velocity of about one meter fifty centimeters for one turn of the driving-pulley B , while during the same time the cylinders F , under the action of the pulleys $A C D$ and the roll E , are actuated to advance the paper about three centimeters. The revolution of the rubber J is in the same direction as the ribbon. (Shown by the arrows, Fig. 1.) The rubber is composed of a small wooden shaft of four and one-half centimeters in diameter, on which a piece of flannel is rolled in ten rounds. The end of this piece, which is in contact with the shaft, is nailed to it without any projection but the thickness of the flannel. The rolling up is made in the direction desired, so that the revolution of the rubber tends to wind the flannel on the shaft—that is, from left to right. The rolled-up flannel is nailed to the rim of the shaft at its two extremities. Under the action of the rubber the heated paper ribbon becomes negative. The rubber is positive. The action of the rubber is a purely mechanical action, by which it takes the electricity at its source, which is the heat in the paper ribbon, as is proved by the working of my apparatus under the different circumstances of the experiments for which I have intentionally arranged my apparatus. The current of electricity is led off from above the rubber and the paper ribbons by means of small tin tubes U , (or rods of a conducting metal,) which terminate in two metal boxes or conductors T , supported each on two glass tubes V on the upper bar A' of the frame and the one corre-

sponding to it at the back of the apparatus. The details of these conductors are indicated by the figure to the right of Fig. 1. Their height (not shown in the drawings) is thirty centimeters. The tubes U, secured to the bottoms of these conductors, must be of a length such that their lower ends are at a half-centimeter distant from the rubber and the paper ribbon, respectively, so that the passage of the electricity is made by discharge through the air and not by contact. These tubes or the metal rods which can be substituted represent the comb of the ordinary electrostatic machines. The tubes of the conductor receiving electricity from the rubber are arranged in a line parallel to this rubber on the side toward the left and a little above the horizontal axis of said rubber, as shown in Fig. 1. The tubes of the conductor receiving electricity from the ribbon are also in line above said ribbon. The conductor above the rubber is charged with positive electricity from the rubber, the other with negative electricity from the belt. The discharge is made either by sparks or by current in the ordinary conditions. The precise place for the tubes with relation to the rubber and to the ribbon is easily found with a little ball of cork suspended by a linen thread held in hand, and with which the electrical field is explored.

The three boxes O, Figs. 1, 5, and 6 are of tin and without cover. They are inverted, so that their bottoms are uppermost. This bottom is pierced with holes, as shown in Fig. 5; but in that side of the third box which lies beneath the rubber, there are no holes in the half before the rubber. These holes permit a more rapid transmission of the heat to the paper ribbon which passes above.

Figs. 6 and 6^a show the three boxes O fixed on a wooden frame P, which by means of two transverse bars R is supported by the bar A² of the frame, Fig. 1, and that which corresponds to it at the back. One of these bars R (shown at the right of Fig. 6 separated from the wooden frame) shows the cuts made at its ends, so that the lower surface of the frame comes down about twenty-two millimeters below the upper part of the two bars of the frame, serving as a support. The wooden frame has openings (shown by letters Q, Fig. 6,) underneath which the lamps are placed to heat the interior of the boxes, as shown in Fig. 1. Fig. 6 shows the bottom of the frame in plan, which is turned over so as to show said openings. Above these openings thin plates o' of sheet-iron are arranged on four feet, which are separated from the bottom of the boxes O by a space of half a centimeter only. This bottom is thus protected against the direct flame of the lamp, whose heat is also better divided on said bottom. The piece of sheet-iron punched to make a plate and its feet and the plate fixed over the opening of a frame are shown by the detached figures

at the left of Fig. 6. The heating underneath the boxes is done by means of twelve small ordinary oil-lamps, (shown by letters I, Fig. 1.) Six are in front on this drawing. The other six are in back. These lamps are mounted on supports S, of which one is shown in Fig. 4 from above and from the side. These supports are fixed to the two bars of the frame in back of Fig. 1, corresponding to the bars A² and A³. To put in and take out these supports easily, they are held on top and at the bottom by two cleats. (Shown by the upper drawing, Fig. 4.)

Fig. 2 shows the arrangements of the apparatus at the left end to show the breadth of the paper ribbon (indicated by broken and dotted lines) and its arrangement relatively to the cylinder F and to the rubber J, whose rubbing-surfaces extend out at each side from the breadth of the paper. This figure also shows the relations of the rubber J to the pulley B, of the pulley C to the pulley A, mounted on the same shaft as pulley B, which shaft is mounted in bearings on the frame and carries the driving-crank of the apparatus, while all the other parts which are revolved are mounted on the points of bearing-pins or studs secured to the frame.

Fig. 3 illustrates the relative sizes of pulleys D and the roller E, which latter, owing to its contact with cylinder F on the left of Fig. 1, transmits a rotary motion to said cylinder and drives the belt α .

Fig. 7 shows a pulley to tighten the cord or belt transmitting movement from pulley B to the rubber J, so that any slack in the cord may be taken up which would result from the lowering of the axis of the rubber should it be desirable to have it exercise a stronger pressure on the paper ribbon. This pulley is mounted on two bars L of the frame, Fig. 1, which are transverse, like the bars M, and secured to bars A³ by means of two screws whose shanks are fixed in the bars A³, but pass up through two slots l, made for this purpose in the pieces L, on which the pulley is fixed. Two nuts n, of hard wood, screwed on the screws above the bars A³, are adapted to clamp thereto the bars L, after adjustment of the pulley, to exercise the necessary pressure on the said cord, as shown by Fig. 7.

The two supports of the rubber are seen from the side in Fig. 1. These supports are fixed on the two bars A' and A² of the frame and on the corresponding ones in back by means of screws fixed in the bars of the frame, traversing slots in the support, and bearing at their ends nuts n' of hard wood, which operate to clamp the ends of the support tightly between the bars of the frame and the nuts. The supports can thus be moved at top and bottom to put them to the desired height.

The ribbon in the engagement just described is of very thin paper, so as to present a small body to be heated. The two ends of the rib-

bon of the desired length are united by means of a paste after the ribbon is rolled on the two cylinders F and passes through the flat openings of the guide, which will be described hereinafter. After placing the ribbon on each cylinder there is at some distance to the front a guide-plate to hold and rectify the direction of the ribbon, if necessary. This guide-plate is shown in the drawings, Fig. 8. It is composed of a little board x' , fixed horizontally at the height of the paper on the vertical bars of the frame of the apparatus shown at the two ends of the board or plate. On the upper surface of this board a band of paper is fixed very smooth and very supple, whose ends are united above the ribbon x to form a loop d , entirely flattened, which covers this ribbon and which is less broad by half a centimeter than the guide. Paper contracting by the heat, the ribbon must not be stretched taut, so that its contraction can take place without tearing it.

The cylinders F F are mounted on movable supports, which permit of their being approached or distanced, as is necessary. The design of one of these supports H is shown between Figs. 1 and 2. Its details are practically the same as the supports fixed on the apparatus.

The disks on top and on bottom are hardwood nuts n^2 , engaged on the screws fixed by their heads in the support, whose thickness at the place of the screw is increased, so as to almost touch the outer surface of the bar of the frame. In tightening the screws the bars of the frame are clamped between the support in the interior and the nut at the exterior. The tension of the ribbon must remain imperfect because of its contraction and expansion, which has been spoken of before. Movement is given it by roller E, bearing on the cylinder F. This roller presses the ribbon against the surface of the cylinder F to the left, to which it communicates movement. This roller E is of wood; but the part which must press on the ribbon is wound tightly around with paper, forming a thickness of three to four millimeters with several rounds. The paper used is common paper—for example, such as is ordinarily used as plain ground under the more costly wall-papers. To preserve its softness it must be applied without paste, but secured by fine tacks to each end of the roller outside of the part which must bear on the ribbon and without leaving any harmful projections. The winding must be made in the direction desired, so that the revolving movement tends to tighten and preserves it on the roll, as has been described of the flannel on the rubber J. The pressure of this roller on the cylinder may be maintained independently of the cord which connects it with pulley D by two springs, the free ends of which are connected to the sides of the movable frame, which bears the said roller, of which springs one is shown in N, Fig. 1,

the other being similarly disposed on the opposite side of the frame. The roller is, as I have just said, mounted on a frame pivoted on the centers C' , Figs. 1 and 3, which permits of its being approached more or less to the cylinder F, on which it acts. To maintain a relative movement between the two cylinders F F and the paper belt without subjecting the latter to strains, the cylinders are provided at the face end, Fig. 1, with pulleys G with flat groove and connected with each other by a cord, whose lower part is indicated by y on said figure. The flat form given to the groove allows the cord to slide in case an accidental circumstance would stop the travel of the ribbon, which would then not be exposed to being torn.

For industrial use my apparatus is shown by Figs. 9 to 14. It comprises a heating-chamber of sheet iron, whose parts are shown in Figs. 9, 10, and 11, and are indicated by heavy lines. The casing in Fig. 9 in rear of the bars H^2 , H^3 , and H^4 of the frame is supposed to have been removed to show the inner details. Said chamber has a grate or fuel-support R' , with an ash-pit S' . The chamber is fitted with return flues or tubes P' , which traverse the heating-chamber proper in its lower part and lead the products of combustion into a single flat uptake or flue X, which extends the entire breadth of the chamber and terminates above this chamber in a pipe (continued in the back of Fig. 9) to conduct the said products of combustion to the outside. Between the tubes P' and the fire-box there is a part Q' of the heating-chamber which is subjected to the direct action of the fire in the combustion-chamber, of which it forms the roof. In the said heating-chamber, above the tubes P' , are horizontally arranged two series of wooden rollers z , Fig. 9, provided with brass plates at their extremities and projecting to the outside on both sides of the chamber, where they are mounted on points carried by two bars in a way to permit of the oiling of the points on which they turn. (See Fig. 11.) The heating-chamber is at its upper right-hand corner provided with a triangular extension formed in one with said heating-chamber to have free communication therewith. An opening, which can be closed tightly, comprising almost the entire top of the heating-chamber, permits of access to arrange the paper in turns on the rollers. The paper ribbon (indicated by a dotted and broken line) enters into the heating-chamber at the height of the lower part of the cylinder F, Fig. 9, and is carried alternatively over the upper and lower rollers Z , as shown by Fig. 9, terminating its windings at the top of the heating-chamber on the last roller in the left corner and passing out at the right side below the upper surface of the heating-chamber and at the height of the top of the triangular extension, which has been men-

tioned above. The openings at the top and at the bottom for the entrance and exit of the ribbon are limited to a just sufficient size to admit of the free passage of this ribbon and provided with a border of highly-polished wood. The openings through which the ends of the rollers Z project are strictly limited to the dimensions of these rollers, at the same time permitting of their free rotation, in consequence of the movement communicated to them by the travel of the ribbon on them. After having been heated in the heating-chamber, where, owing to its sinuous course, it remains a sufficient time to be thoroughly heated, the ribbon comes out of the said chamber above the extension or annex and passes between the rubber J and the top of said annex, where it undergoes the action of the rubber. The ribbon is carried over a glass tube I, mounted as a roller on two points, and then goes on the cylinder F, from whence it is carried back into the heating-chamber by the opening at the bottom, and continues its circuit indefinitely. The conductors above the rubber and the paper ribbon only differ from those of the first apparatus in consequence of the wider ribbon necessitating the corresponding increase in dimensions, and in the number of tubes or stems of metal which they bear at their lower part.

The roller exercising the pressure on the ribbon and the cylinder is shown at E, Figs. 9 and 10. Contrary to what takes place in the first arrangement of my apparatus, this roller turns under the action of the cylinder F. The pressure is regulated by the adjustment of the point-supports, on which it is mounted. To permit of this adjustment each point passes freely through a vertical slot formed in the two upright bars of the frame in front and in back, between which is the roller. The two supports are held on the bars of the frame by means of screws and hard-wood nuts n^3 , like the supports K of the rubber and H of the roller-tube I.

Fig. 10 shows the apparatus seen from the right end, the disposition of the tube I, the cylinder F, the roller E, and the movable bars, which bear the points on which the rollers Z are mounted. The dotted lines R'' and S'' in the same figure indicate the lines of the openings of the hearth and the ash-pit, which are at the other end of the apparatus. The dotted and broken lines on the tube I and the cylinder F represent the width of the paper ribbon, which has the strength of good ordinary school-paper, and the place it occupies on said tube and cylinder. The guide-plate of the ribbon, arranged like the one in the first disposition of my apparatus, is vertically arranged like the ribbon in this part. It is shown at H' on Fig. 10, and is indicated by this same letter on Fig. 9.

Fig. 11 represents the interior and exterior ends of the rollers Z of the heating-chamber,

with the movable bar bearing the points of these rollers and the supports of this bar seen from above. This same Fig. 11 shows, seen from above, the arrangement of the pulleys A and G to move the cylinder, and of the pulleys B, C, and D to move the rubber J. The shaft of the pulleys A and B is mounted in bearings in front and on points in back. The points of the two shafts in back are carried by two upright bars, corresponding to those shown facing in Fig. 9. These upright bars rest at the top and the bottom on the transverse bars M of the same figure, and are connected at the side of the frame to the right by two bars, the one on top, the other at the bottom, (of which one seen from above is shown in this Fig. 11,) which corresponds with the bars H³ H⁴ of Fig. 9.

Fig. 12 shows the rubber J, with its pulley and its supports, which allow of its being raised and lowered to regulate the pressure on the ribbon.

Fig. 13 shows a small pulley mounted on the transverse bar L, (see same letter, Fig. 9,) which it is possible to displace, and thereby to more or less stretch the left part of the cord going from pulley D to the pulley of the rubber J.

Fig. 14 shows the arrangement of the return-tubes P' for the products of combustion ending at the flue X.

I claim—

1. The combination, substantially as described, of the cylinders, the paper belt thereon, a heating device to heat said belt, a rubbing-roll arranged above the rear end of the heating device to revolve in contact with the belt, conductors each having a set of conducting-points arranged one to receive electricity from the rubber and the other from the belt, and means for rotating the cylinders and the rubber.

2. The combination of the cylinders with their paper belt, the heating devices and rubbing-roll for said belt, the insulated conductors each provided with a set of conducting-points terminating one near the rubber and the other near the belt, and driving mechanism transmitting motion to the cylinders through a roll held in frictional contact with one of said cylinders, substantially as described.

3. The combination of the cylinders, a paper ribbon or belt mounted thereon, a driving-belt connecting said cylinders, the heater, the rubbing-roll and conductors arranged as described, the roll E, held in frictional contact with one of the cylinders and its paper belt by spring-pressure, and mechanism for rotating said friction-roll, substantially as hereinbefore set forth.

4. The combination of the cylinders, the paper ribbon or belt, the heater, the flannel-surfaced rubbing-roll, the conductors with their points, the frictional driving-roll, and

mechanism for rotating said driving-roll, substantially as described.

5 5. The combination of the cylinders, the paper ribbon or belt thereon, a driving mechanism for the cylinders, the rubbing-roll, the frictional driving-roll, and mechanism arranged to drive the rubbing-roll at greater speed than the cylinders, substantially as described.

10 6. The combination of the cylinders, the paper ribbon or belt, the rubbing-roll, the pa-

per-surfaced frictional driving-roll, the conductors, and the power-shaft having pulleys connected with the rubbing and frictional driving-rolls, substantially as described. 15

In witness whereof I have hereunto set my hand in presence of two witnesses.

VICTOR HIRBEC.

Witnesses:

EMILE LEVERQUE,
J. L. RATHBONE.