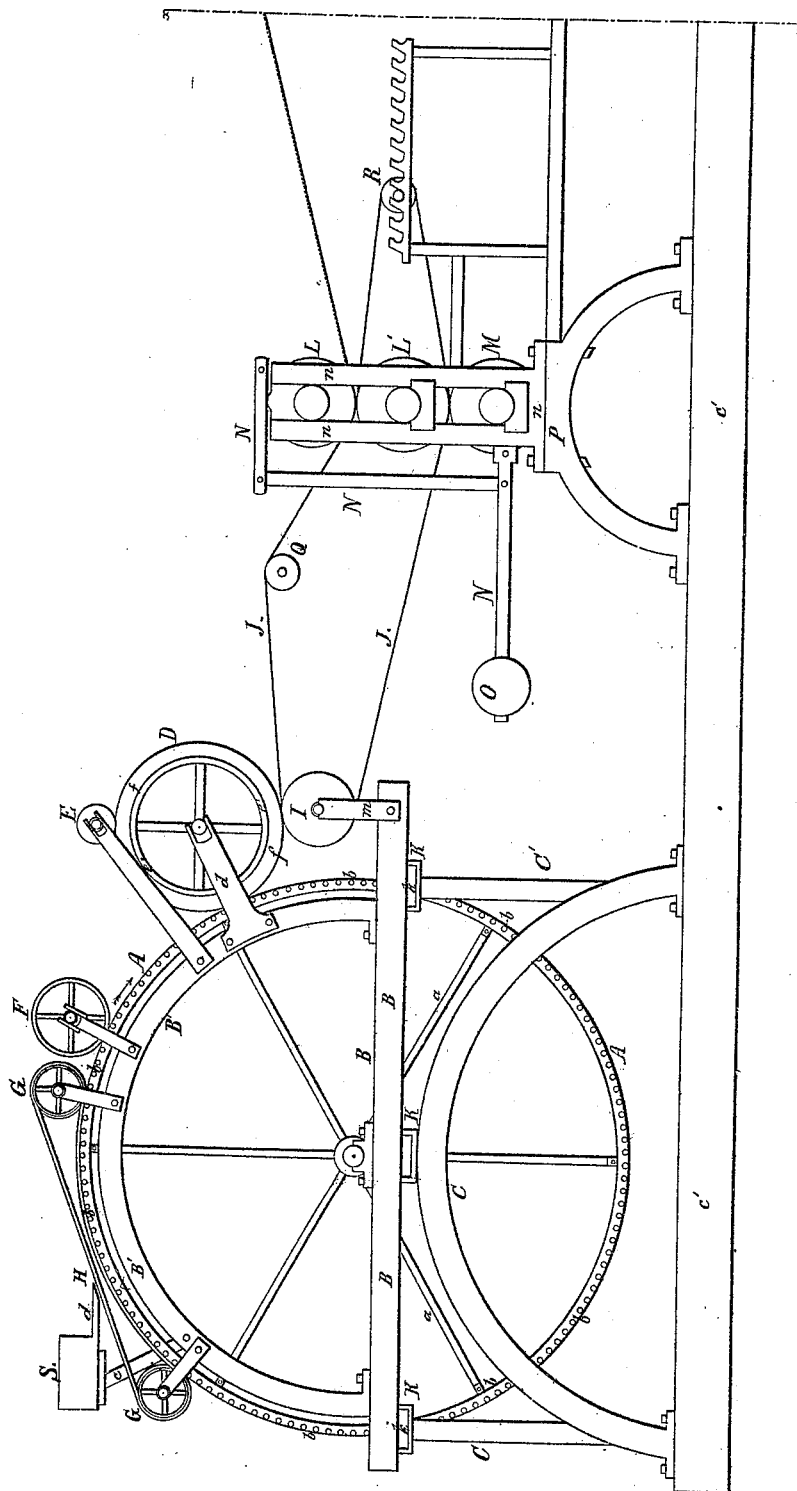


Fig. 1.



Knight & Condict. Sheet 2 of 2 Sheets.
Paper Mach.

N^o 1,336.

Patented Sept. 25, 1889.

Fig 1.

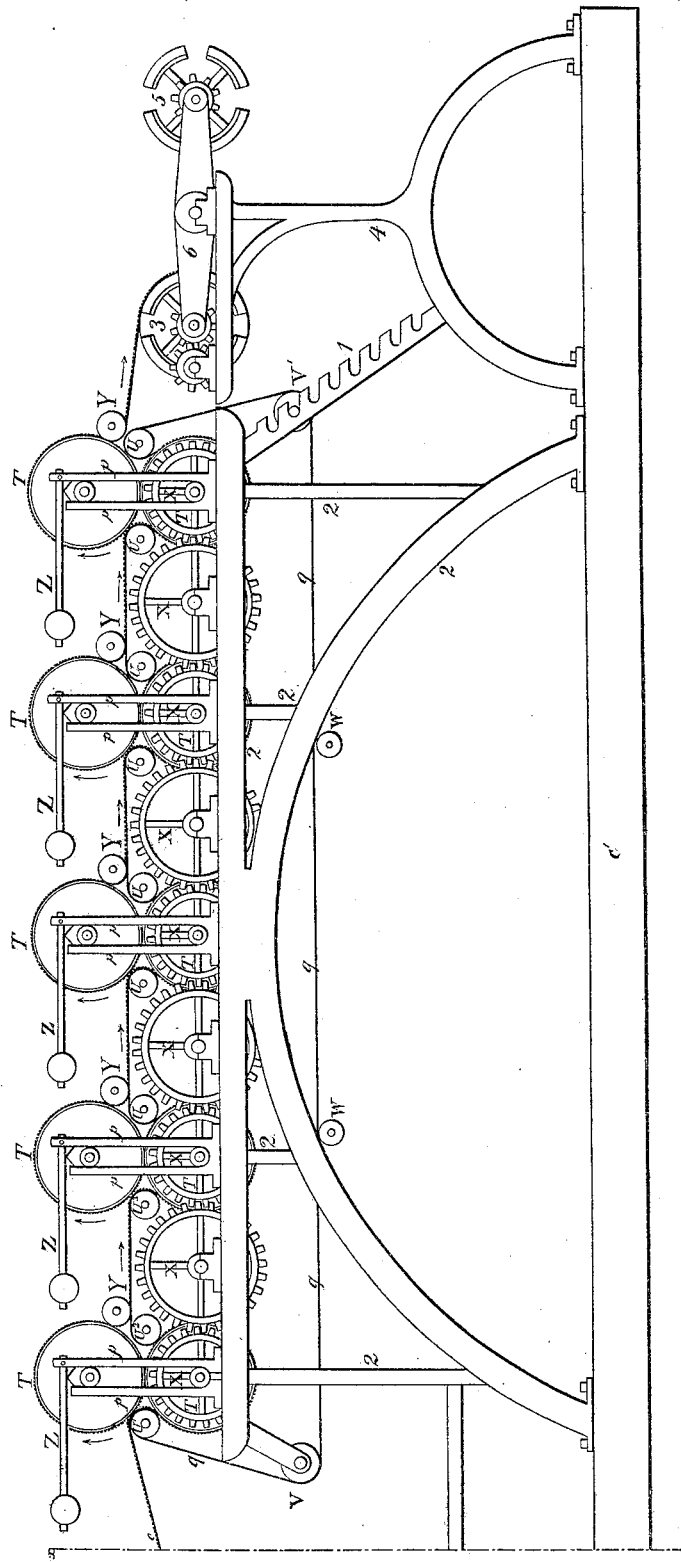
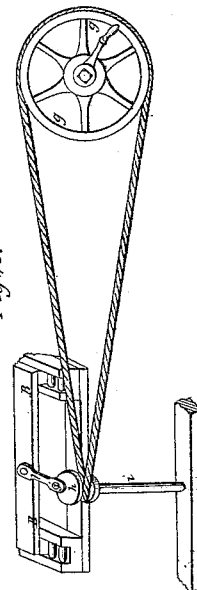


Fig 2.



UNITED STATES PATENT OFFICE.

WILLIAM KNIGHT, ABIJAH L. KNIGHT, AND EDWARD F. CONDIT, OF
WHIPPANY, NEW JERSEY.

IMPROVEMENT IN MACHINES FOR MAKING PAPER.

Specification forming part of Letters Patent No. 1,336, dated September 25, 1839.

To all whom it may concern:

Be it known that we, WILLIAM KNIGHT, ABIJAH L. KNIGHT, and EDWARD F. CONDIT, of Whippany, in the county of Morris and State of New Jersey, have invented certain Improvements in Machines for Manufacturing Paper; and we do hereby declare that the following is a full and exact description thereof.

In our machine the paper is formed upon a revolving cylinder, the construction of which is similar to the cylinders now in use; but it is made considerably larger in diameter than those originally employed, and the paper stuff or pulp is supplied to it in a mode altogether different from that used in other cylinder-machines.

In the accompanying drawings, A A represent one end of the cylinder, Figure 1 being a side view of the machine, A being the shaft upon which it revolves, and *a a* the arms or spokes which sustain the rim A A. This cylinder is made, as above indicated, in a manner already known, the skeleton or frame of it consisting of a number of wheels, all of the same size and placed upon the same shaft at the distance of six or eight inches from each other, their number being determined by the destined length of the cylinder, which must equal the width of the widest paper intended to be made upon it.

b b b are the ends of the rods or bars, which extend from end to end of the cylinder, passing through and attached to the rims of the respective wheels. These rods may be at the distance of about an inch from each other, and they must be made perfectly true, in order that the cylinder may present a true and uniform surface. These are to be covered with wire-gauze in a manner well known to the makers of cylinder paper-machines—that is, a covering of coarse wire-cloth is first placed upon the cylinder, and over this the fine one, upon which the paper is to be formed. The axis of this cylinder has its bearings upon a frame B B' B', the arch portion of which B' B' serves as a support to some of the appendages of the machine, to be presently described. This upper frame, which is made movable, rests upon a stationary frame C C C, which is firmly secured to the ground-sill or basis of the machine C' C' C'.

S is a pulp-box, from which the paper-stuff is supplied to the cylinder. This box is attached to the arch B' B' by support *c*, the pulp flowing through a spout *d*, extending from end to end of the cylinder and regulated by a suitable gate, by means of which its quantity may be graduated or entirely arrested.

A revolving motion may be given to the cylinder A A in any convenient way. The plan which we have adopted is to extend a band from a whirl or pulley on the axis of the pressing-roller L to a whirl or pulley on the axis of the paper-cylinder A A. When the machine is in action, the cylinder A revolves in the direction of the arrows, and as the pulp flows upon it the water passes through the meshes of the wire-gauze, so as to prepare the deposited pulp for the action of the cylinder F, which cylinder we make about eight inches in diameter. Its surface is covered with wire-cloth and its journals run in standards *e*, attached to the arch B' B'. Its office is to aid in pressing the water from the pulp, which it does by its own gravity as it rests upon and receives its motion from the cylinder A. It may be constructed in various ways; but we prefer to make it of metal, turned true on its surface and having wires or rods of copper or of brass extending along its periphery to support the wire-cloth.

To give an even edge to the paper made upon cylinder-machines, it has been the practice to pass a band or fillet of cloth, leather, or other suitable material around each end of the cylinder; but as a substitute for this on our cylinder we place at each end two band-wheels G G, carrying a band H, which bears upon the cylinder to a sufficient distance to effect this object.

D is a second pressing-cylinder having its bearings in standards *d*, attached to the arch B' B'. This cylinder we make about eighteen inches in diameter, and its axis is about seventeen or eighteen inches above that of the cylinder A. Its surface we cover with cloth. Its office is to aid in consolidating the paper and to take it off from the cylinder A. It rests, like the cylinder F, upon the periphery of A and is made to revolve by it. Its pressure is equalized by allowing its journals to play up and down between cheeks on the upper ends of the standards *d*. We have made

this cylinder in the following manner: The part *ee* (shaded dark in the drawings) we have made of cast-iron, and this we have covered with wooden staves, (represented by the lighter part *ff*) which, being turned true, form a good foundation for the woolen cloth with which it is to be covered. It may, however, be made in other ways to answer the same purpose. Upon the top of the cylinder *D* rests the cylinder *E*, which is of wood, uncovered, and about four inches in diameter. Its office is to collect the broken paper and waste pulp that will occasionally be produced or escape in the operation of the machine, and this will be carried up to it by the cylinder *D*. To the naked wood such stuff will cling, and it may then be readily disposed of. A very important feature in our machine is the giving a vibratory motion longitudinally to the paper-cylinder *A A* and to its immediate appendages—that is, to the parts attached to the arch *B' B'*. We have said that the upper frame *B B*, with its appendages, rests and is movable upon the lower stationary frame *C C*. At the upper ends of the standards or uprights *c' c'*, as at *K*, we place cylindrical rollers *K K*, which rest upon the stationary frame and support the vibratory frame *B B*, which rests on the top of said rollers, and as these are made hard and true the upper frame may be moved upon them with facility. The motion communicated is to be a rapid vibratory one, endwise of the cylinder. The distance which it moves will be generally limited within three-fourths of an inch, and it will sometimes be much less, this being determined by the quality and state of the paper-stuff which is being used. This vibratory motion may be communicated in various ways well known to mechanics. That which we have essayed is represented in Fig. 2. In the accompanying drawings, *g g* is a band-wheel placed on one of the journals of the pressing-rollers *L*, Fig. 1, from which a band is carried around a whirl *h* on a vertical shaft *i*, running in bearings at one end of the frame *C C*. Near its center on the upper end of this shaft there is a crank-pin *g*, which by means of a link *b* is connected to the frame *B B*, and will of course cause it to vibrate. The length of the vibrations may be determined by shifting the crank-pin and their rapidity by the dimensions of their respective whirls.

The roller *I*, which may be about eight inches in diameter, is like the other cylinder already described, connected to the vibratory frame *B B* by being placed on standards *m*. It is placed immediately under the roller *D*. The endless apron *J J* of woolen cloth by which the paper is carried off from the cylinder *D*, passes around this roller. It will be seen that the respective cylinders which we have described, as well as the pulp-box *S*, being attached to the frame *B B*, vibrate with it, and there is not, consequently, any chafing of the paper which is being made. The end-

less apron *J J* passes between the rollers *L*, *L'*, and *M*, which have their supports in the frame *n n n*, the rollers *Q* and *R* serving as guides and sustaining rollers to it and the latter serving to stretch it by passing it at a greater or less distance, as will be seen by inspection.

L and *L'* are two metallic pressing-rollers, made perfectly true, and between these the endless apron and the paper pass, and the latter has the water sufficiently pressed out by them to prepare it for the drying-rollers.

The roller *M* is of wood, and its use is to press the water out of the endless apron as it returns toward the paper-cylinder *A A*. The bearing of the cylinder *L'* may be stationary and to its journals may be attached a spur-wheel or other gearing, by which motion may be given from the first to the respective parts above described.

The compound levers *N N N* serve by the aid of weight *O* to press the upper roller *L* and the lower roller *M* against the middle *L'*. This part of the apparatus is shown as sustained on a part of the frame *P*. The paper and the endless apron *J J* separate on their passing between the rollers *L L'*, the former passing alone, as at *o o*, toward the drying-cylinders *T T*.

We usually employ ten drying-cylinders placed in pairs one above the other, and although we consider these as sufficient for all useful purposes we do not intend to confine or limit ourselves to this number. They are marked *T T T* in the drawings. They are about twelve inches in diameter, usually of iron or copper, turned perfectly true upon their surfaces. They are hollow and have hollow journals for the introduction and discharge of steam, and are, in fact, made in all respects like the drying-cylinders in other paper-machines, their difference consisting of their being made of a smaller size than ordinary and in their being used in pairs one above another, so that they may press as well as dry the paper. These journals may work between uprights *p p*, and the upper may be pressed upon the lower roller with any desired degree of force by means of the weighted levers *Z Z Z*. The upper rollers are without gearing, and are made to revolve by the motion of the lower rollers. These latter are geared together by means of spur-wheels on their axes and intermediate spur-wheels *xxx*. The cylinders thus constructed will press closely throughout their whole extent; but they may be made to work at any desired distance from each other by placing hoops or bands of a determined thickness on each end of one of the pairs of rollers. To each pair of drying-cylinders there is a pair of guide-cylinders *U U*, the journals of which have their bearings in the frame-work of the apparatus. Their peripheries stand as near to the drying-cylinders as can be admitted. Between them and the upper drying-cylinders there should

be just sufficient space for the naked paper to pass on its return from the lower cylinder over the upper one.

Nos. 9 9 9 represent an endless woolen apron or cloth upon which the continuous sheet of paper O O (represented by dotted lines) is received as it arrives from the paper-cylinder A A to be acted upon by the drying apparatus. Upon the apron the paper is received at U, over which cylinder the paper and cloth pass together, thence around and under the first lower drying-cylinder; but when the two arrive at the second small cylinder U² they separate, the paper passing alone under and around the first upper drying-cylinder, as shown by the dotted lines, while the apron passes onto the third small cylinder U³, the paper being again received upon it as it passes the holding-roller Y, which serves to hold or keep the paper in contact with the upper drying-cylinder and to conduct it onto the apron. In this manner the paper passes along the whole series of drying-cylinders, and when delivered from the last is wound on the reels 3 or 5 placed on the ends of levers 6, precisely as in many other paper-machines, there not being anything new in this part. The rollers V V and W W serve as guides and straightening-rollers to the apron 9 9, the course of which is clearly indicated by the yellow lines. No. 1 represents a notched rack for the reception of the journals of the stretching-roller V'.

Nos. 2 2 2 are parts of the frame, sustaining the part of the machinery; No. 4, the frame which supports the reels. In the drying-cylinders now in use the cylinders or driers work separately, not in pairs or in contact with each other, in consequence of which they consume more steam than our cylinders, and the paper made by them is less smooth than that which is pressed between heated cylinders, as in our machine. The number of drying-cylinders most commonly used in other machines is five, and these are ordinarily from two to three feet in diameter. In these there can be but five different degrees of temperature, subjecting the paper frequently to too sudden a transition, causing

the paper to cockle or wrinkle. In our apparatus we have ten cylinders. A successive graduation of temperature to that extent may be obtained without it being necessary to furnish a larger drying-surface than on the ordinary five cylinders.

The mechanician will readily understand that a corresponding side elevation is to be found on that side of the machine opposite to that shown in the drawings, and that these are connected together by suitable girths or frame-work of wood or metal in the ordinary way.

Having thus fully described the manner of constructing our machine and also explained the manner in which the same operates, we do hereby declare that we do not claim as of our invention either of the individual parts of the machine taken separately; but we do claim to have combined and arranged these parts with each other and so to have proportioned them as to have produced new and useful results.

We claim—

1. The combination of the revolving bands H H with the cylinder for giving an even edge to the paper at each end of the cylinder, causing by said arrangement the said band to revolve by the cylinder itself.

2. The running of the paper-cylinder A A upon an independent frame B B, resting upon rollers upon a stationary frame in such manner as to admit of a vibratory motion being communicated to said upper frame and the parts appended thereto, as herein described.

3. The combining of the naked wooden roller E with the roller D for the purpose of collecting the broken paper or pulp, as set forth.

4. The arrangement of the drying-cylinders in a number of successive pairs for the purpose of simultaneously drying and pressing the paper, as herein described.

WM. KNIGHT.

ABIJAH L. KNIGHT.

EDWARD F. CONDIT.

Witnesses:

CHARLES FORD,

EDWIN FORD.