Jan. 3, 1939. F. KIENZLE 2,142,728

PERFORATING DEVICE

Filed May 22, 1936

Fig. 1.

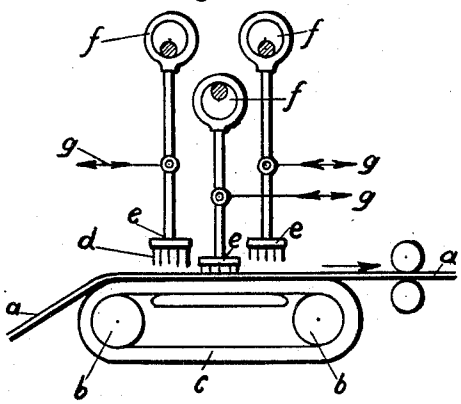

Fig. 2.

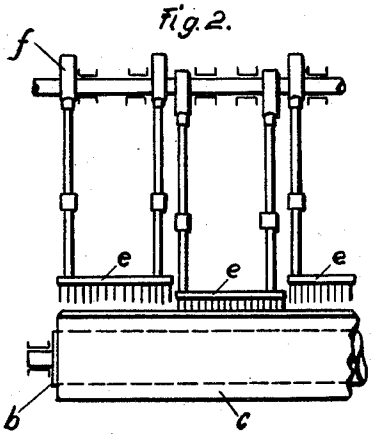

Fig. 3.

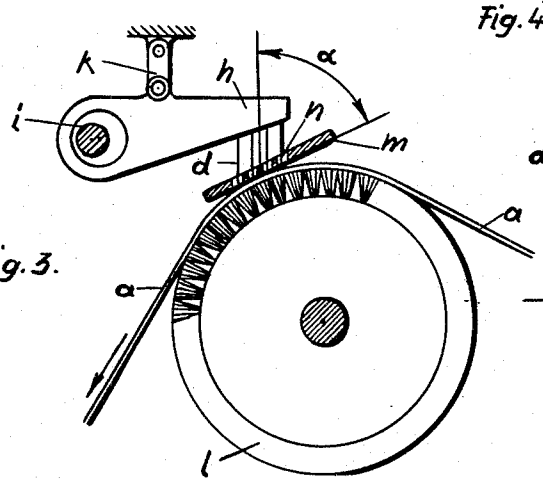

Fig. 4.

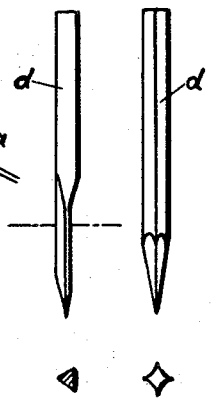

Fig. 5.

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UNITED STATES PATENT OFFICE

2,142,728

PERFORATING DEVICE

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In Austria May 23, 1935

4 Claims. (Cl. 164—89)

My invention relates to a device for perforating materials which have the form of sheets as for example sheets of paper stuff, wood pulp, cellulose, paper, card board, or any other kind of sheets, or films of a fibrous composition, of fabrics or plaited materials thereby improving certain important qualtities as regards their use or subsequent treatments. It has been proposed to perforate sheets of the said kinds in order to render them more permeable to liquids or gases or light and also more able of drying or to be freed of certain contents by the application of pressure, or by evaporation, or by heating, in short to prepare them for any kind of treatment whatsoever affecting their interior parts. Sheets or films thus perforated can in certain cases thereby acquire the qualities of fabrics or plaits such as elasticity, softness, pliability, soaking ability, and others.

My new device has for its object to produce perforations for the said purposes in a most efficient way without any waste of material and allowing of arranging the single perforations as closely spaced apart as is preferable for special purposes. It may be broadly stated that usually it serves the purpose of better opening up a sheet of whatever material to a certain treatment the nearer the perforations are located to one another. A further object of my invention is to make the perforations at a great speed and to reduce the power needed.

With these objects in view, I provide a device with a plurality of needle-like pins operated to be oscillated in a vertical but simultaneously also in a parallel direction to the sheet, which itself is moved at a certain speed along and in front of the said tools. Instead of being moved vertically the pins can also be moved at a certain angle to the sheet. Further, these pins can form a single group or a plurality of groups arranged side by side or behind one another, or also in staggered positions and they can be operated so as to move simultaneously, or they can be timed differently. For supporting the sheet to be perforated I use a carrier which is itself of an open structure in the sense to let the pins enter freely when they penetrate the sheet farther than its thickness. Such a carrier for example may be a drum the surface of which consists of felt, or of a brush, or of other materials which likewise can support the sheet against the action of the pins without offering the said pins any resistance against penetrating. It may be of advantage to arrange between the sheet and the pins members for holding the sheet free from the pins, the said members being either stationary or operated to move as the case may be or also of a resilient nature and in any case possessing slots for letting pass the pins towards and from the sheet. Finally, I use pins which in planes rectangular to the axis have a profile differing from a circle being polygonal while the projecting corners of the polygon are connected by level or convex surfaces, whilst in the direction of the axis the surfaces may arch concavely. It may be of advantage to perforate the sheets while still being treated as they may possess in that case a greater elasticity or permeability. This may also simplify the kind of movements of the pins, for example when the sheet is in a moist condition it may suffice to move the pins straight in the direction of their own axis only.

In the drawing in which I have shown schematically two embodiments of my invention and of the tools employed therein,

Figs. 1 and 2 are views at right angle to each other of one embodiment;

Fig. 3 is a sectional view of another embodiment of my invention, all parts not necessary for the understanding of the invention being omitted and only the tools in their working position in relation to the sheet under treatment and the support of the latter being shown.

Figs. 4 and 5 show two different forms of tools with the profiles of their cross-sections.

In Figs. 1 and 2 the sheet *a* to be perforated is supported by an endless yielding member, e. g. felt-band *c* upon two rolls *b* which band is driven in the direction of the arrow. The pins *d* are arranged and held in groups by members *e* which form the bottom ends of vertically suspended excentric rods each two of them being united by one of the said members *e*. The excentric *f* and the rolls *b* are supposed to rotate under the driving action of the main shaft of the device here not shown thus moving the pins up and down and simultaneously transporting the sheet upon felt *c* by the transporting rolls. The totality of pins is divided in groups in lateral direction as well as in the direction of the movement of the sheet, and their movements are differently timed, in order to allow the sheet *a* to move with a constant but high speed as is necessary with many materials and to balance the oscillating movement of the pins and their driving members. In the direction of the arrows *g* further excentric rods not shown and linked to the vertical ones give the latter a simultaneous oscillating movement in the horizontal direction. Their movements are timed so as to move the single group

of pins in the same direction in which the sheet moves whilst the pins do penetrate the sheet but moving them in the opposite direction whilst the pins are lifted to clear the sheet.

In Fig. 3 the sheet *a* is supported by a roll the surface of which forms a brush *i*. The pins *d* project from the underside of a lever *h* which is guided by a link *k* and is oscillated by an excentric *l*. The direction of the pins forms an angle α with the plane of the sheet *a* at their points of action. The sheet *a* is here held free from the pins by a plate *m* with slots *n* for letting the pins pass through. This means prevents the sheet eventually from being caught by the pins on their retreating movement and likewise to be impaired by them. By a selection the aforesaid angle α for the direction of the pins and by the use of the plate *m* the working speed can be considerably increased.

Fig. 4 shows one preferred form of a pin *d* possessing a round shaft with a pointed end portion of triangular profile. The surfaces between the three edges are level and should not project over the direct connecting line between two edges in order to lessen friction when penetrating the substance of the sheet. In the direction of the axis of the pin the edges may be arched outwardly.

In Fig. 5 the point has a profile with four edges whilst the surfaces between these edges recede somewhat for further diminution of possible friction. In the direction of the axis of the pin these edges run straight.

In my device the sheet substance is only displaced at the point where a pin penetrates it. There are no parts of it cut out and wasted.

I claim:

1. In a perforating apparatus, in combination with pointed pins and means for moving the same towards and away from the material to be perforated, a movable endless member carrying a brush both for supporting the material while being perforated and feeding the same.

2. In a perforating apparatus, in combination with pointed pins and means for moving the same towards and away from the material to be perforated, means for imparting to said pins an oscillating movement at an angle to the material to be perforated, and an elastic support both for supporting the material while being perforated and feeding the same.

3. In a perforating apparatus, a series of pointed pins adapted to be moved towards and away from the material to be perforated and of angular cross-section forming edges, the latter being arched in the direction of the axes of the pins.

4. In a perforating apparatus, in combination a pivoted two-arm lever, pointed pins carried by one arm of said lever, means engaging the other arm of said lever for oscillating the lever to move the said pins towards and away from the material to be perforated, a link for guiding said lever during its oscillations, and a yielding support both for supporting the material while being perforated and feeding the same.

FRITZ KIENZLE.