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(54) **INFLUENCING THE PROFILE OF THE PROPERTIES OF A WEB BY MEANS OF AN ACOUSTIC FIELD**

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(57) **ABSTRACT**

The invention relates to a method and a device for the processing of a fiber web or a suspension layer in a paper-, cardboard- or coating-machine or a size press for influencing the profile of the properties of a web by means of at least one sectional, directed acoustic (sound) field. In other words, the acoustic field is narrower than the width of the fiber web or the suspension layer, and the acoustic field affects components of the fiber web or suspension layer at a defined angle. Profiles of the properties of a web influenced by acoustic fields are lamination, spatial orientation, fiber orientation, dry content, breaking length ratio, flocculation and color coat thickness. Furthermore, the introduction of a signature mark into the fiber web or suspension layer is possible.

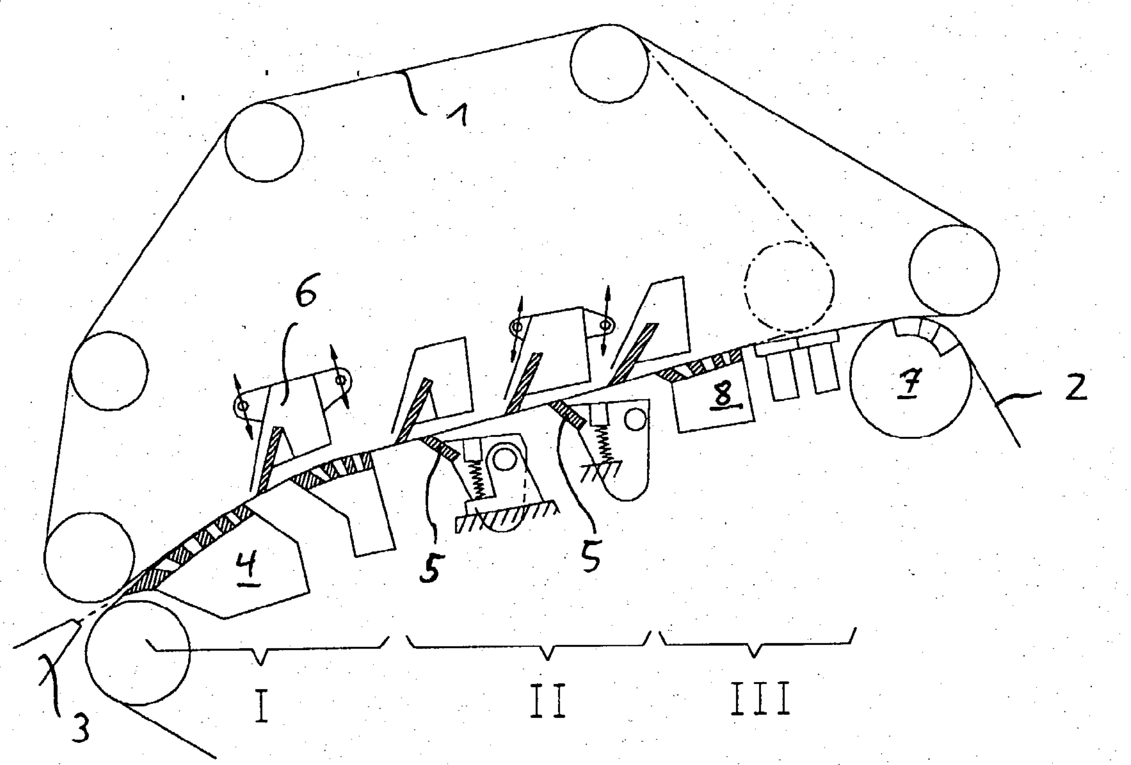
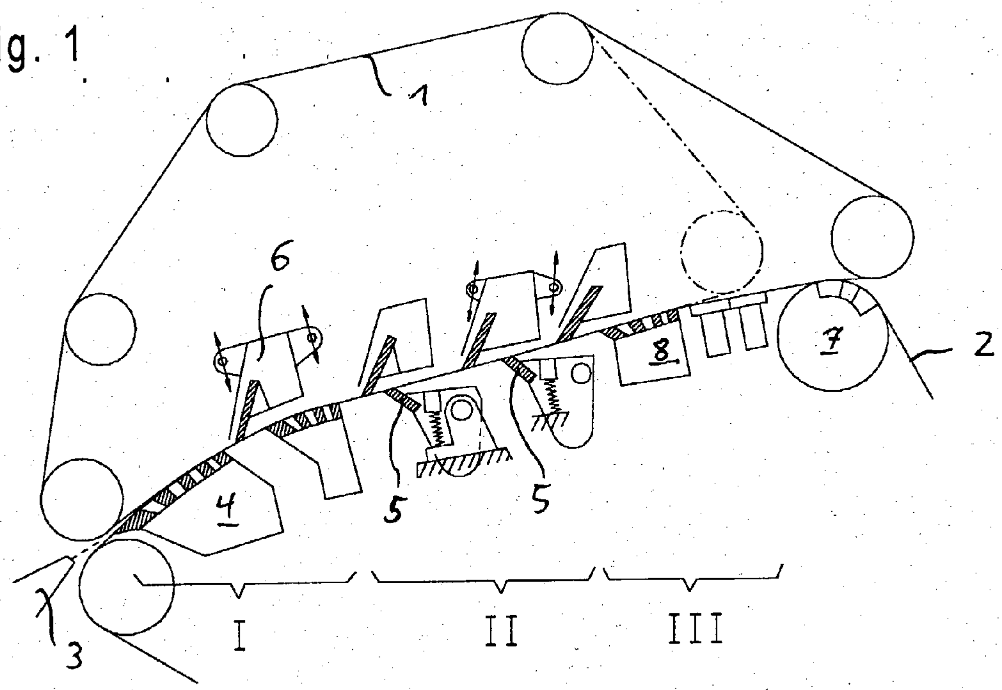


Fig. 1



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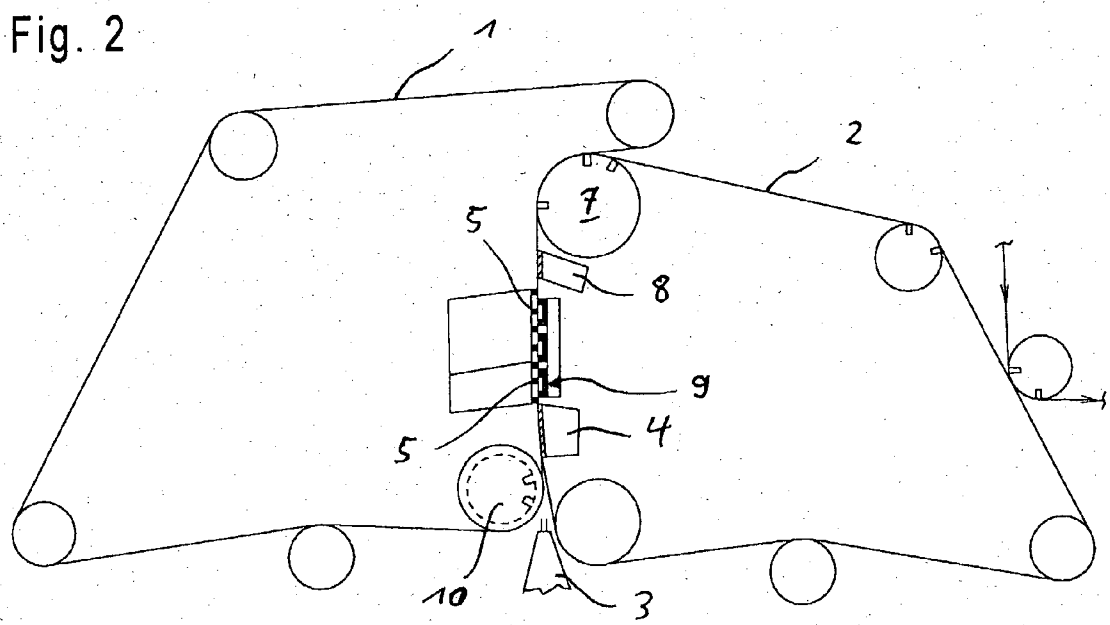

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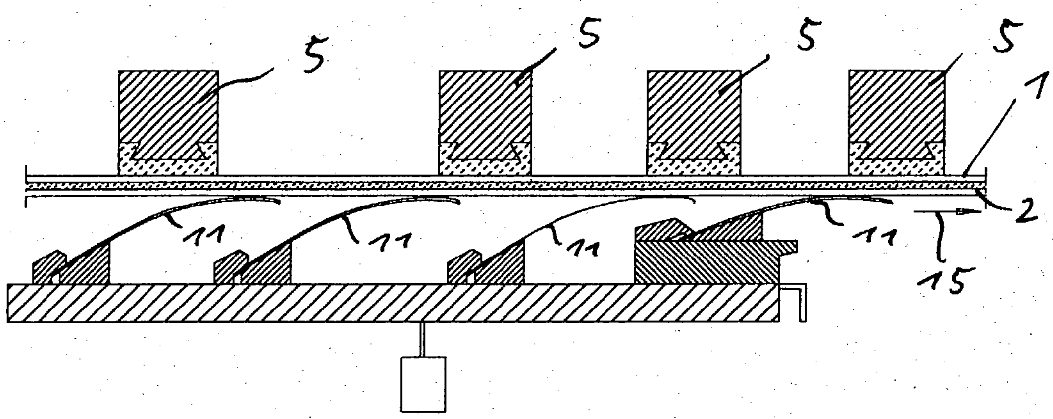

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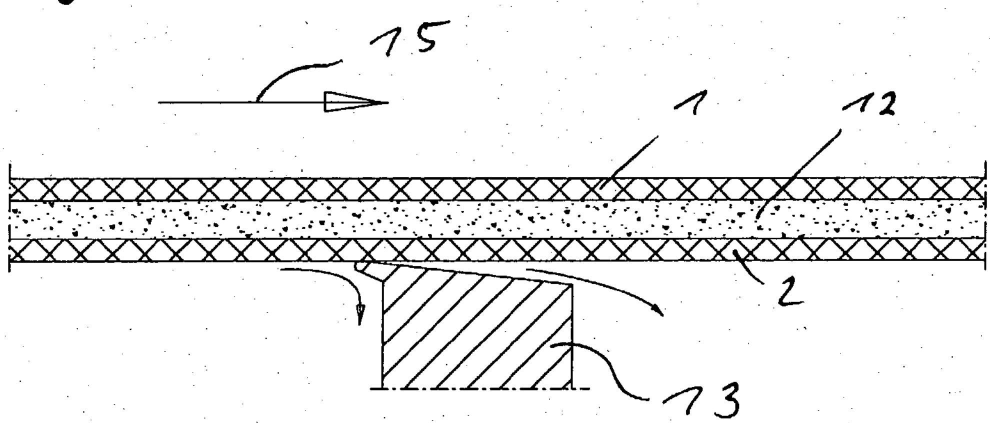

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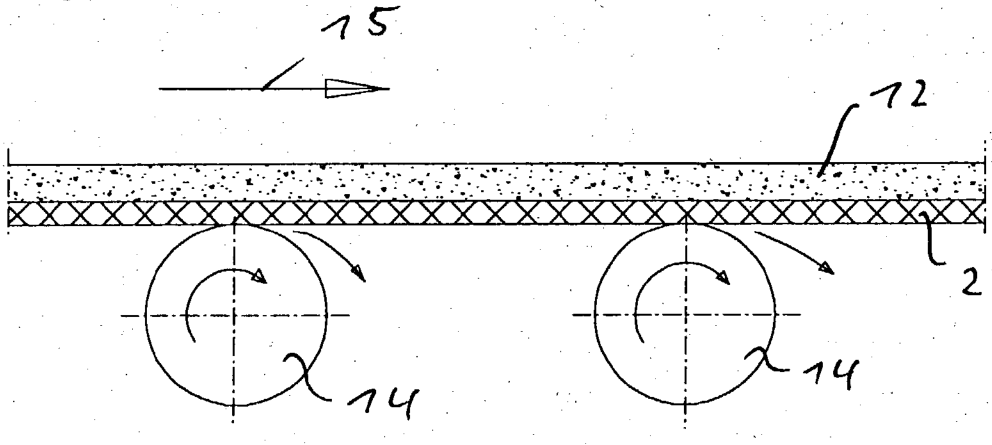

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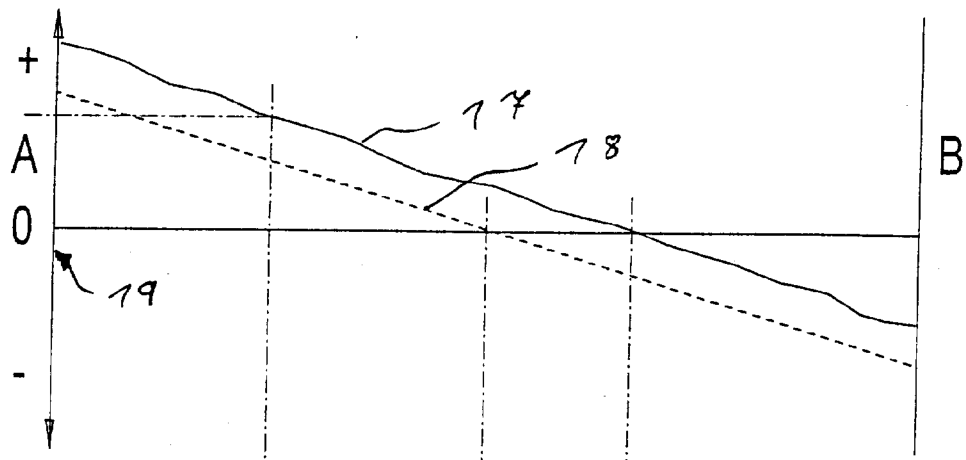

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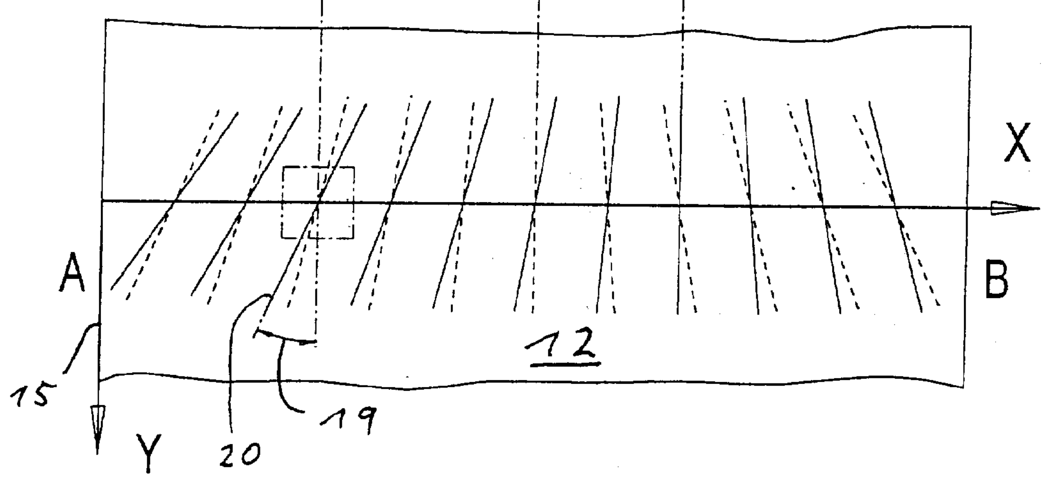

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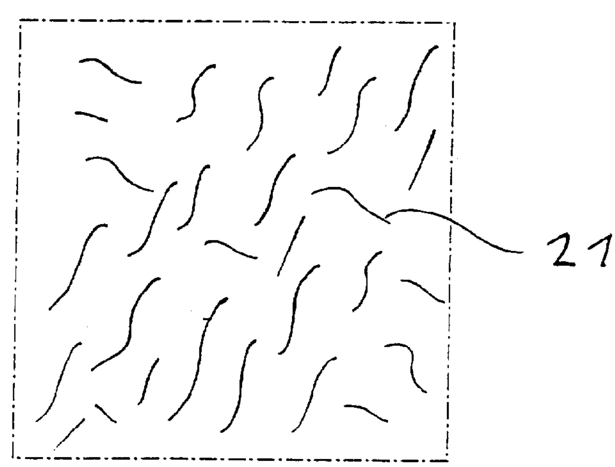

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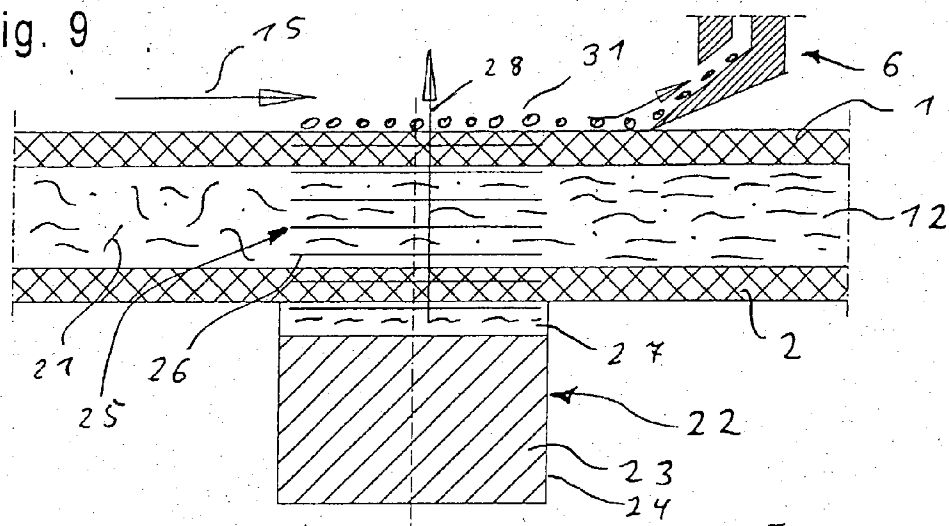

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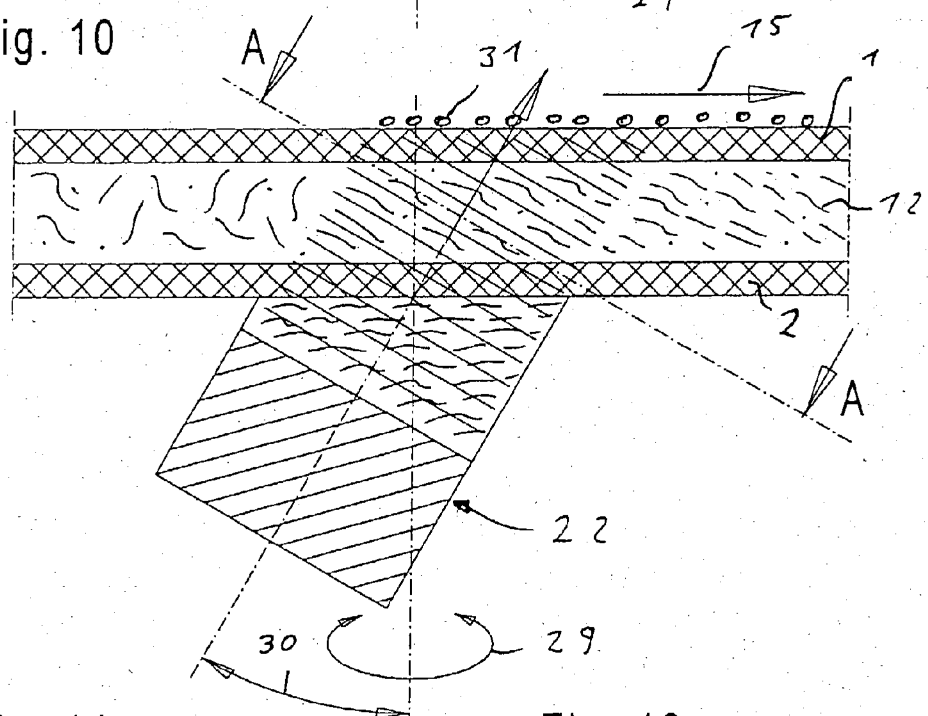

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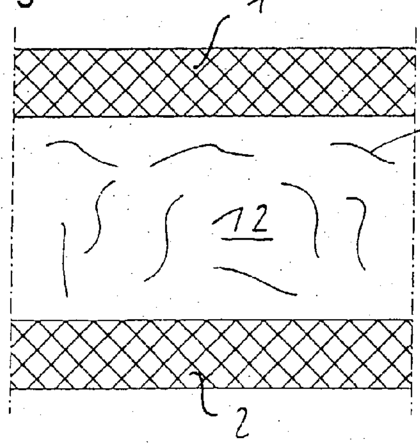

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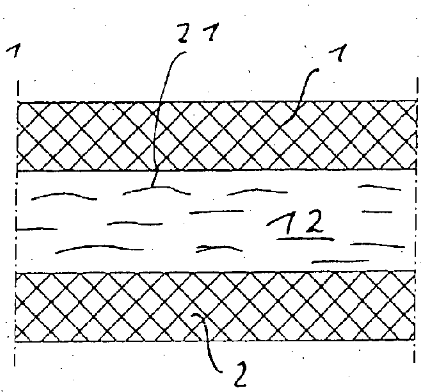

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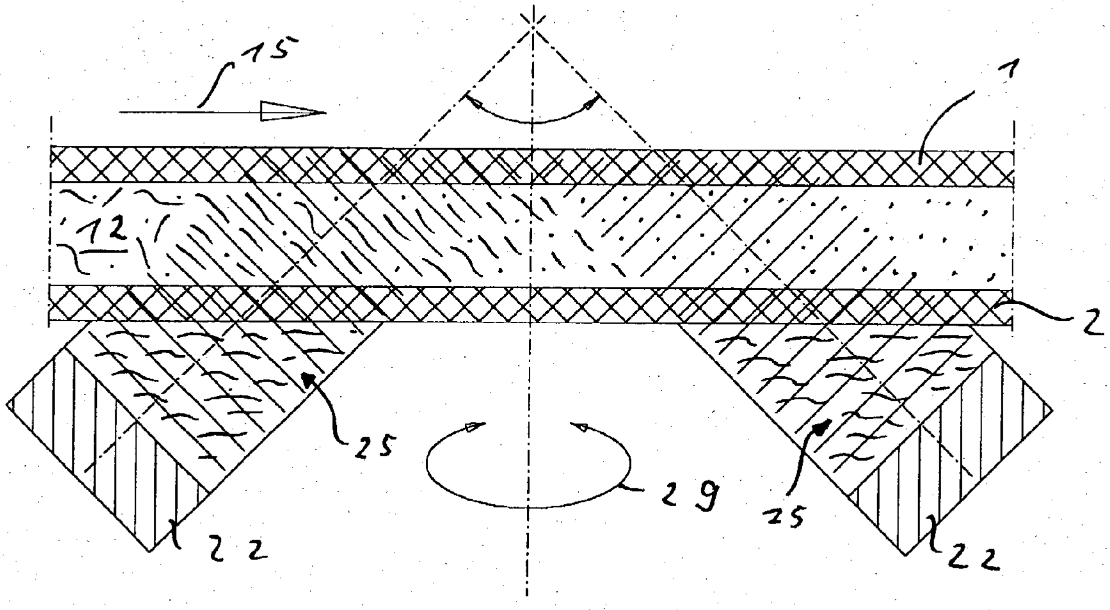
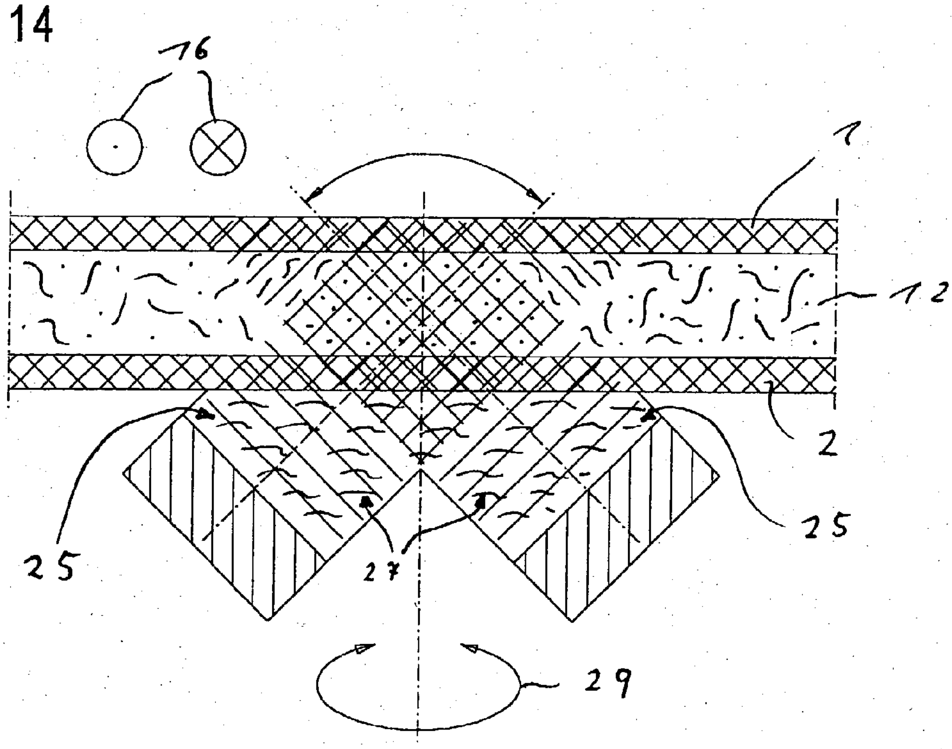


Fig. 14



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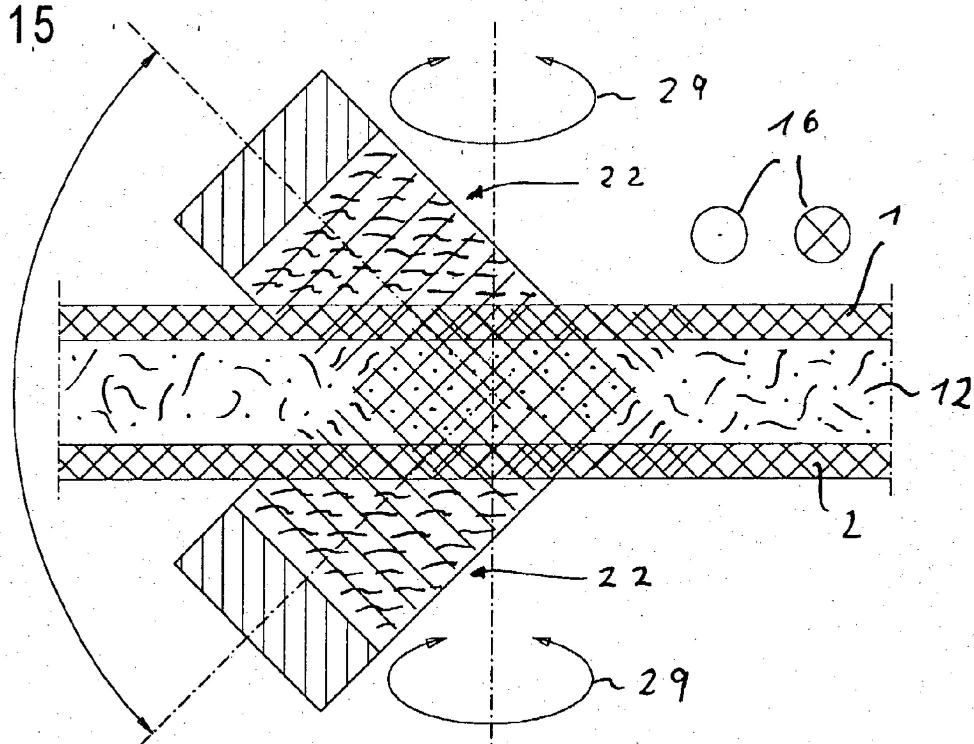

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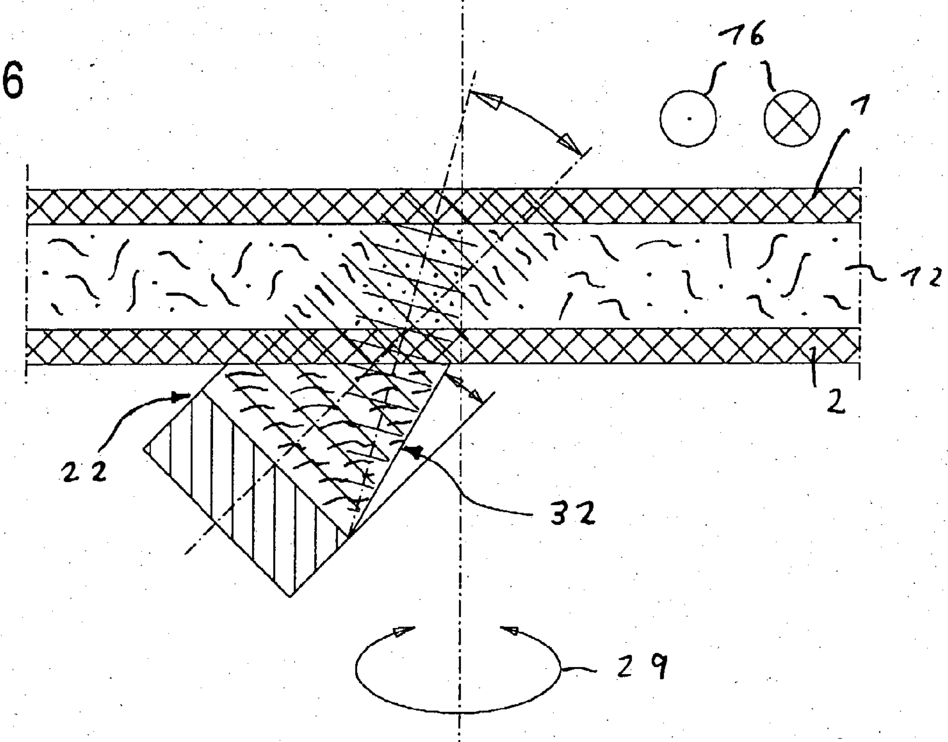

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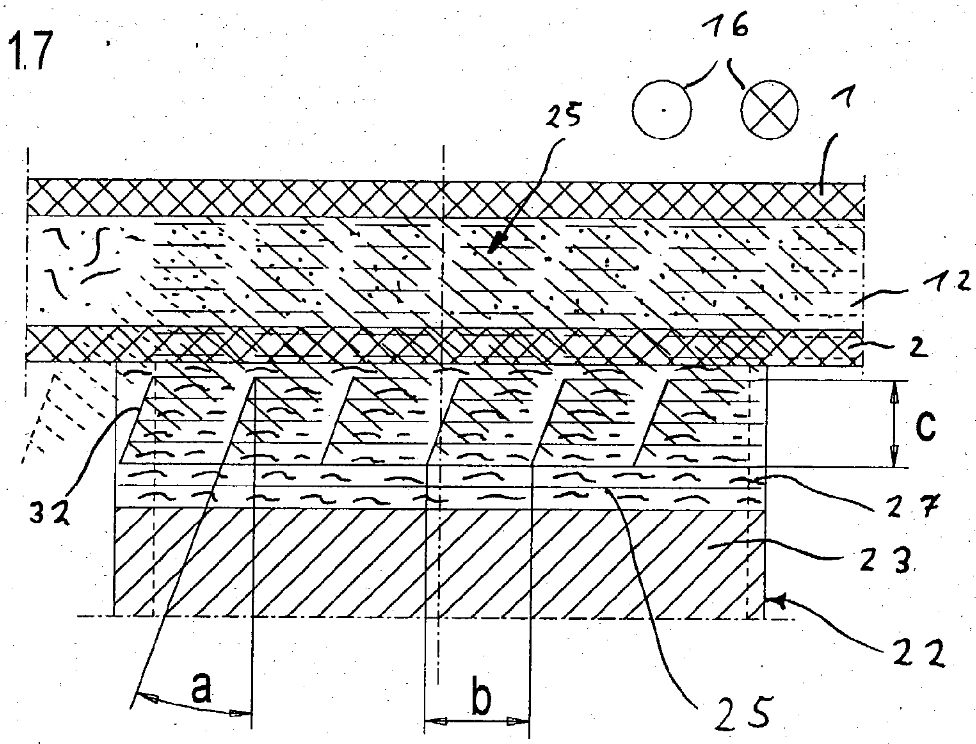

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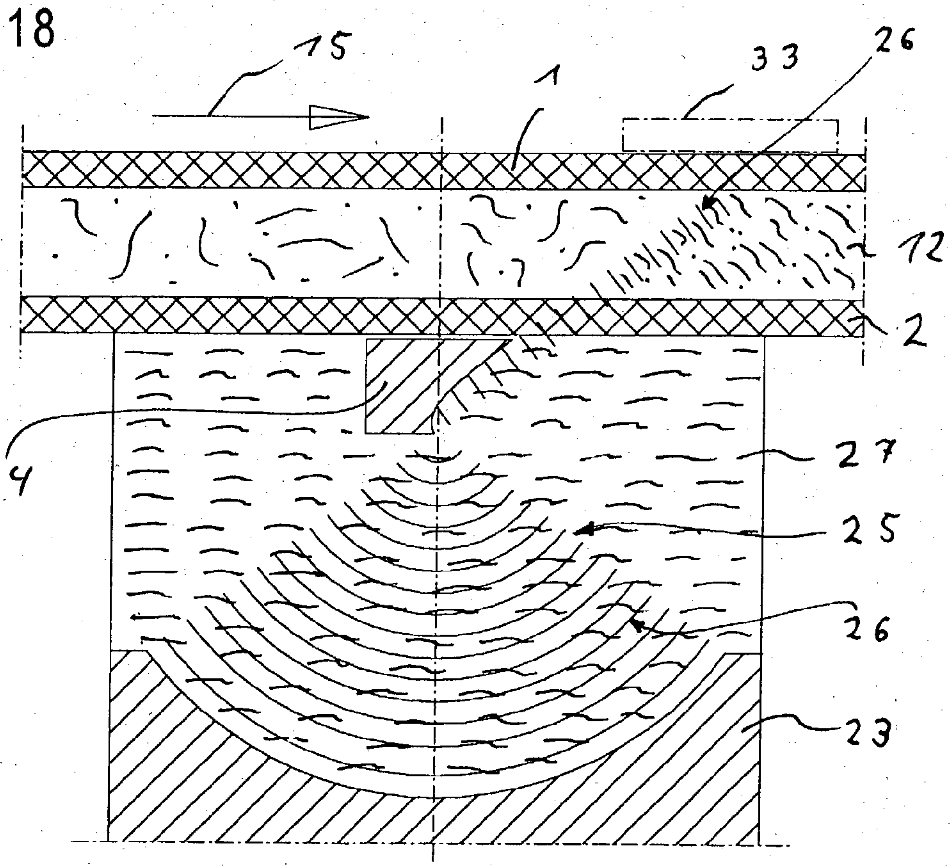

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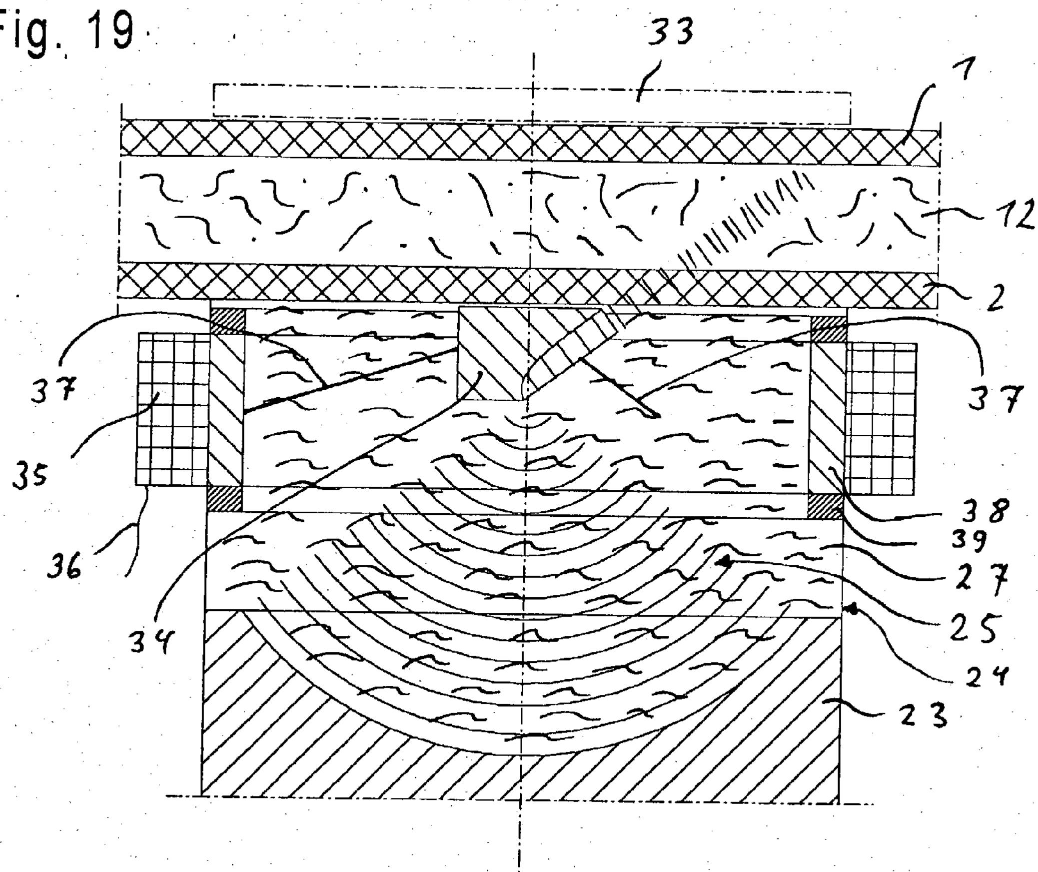

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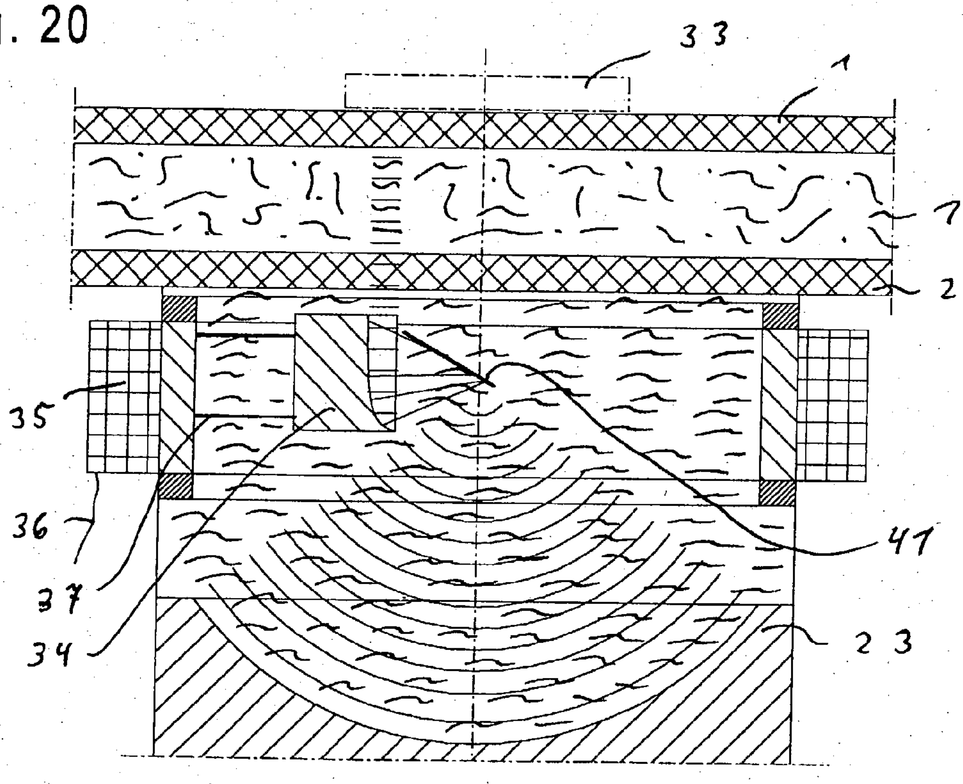

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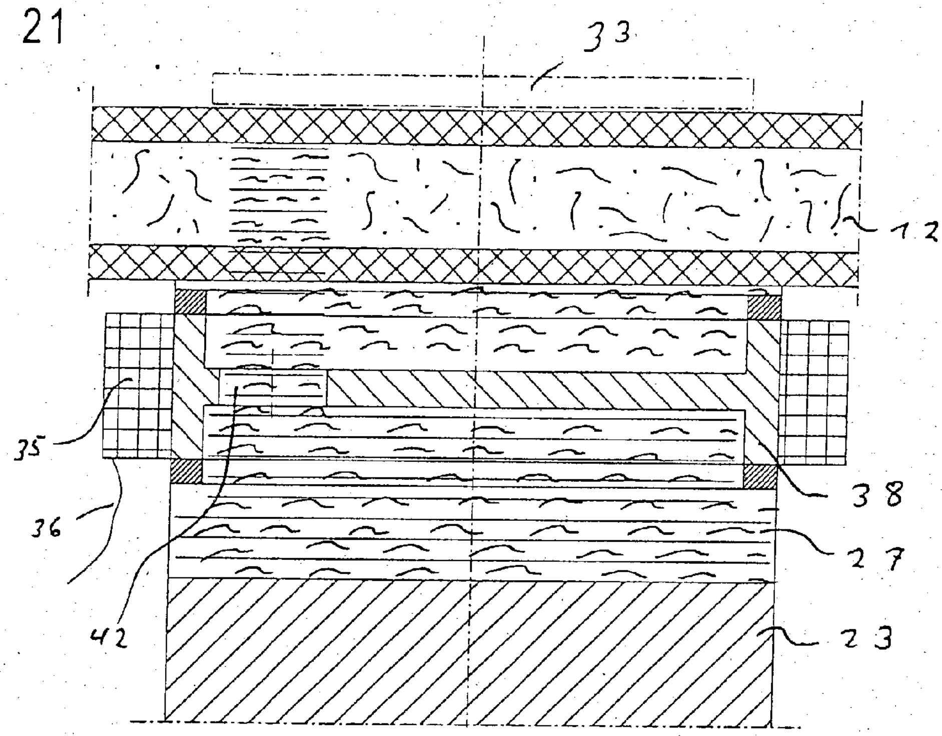

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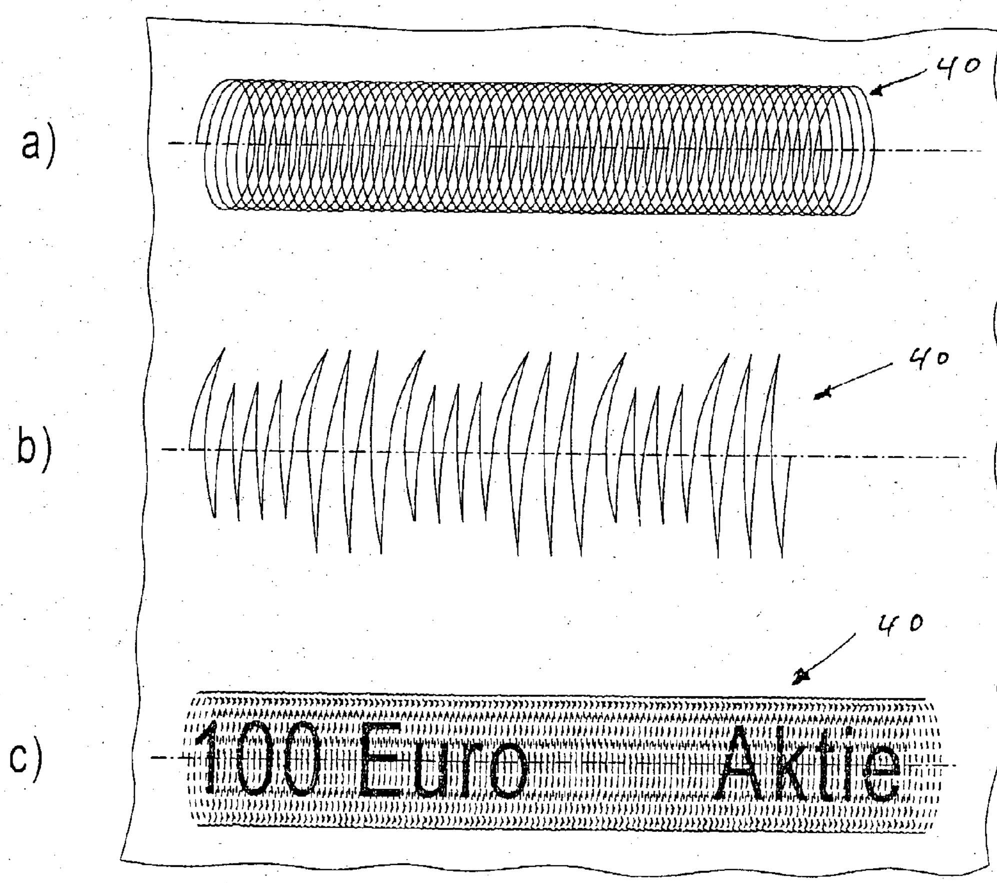

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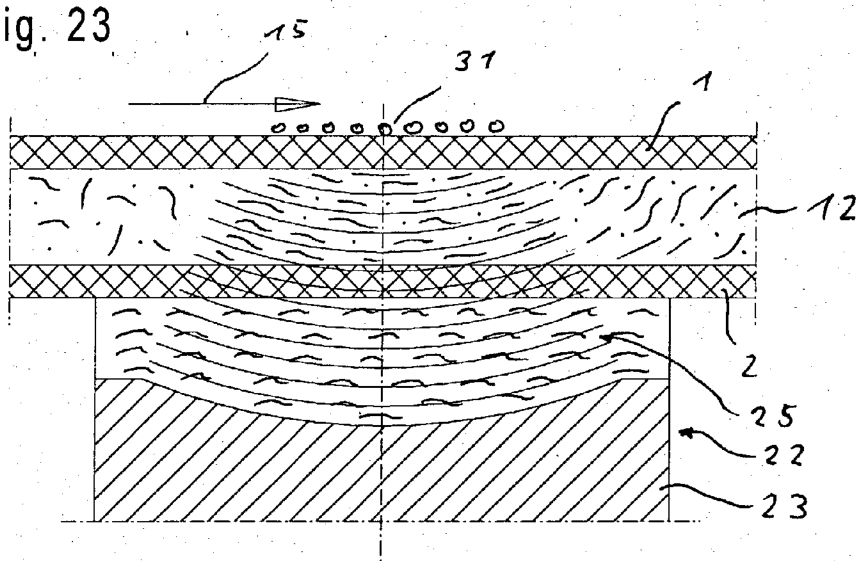
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Fig. 24

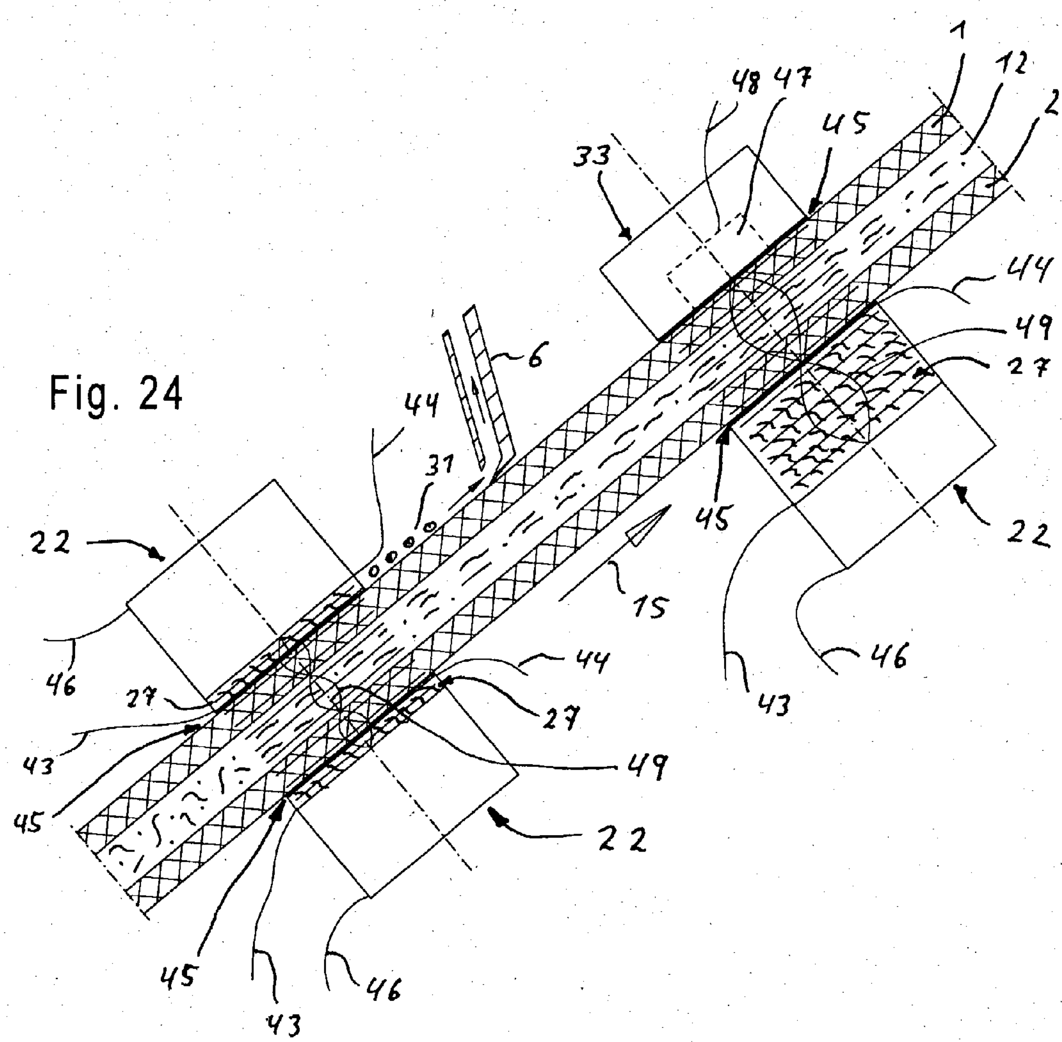
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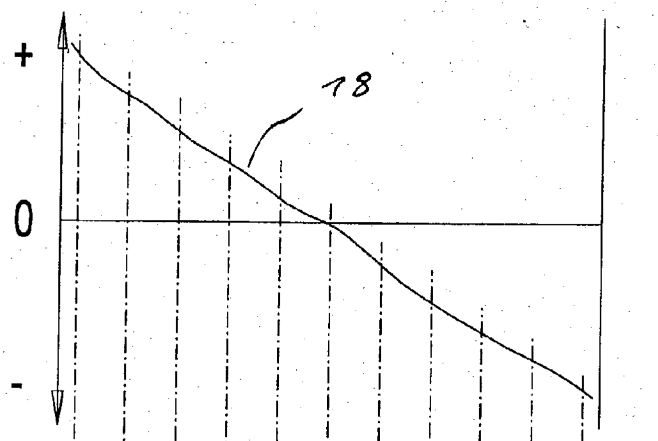
Fig. 25



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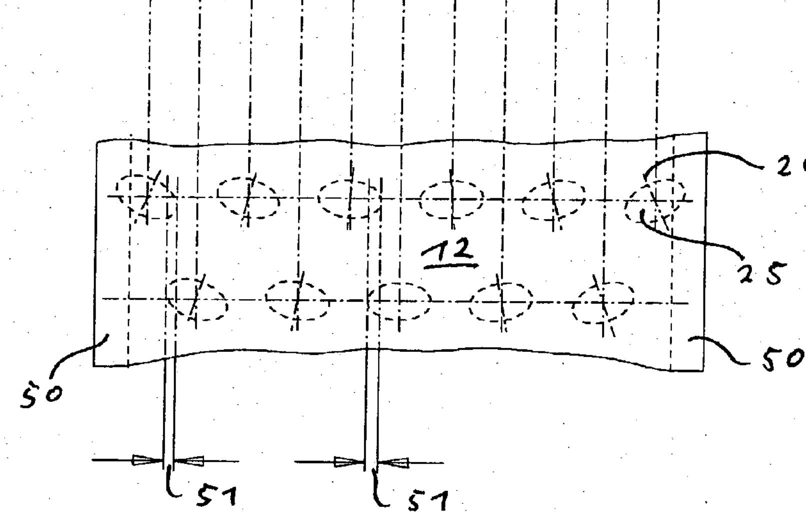

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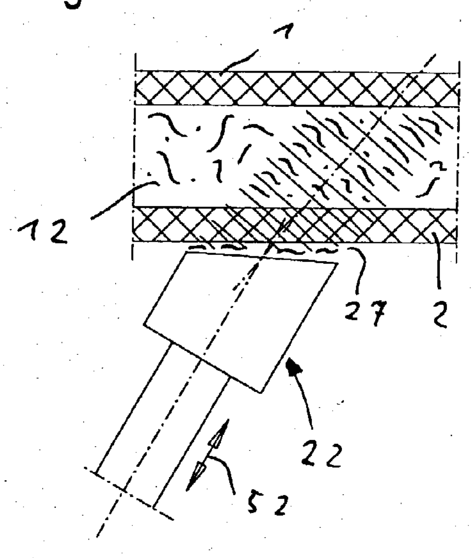

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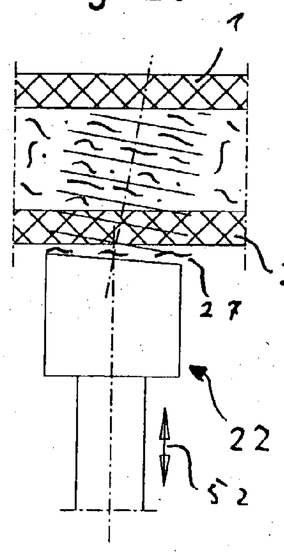

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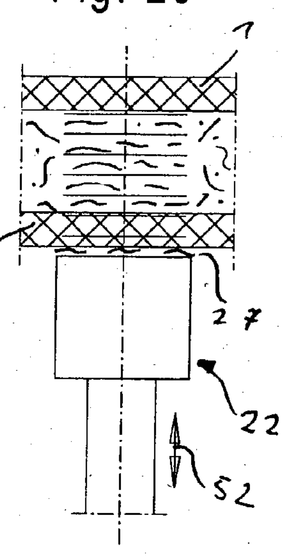

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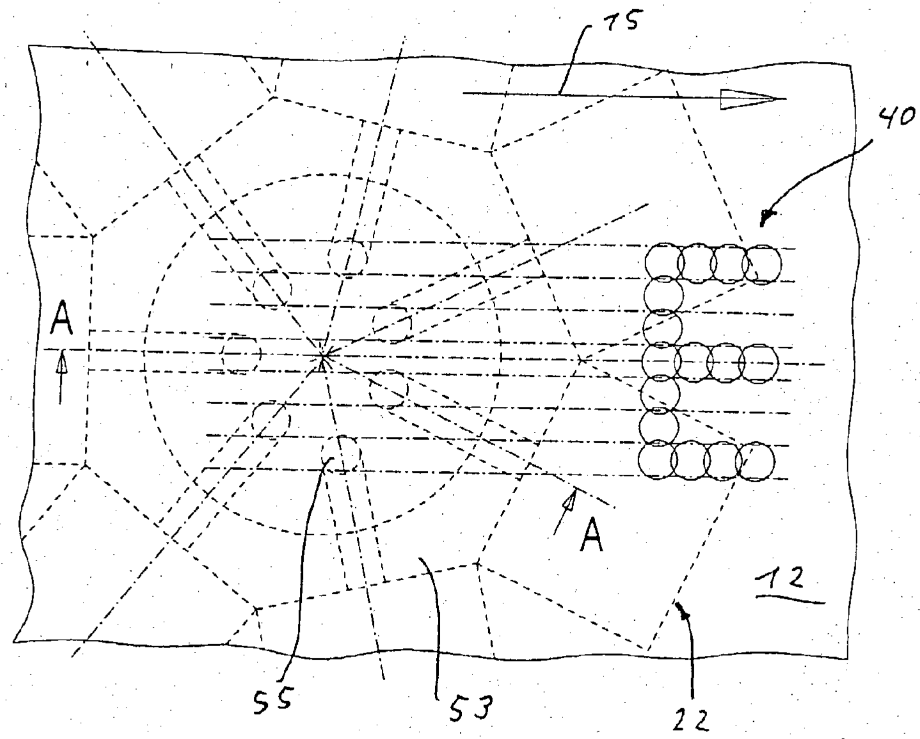
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Fig. 31

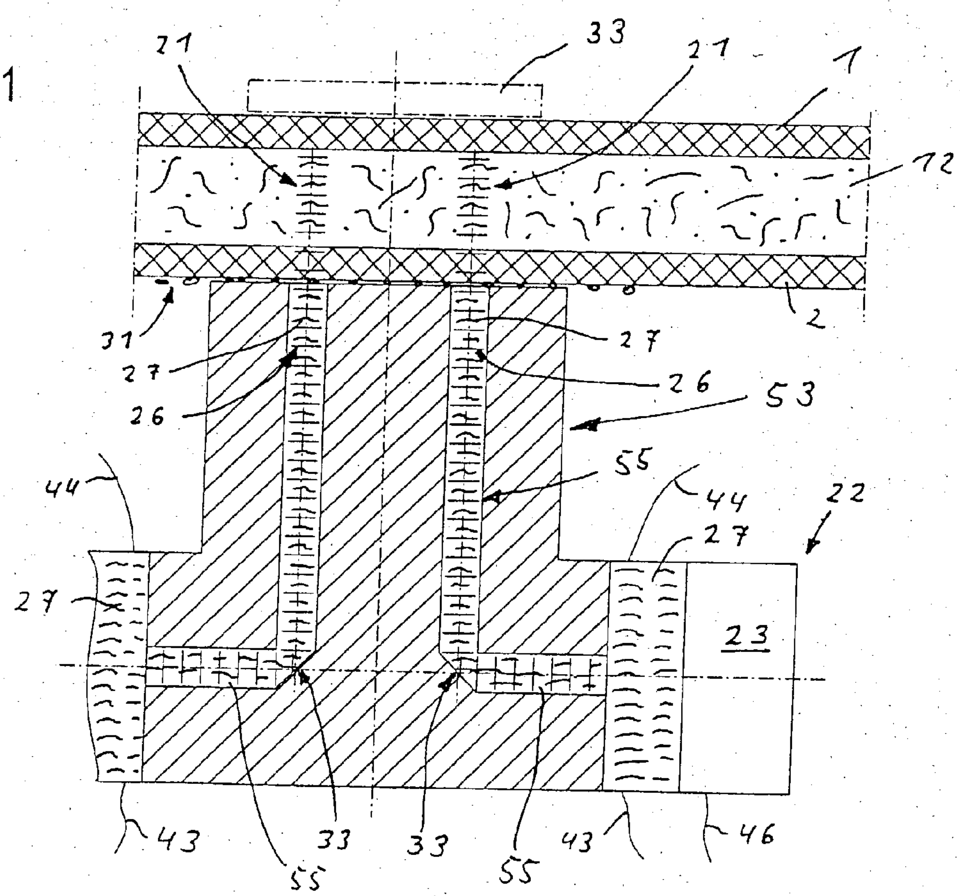
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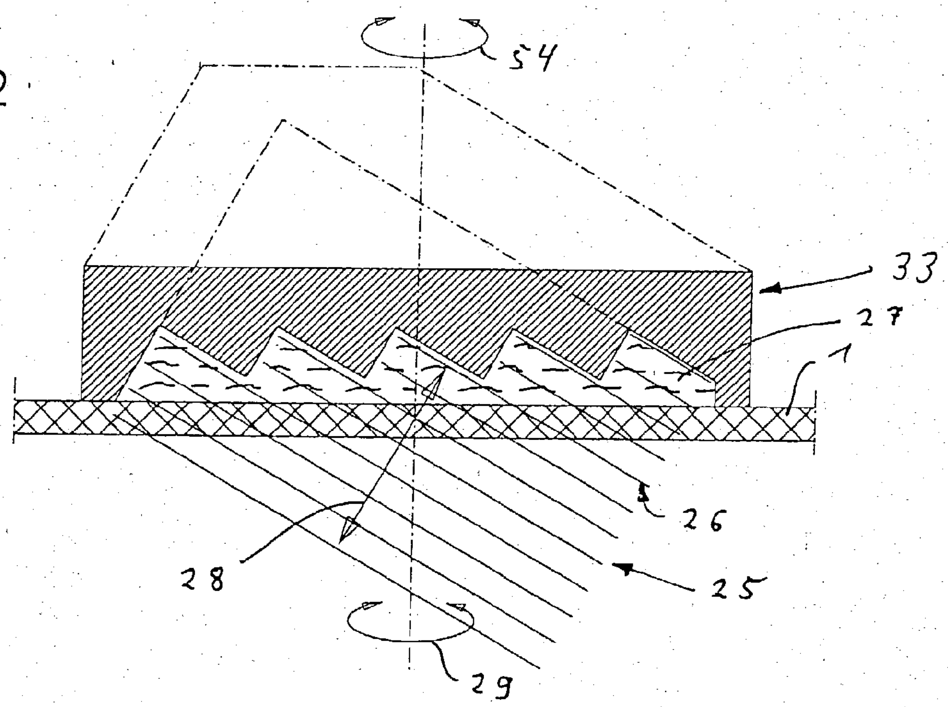
Fig: 32



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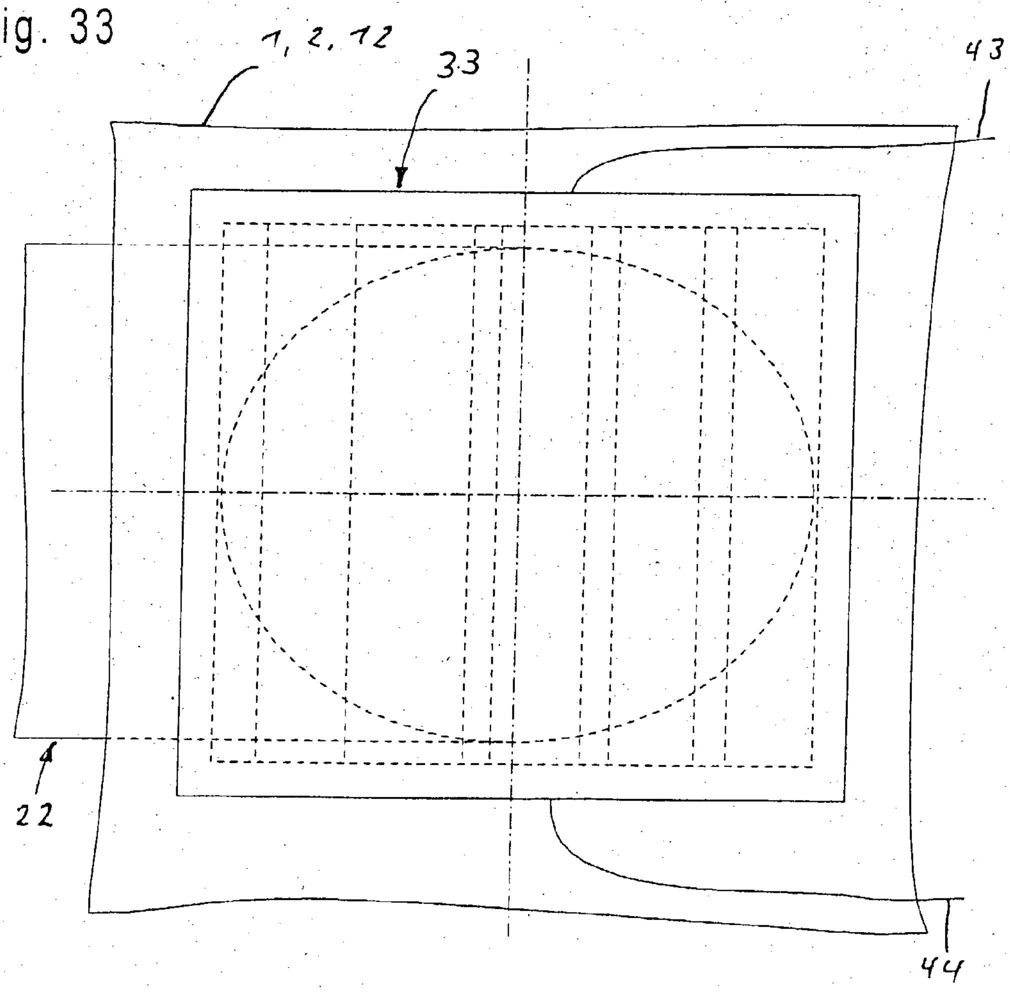

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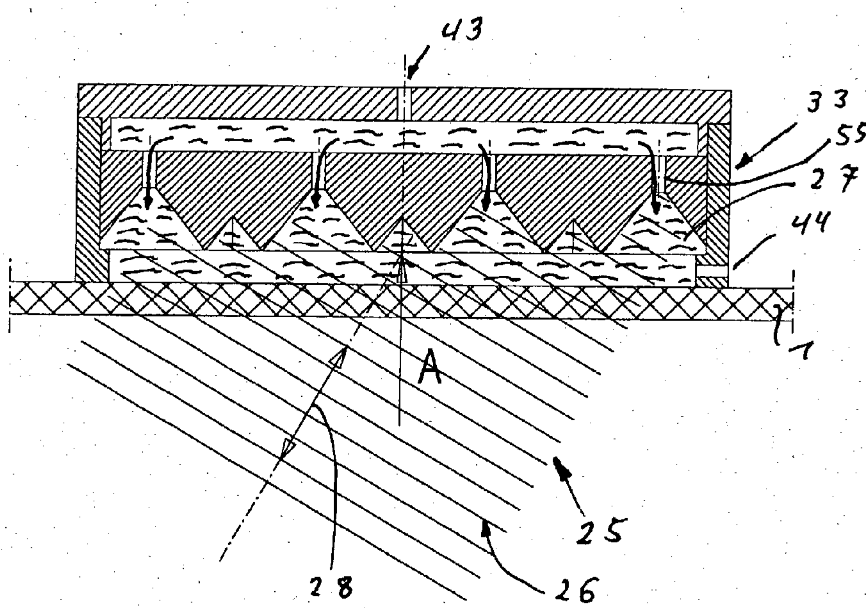

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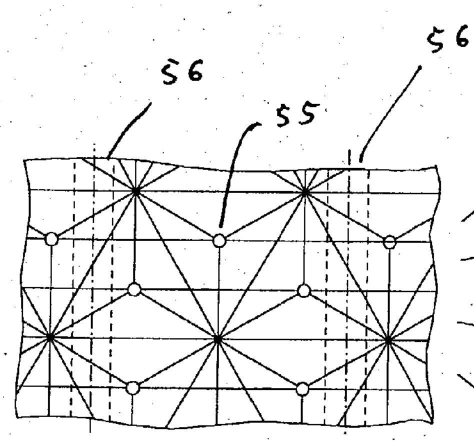

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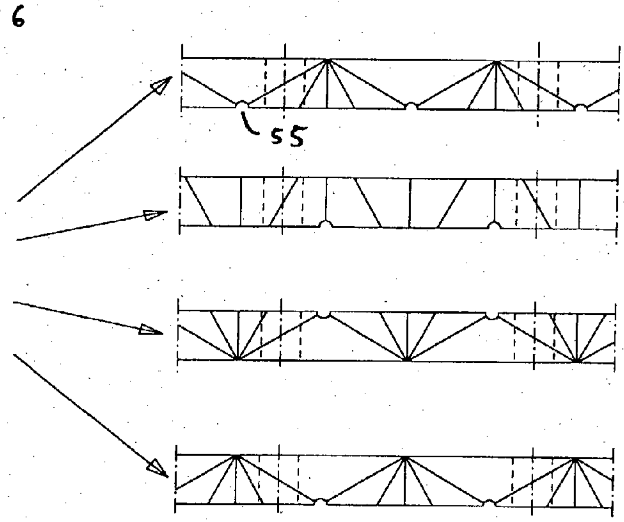

Fig. 37

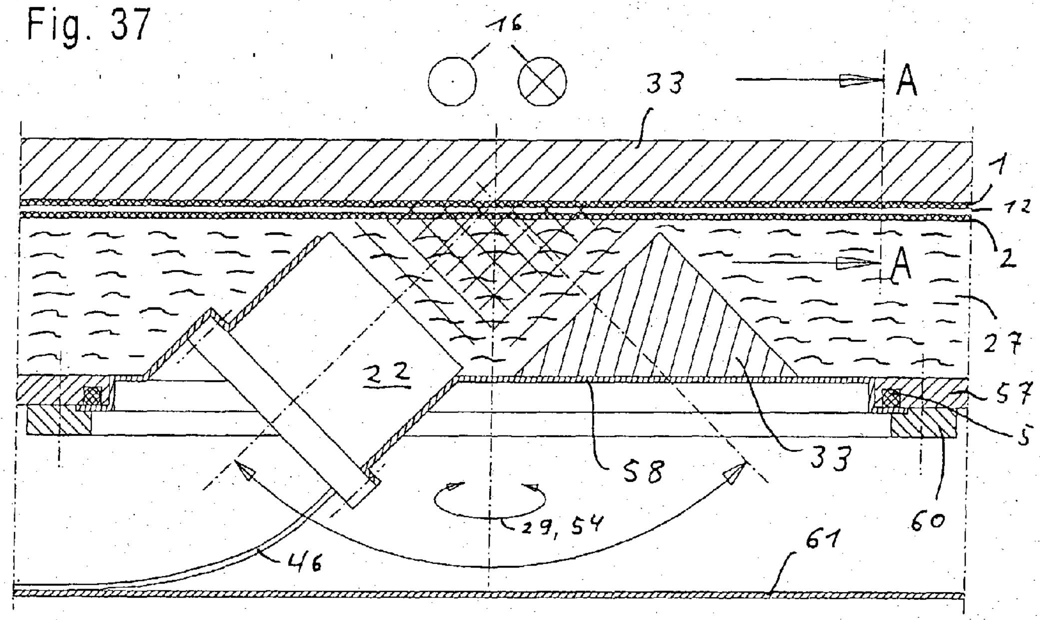
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Fig. 38

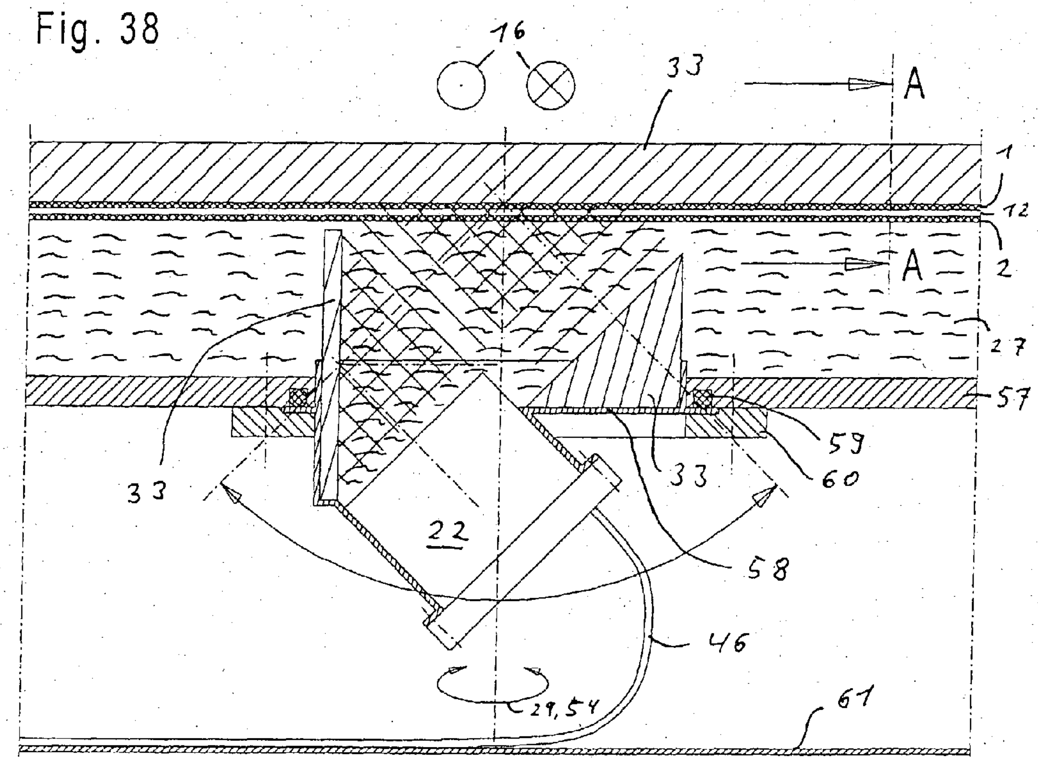
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Fig. 39

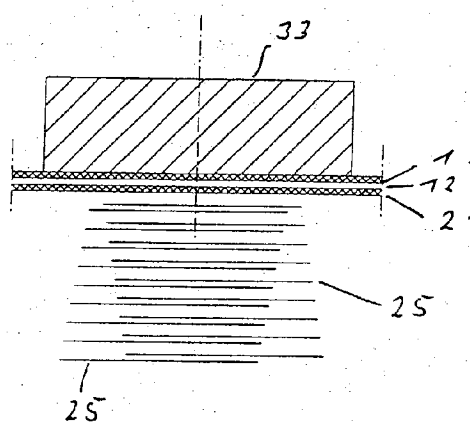


Fig. 40

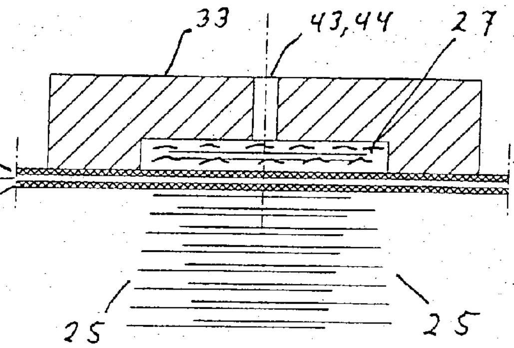


Fig. 41

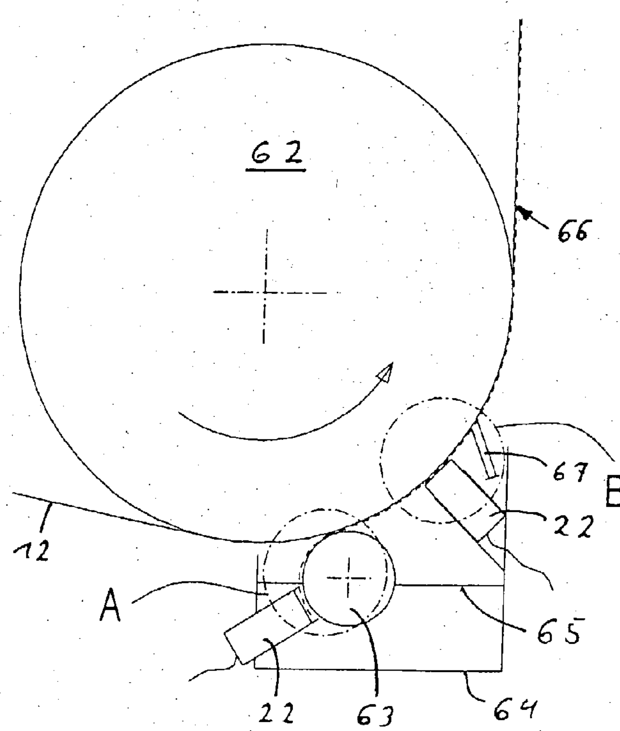


Fig. 42

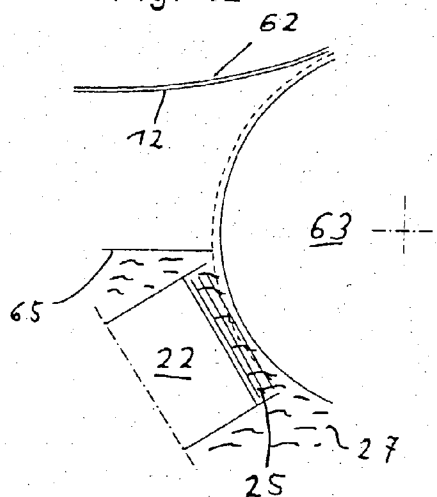
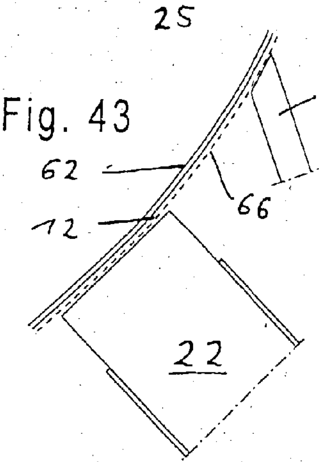


Fig. 43



INFLUENCING THE PROFILE OF THE PROPERTIES OF A WEB BY MEANS OF AN ACOUSTIC FIELD

BACKGROUND OF THE INVENTION

[0001] The invention relates to a method and a device for the processing of a fiber web or a suspension layer in a paper-, cardboard- or coating-machine or a size press for influencing the profile of the properties and in this way the paper or cardboard produced.

[0002] Despite the fact that the present invention under discussion is suitable for paper machines as well as cardboard machines, it will (for stylistic reasons only) be referred to throughout as a "paper machine". The transition from a suspension layer to a fiber web in a former of a paper machine is called the "immobility point" by experts. Expert's current opinion is that the fibers do not change their orientation in the fiber web after that point. Due to the fact that the position of the immobility point cannot exactly be defined and, additionally, the fact that in the invention under discussion this point movable towards the press section, the term fiber web alone will be used in future. These stylistic definitions are not valid for the claims and the abstract in this text.

[0003] By the prior art many paper machines and their components are known. As examples are the publications EP 0489094 A1 and EP 0627523 A1 cited. In these publications a special kind of former is described. Both formers have in common that a suspension beam comes out of the headbox and that the beam is as broad as the width of the paper machine and that it runs into a gap between two wires of the former. There are several dewatering elements in the former, which take the water out of the suspension layer, so that linked fiber web is build at the end of the former. As the fiber web is so unstable that a suction roll of the following press section has to carefully take on fiber web without the use of a so called open draw.

[0004] The two most important characteristics of a fiber web at the end of a paper machine are the cross profiles of paper weight and the fiber orientation. Since the invention of a sectional (i.e. in zone divided working width), density controlled headbox, cross profiles are controllable independently of each other. This is published in the extra print p2971"Faserorientierungs-Querprofil" (translated: Fiber Orientation Cross Profile) by the Voith Sulzer company. But, nevertheless, despite using this headbox, the fiber orientation cross profile is often incorrect.

[0005] As every person skilled in the art knows, at headboxes, which are not sectionally, density controlled, it is more difficult to approximately control the desired basis weight cross profile and the fiber orientation cross profile.

[0006] Substantially the dewatering of a fiber web in a former is made by the forming roll and to the direction of the wire running over the working width cross directional orientated following dewatering slats (=ledges). In some cases the dewatering is made by dragging blades, foils and so called skimmers. In the past with table paper machines (=Fourdrinier paper machines) register (or table) rolls were used. In spite of the invention of the sectional, density controlled headbox, there is an additional and significant problem in the paper production. Because the dewatering line from the headbox outlet to the immobility point amounts to a few meters and because the suspension beam is highly turbulent, the fiber orientation by the dewatering in the former undergoes significant disturbances, which are cause worsening the fiber orientation cross profile.

[0007] A further disadvantage in prior art is the point that in the former the fiber orientation cross profile can only be little influenced. The influencing, for example, is made—in a view the width of the machine—by means of different pressure against the dewatering element. In prior art the dewatering elements are substantially rigid elements, so even if pressure is only applied at a pressing at one point of the dewatering elements, neighboring regions of that pressing point are also affected. Therefore—as one could say—a so called "emitting" effect is caused by the dewatering elements. Altogether the pressed area amounts to perhaps 1 meter. Due to the varying pressure on the dewatering elements, a cross directional flow (i.e. cross directional to the wire running direction) in the fiber web occurs. This causes further disadvantages because of the dependent interaction of the basis weight cross profile, the fiber orientation cross profile and the dry content cross profile (see extra print p2971).

[0008] Every time, if the wire of a former runs over a dewatering element, pressure pulses have an effect on the fiber web. This is, for example, written in the extra print p3025e "High Technology Components for Cost Effective Paper Machine Upgrading" by Voith Sulzer Paper Technology, page 4 and 5. A further disadvantage in prior art is that the number of pulses are the same as the number of dewatering elements and therefore the number of pulses are limited. Furthermore, the pulse itself is a technological disadvantage: According to Fourier-mathematics a pulse is a superposition of different sine- and cosine-functions, which are whole-numbered multiples of a basic frequency. The pulseform is the result of the hydrodynamic situation between the dewatering elements and the wire. If the hydrodynamic givens change temporarily even a little (for example by an alteration in the water shim between the dewatering element and the wire), it is possible that the ranges of the frequency spectrum, which is responsible for a good fiber orientation (or retention), is not available. The pulseform alterations just have an effect on the higher ranges of the frequency spectrum and just this ranges are very powerful, which is clearly advantageous.

[0009] A further disadvantage in prior art is that the pulses substantially are vertical to the fiber web and to the wires respectively. Also the pulses—in view over the width of the paper machine—only partially influenced by varying pressure against the dewatering elements, which causes the already mentioned disadvantage of the "emitting" effect.

[0010] It is the object of the invention to provide a method, a devise and a paper which would reduce or avoid the cited disadvantages.

SUMMARY OF THE INVENTION

[0011] As already stated, if the suspension beam leaves the outlet of the headbox, the is only a little and an insufficient possibility for influencing the basis weight and/or the fiber orientation cross profile by the dewatering elements. Fundamentally, this problem is based on the fiber web, which is "caught" between two wires. Because the wires are running, it is not possible to "grab through" the wires to influence, for example, the fiber orientation. There is also no possibility of influencing, for example, the fiber orientation by means of the gap between the wires at the tender and the drive side. This method of influencing is not possible, because it has to effect at least than half of the width of the fiber web. The width of the fiber web amounts to perhaps 10 meters, but the distance between the wires amounts only a few millimeters. Therefore today the influencing over the gaps is not controllable. This lack of control also occurs, because the regions of the fiber web, which are closer to the tender or drive side, hide the more inner regions of the fiber web.

[0012] Therefore, the inventor searched for a constructional element, which would allow to "grab through" at least one wire. This tool ought to be able to influence through the meshes of the running wire, but without placing itself in the meshes. Because that area of the paper machine is a "rough" environment and a such fine material tool would not be practical, the inventor had the idea that one should send a directed energy to the meshes. Because non insulated electrical energy in a wet environment is not practical (because of possible electric shocks), the decision was made in favor of sound energy. The wave fronts of the sound waves are destroyed by the strings of the wire, but—as the inventor discovered—by the Principle of Huyghens, elementary waves arise in the meshes of the wire and on the other side of the wire that elementary waves interfere with each other to wave fronts again.

[0013] Influencing on a fiber web by means of a sound field has an elementary advantage: The sound field is positionable directly to the desired region of the fiber web which needs to be influenced, because the sound field is positionable on the opposite side of the wire, which is the region, which shall be influenced. The distance to the fibers between the wire surface amounts less then one millimeter (the thickness of a wire is, for example, 0.7 millimeter) and not few meters as in prior art. As shown, by the described first step of the invention, the wire is no serious barrier. A further advantage in comparison to the influencing with dewatering ledges is, that with the invention the "emitting" effect does not occur.

[0014] In physics the so called Kundt's Dust Figures and Chladni's Sound Figures are well-known. In these figures particles take an orientation by means of vibrations at a horizontal plane surface (particle accumulations in vertical direction in relation to the horizontal plane surface can be ignored). An orientation of the particles—as would be necessary, for example, for a fiber orientation—is not known in the cited figures. Also the forms of the figures are not practicable for the influencing of a fiber web, because a homogeneity of a fiber web is desired.

[0015] With the current average fiber web width of up to 10 meters, one single sound field wouldn't be enough and by use of at least two (in relation to the working width) spotlike sound fields, interference hyperbolas will occur. Therefore, a homogeneous sound field between the wires are impossible.

[0016] Thus the question is, how must the form of a sound field be designed for the influencing, for example, of the fiber orientation. Furthermore, does a fiber web transitioning sound field only shake up the fibers—like feathers in a pillow—or do the fibers receive a defined orientation from the direction of the sound field. In the magazine article "Das Ultraschallfeld als Kaltgasfalle" from "Spektrum der Wissenschaft" (translated: The Ultrasound Field as Cold Gas Trap) from January 2000 (German edition of Scientific American) the inventor has discovered that it is possible to let hang ice crystals by means of an ultrasound field. In the aspect of hanging particles for the described device, the inventor saw a further part of the solution for the particles of the Kundt's Dust respectively Chladni's Sound Figures. The ultrasound is not absolutely essential for the "Cold Gas Trap", but because of its higher energy it is a helpful tool. Whilst researching the studies in basic literature (Physics and Technique of Ultrasound, author Heinrich Kuttruff, S. Hirzel publishing house, Stuttgart, edition 1988), the inventor discovered on page 169 a treatise about the so called Pohlman-Cell. This Pohlman-Cell (quotation) ". . . is a flat box with transparent walls. To the incoming sound orientated wall is a thin foil which lets sound pass. The cell contains a liquid in which numerous little metal plates are suspended. In a state of rest these little metal plates do not have an ordered orientation. But if the little metal plates come into contact with a sound wave, so they align themselves vertical to the sounds incoming direction . . . ". This also shows valid that ultra sound not essential, but because of its high energy density it is helpful. The described orientation of the thin plates—as referred to in physics—is based on the "effects of second order".

[0017] Due to technical production reasons, in a paper machine, the main direction of the fiber is mostly wanted in the running direction, because then in this direction a higher tensile strength is present and, therefore, the risk of the fiber web snapping is reduced. If someone wants to use the effect of the Pohlman-Cell for the fiber orientation, for example in the running direction, so the spreading direction of the sound field must be cross directionally orientated to the running direction and must also be directed in an as acute as possible angle to the wire. By this alignment of the sound field, the fibers of the fiber web—at least partially—are orientated in a plane, which is on the one hand, in the running direction and, on the other hand, oblique between the wires. In an extreme case, the fibers in the plane are orientated with there one end to one wire and with there other end to the other wire, and not in running direction. For the moment these fibers do not contribute to an increase of tensile strength, the so called tear length. But the inventor recognized that by the gradual approximation of the wires during the run at the dewatering of the fiber web and during the dewatering flow in direction to the wire outside, these fibers turn in, respectively against, the running direction, but the fibers retain in this process there orientation in the plane of the wave fronts.

[0018] Even if the fibers, by their past movement to the sound field (together with the wires), might only turn a little bit in the plane, which is perpendicular to the spreading direction of the sound field, the fibers nevertheless take on an angular momentum and so the fibers turn again after their passing of the sound field, so that they attain the desired direction.

[0019] For the sake of completeness, it should be mentioned that in the area of the former, partly the main fiber direction—e.g. near the tender and the drive side of the fiber web—an acute angle intentionally is desired in relation to the running direction. During the further dewatering and drying process, the fiber web undergoes a shrinkage, so that finally at the end of the paper machine the main fiber direction is essentially parallel to the running direction. So one can say: the desired fiber orientation cross profile at the end of the former is not at all identical with the zero-line of a graph.

[0020] Additional to the described possibility of the alignment of fibers by means of a sound field, there is an alternative to influencing the fibers with two sound fields. These two sound fields either effect the fibers (in view of the running direction) consecutively, or simultaneously of a section of fiber web width (sectional working width). This is important to the inventive process, because that fibers are not little metal plates or thin plates (see previously cited Pohlman-Cell). The fibers are more comparable with stick-shaped elements. Therefore fibers are able to align as to the plane of wave fronts of a first sound field as well as to the plane of wave fronts of a second sound field. The fibers are then parallel to the line of intersection of these two sound fields and therefore generate the new main fiber direction. If the main fiber direction is desired in the running direction, so the line of intersection of the sound fields must be aligned in the running direction, which is possible by a respective swiveling of the sound fields around an axis, which is perpendicular to the plane of the fiber web.

[0021] The influencing of a fiber web by means of at least one directed sound field includes a further advantage: If the sound field penetrated the fiber web and an optional second wire, so suspension water will be pressed through the outer surface of the second wire. If a skimmer is placed downwards to the running direction, it is able to take this water away. In physics this lifting of water is called levitation. If a sound field is perpendicular to the fiber web, so this effect gets is maximized.

[0022] With a directed sound field, it is further possible, to unlink already linked fibers, because the wave fronts penetrate the fiber web and by this the unlinked fibers loosen their contact with other fibers. Subsequently these unlinked fibers will at least be placed down on the inner surface of the second wire. Due to this effect, the immobility point in the dewatering line in a former moves closer to the press section.

[0023] From this, a further advantage arises, in that if a few separate fiber webs are brought together (to build a multilayer fiber web), these layers can be "woven together" with a directed sound field.

[0024] An another advantage of the invention is that the influencing of fiber orientation and the influencing of basis weight cross profile in the headbox are as independent from each other as possible. In other words, by means of the invention the fiber orientation (sectional) is possible alone with a directed sound field, while the headbox controls only the desired basis weight cross profile. It is also intended that by use of a sectional density controlled headbox, the fiber orientation in the consecutive former can improved by the present invention.

[0025] But not only fibers can be aligned with a directed sound field: generally color particles haven't a sphere form. The kaolin used in paper production has a lamella like structure. By reason of the above mentioned facts it is understandable that color particles can also be aligned by the proposed method. If the color particles—or, for example, little metal plates—are mixed into the suspension and the wave fronts are parallel to the surface of the fiber web, so the particles or the little metal plates will also undergo a parallel orientation to the surface of the fiber web. If the sound field in this embodiment does not effect the whole width of the fiber web, a colored signature in the fiber web is possible, which is translucent in the dry fiber web. If the sound field additionally is oscillating and/or intermitting, so line shaped or pattern shaped signatures can be designed. This has the advantage that, for example, paper documents and also paper money can be provided with a kind of signature, which is positioned inside the paper and not printed on the paper and therefore exceptionally counterfeitproof. But in this way the fibers are also alignable so that, for example, with a special lamp the inventive signature can be read or checked. This method of reading works by light reflection and/or light transition.

[0026] Color particles in the sump of a coating machine or color particles at the surface of a fiber web in a coating machine can also be aligned, by means of the invention, parallel to the fiber web surface. There is the advantage that the irregular color plates can be aligned in layers and therefore the aligned plates can better glide relative to each other at the coating operation or the doctoring process. This means that the shearing stress in the coating color can be reduced by the invention. By this gliding, the color particles don't hook together or don't block, which otherwise would create a thicker and above all an irregular coating film. A positive side effect is that the sound field in the sump of a coating machine can destroy color lumps and/or can remove containing gases out of the coating color.

[0027] A further, very essential advantage of the invention is that the spreading speed of a sound field in a liquid amounts to nearly 1500 m/s, but the working speed of a modern paper machine is only 30 m/s. If a sound field, for example, has a width of 100 mm (in the running direction of the fiber web) and a frequency of 20,000 Hz, so the fibers are influenced by a total 67 vibrations in their run over the sound field. In comparison to the formers of the prior art with their limited number of slats (dewatering ledges), the inventive use of the sound field presents a much higher number of pulses, wherein the pulses/vibrations not only influence the dewatering, but also influence selectively the orientation of fibers and other particles. This just mentioned advantage can be heightened, if the chosen frequency is substantially higher. Because the inventive device—in view of the running direction—is very narrow, either it is possible to place the device between two slats or to place instead of few slats (dewatering ledges) . So at least the number of ledges substantially remains the same.

[0028] The inventive sound fields are generated by an electric powered emitter. Every emitter consists of a power unit and a housing. The drive is created by a coil, a magnetic piston and a membrane or by piezo elements or the drive works on the magnetostrictive or capacitive principle. The surface of the power unit which emits the sound field does generally has a parallel stroke. Because the emitters are electrically driven, their power units can be designed by means of electro-technics and electronics in manifold ways. By using a central control unit, vibrations for each power unit are individually adjustable. By superposition of vibrations, periodic pulses can also be generated. The vibrations will be defined, for example at the control unit, in their amplitude, phase, frequency and energy. So that for every power unit a separate cable need not be laid, it is particularly advantageous, if the control occurs by means of a central data bus. Because with a paper machine several kinds of paper will be produced and therefore a lot of production parameters are necessary, it is advantageous, if the parameters of the inventive device are stored in a database of the control unit. If production of a specific kind of paper with know parameters will be restarted, the parameters will be reloaded from the storage. Production costs are reduced due to this increased efficiency. Further it is advantageous if the control unit is linked to an online-measuring system, for example, to a so called measuring frame.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Further advantageous embodiments of the invention are the object of pending claims and will be explained in the context of the description of the FIGS. **9** to **43**. The FIGS. **1** to **8** show illustrating prior art.

[0030] **FIG. 1**: one embodiment of a former;

[0031] **FIG. 2**: another embodiment of a former;

[0032] **FIG. 3**: detail of a former with dewatering elements (ledges and dragging blades);

[0033] **FIG. 4**: dewatering element foil;

[0034] **FIG. 5**: dewatering element register (or table) roll;

[0035] **FIG. 6**: graph of a fiber orientation cross profile;

[0036] **FIG. 7**: detail and top view of a fiber web with main fiber directions drawn in;

[0037] **FIG. 8**: a magnified detail from **FIG. 7**;

[0038] **FIG. 9**: cross section through wires and fiber web with a perpendicular aligned sound field;

[0039] **FIG. 10**: cross section through wires and fiber web with an inclined aligned sound field;

[0040] **FIG. 11**: section A-A in **FIG. 10**;

[0041] **FIG. 12**: section A-A in **FIG. 10** at a later time as in **FIG. 11**;

[0042] **FIG. 13**: cross section through wires and fiber web with two inclined sound fields in the running direction consecutively arranged;

[0043] **FIG. 14**: cross section through wires and fiber web with two inclined sound fields which interfere directly with each other;

[0044] **FIG. 15**: cross section through wires and fiber web with two inclined sound fields which interfere directly-but mutually-with each other;

[0045] **FIG. 16**: cross section through wires and fiber web with two inclined sound fields which interfere directly with each other and with a sound field duplicator;

[0046] **FIG. 17**: cross section through wires and fiber web with an origin sound field, which directly interferes with each other by several sound field duplicators;

[0047] **FIG. 18**: cross section through wires and fiber web with wedge-shaped origin sound field and a diverging reflector;

[0048] **FIG. 19**: cross section through wires and fiber web with wedge-shaped origin sound field and a rotating diverge reflector;

[0049] **FIG. 20**: as **FIG. 19**, but the reflected sound field is perpendicular to the fiber web;

[0050] **FIG. 21**: cross section through wires and fiber web with a rotating aperture plate;

[0051] **FIG. 22**: detail of a fiber web with several signatures;

[0052] **FIG. 23**: cross section through wires and fiber web with a trapezoid-shaped sound field;

[0053] **FIG. 24**: cross section through wires and fiber web with an arrangement for standing waves;

[0054] **FIG. 25**: graph of a fiber orientation cross profile;

[0055] **FIG. 26**: detail of a fiber web;

[0056] **FIG. 27**: cross section through wires and fiber web with a wedge-shaped water gap between an incline emitter and a first wire;

[0057] **FIG. 28**: cross section through wires and fiber web with a wedge-shaped water gap between an perpendicular emitter and a first wire;

[0058] **FIG. 29**: cross section through wires and fiber web with a parallel water gap between an perpendicular emitter and a first wire;

[0059] **FIG. 30**: top view to a fiber web with a device for drawing a signature;

[0060] **FIG. 31**: section A-A to **FIG. 30**;

[0061] **FIG. 32**: section through a "Fresnel"-reflector;

[0062] **FIG. 33**: top view to **FIG. 32**;

[0063] **FIG. 34**: section through triple-prism-reflector;

[0064] **FIG. 35**: detail of view A from **FIG. 34**;

[0065] **FIG. 36**: stretched view from **FIG. 35**;

[0066] **FIG. 37**: cross section through wires and fiber web, emitter and two reflectors;

[0067] **FIG. 38**: cross section through wires and fiber web, emitter and three reflectors;

[0068] **FIG. 39**: section A-A to **FIGS. 37 and 38**;

[0069] **FIG. 40**: alternative section A-A to the **FIGS. 37 and 38**;

[0070] **FIG. 41**: coating apparatus of a coating machine;

[0071] **FIG. 42**: detail A from **FIG. 41**;

[0072] **FIG. 43**: detail B from **FIG. 41**.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0073] **FIG. 1** shows a kind of former, which is published in the above cited document EP 0489 094 A1. A suspension stream comes out of the headbox **3**, which will surrounded by two wires **1**, **2** and dewatered in a first dewatering line I by means of a curved dewatering element (here a forming shoe). The following dewatering line II is characterized by partly fixed and partly flexible ledges **5**. The final dewatering line III consists of about at least one stationary dewatering element (for example forming shoe, suction box). The forming shoe also consists of ledges, but these ledges in contrast to the ledges **5** are a fixed components of the forming shoe **4**.

[**0074**] In the former of **FIG. 2 a** former is shown, which is published in the document EP 0627 523 A1. The first dewatering element after the headbox **3** is here a forming roll **10**, which follows a forming shoe. **4**. In a further unit are arranged double ledges **9** and simple ledges **5**. The dewatering in these twin wire zones ends with a suction box **8** and a suction roll **7**.

[**0075**] In **FIG. 3** is an arrangement of dragging blades **11** and ledges **5** in a twin wire zone of a former shown (**FIG.** 6 by EP 0516 601 A1) . The ledges **5** have at there ends, which are facing wire **1**, ceramic linings. This ceramic linings are connected by means of V-shaped fittings. The dragging blades **11** affect—similar to the ledges **5**—pressure pulses towards to the wires **1, 2** respectively to the fiber web or suspension layer **12** at the movement of the wires **1, 2** in running direction **15**.

[**0076**] Foil **13** shown in **FIG. 4** strips off the suspension water with the help of a left orientated nose. This dewatering principle also affects a pressure pulse to the fiber web **12**. Further along the course of the wire **2** the wire section comes to a diverging wedge, which is placed between the foil **13** and the wire **2**. The suspension water, which sticks to the outer surface of the wire, creates in the subsequent movement of the wire a suction effect towards the fiber web **12**.

[**0077**] In **FIG. 5** is the relative outdated dewatering principle of dewatering pulse generation by means of register rolls **14** shown. Generally a wire **2** was only arranged at the lower surface of the fiber web **12**. In the view of the running direction **15** at the narrowing gap between the register roll **14** a pressure pulse occurs. At the other side of the register roll **14** the opening gap affects a suction force towards the fiber web **12**.

[**0078**] The embodiments to the prior art of FIGS. **1** to **5** is common that the number of pulses for the dewatering and the fiber orientation—respective formation—is very limited and an individual adjustment to the pressure of the ledges for the sections of the width (sectional adjustment) is only insufficiently given.

[**0079**] FIGS. **6** to **8** must considered in context. **FIG. 6** shows a graph with a measured **17** and a desired **18** fiber orientation cross profile. The letter A stands here, for example, for the tender side of a paper machine and the letter B stands accordingly for the drive side. At the left vertical axis is the angle of the main fiber direction to the running direction **15**. **FIG. 7** shows the section of the fiber web **12**, which corresponds to the graph of **FIG. 6**. The fully line drawing of the main fiber directions **20** corresponds to graph **17**; the broken line drawing of the main fiber directions **20** corresponds to graph **18**. The lengths of the main fiber directions **20** shall represent the amount of the particular breaking length. In this example every main fiber direction **20** is chosen to be as long as the other and respectively the same size as the other. **FIG. 8** shows a quasi microscopic magnified detail of **FIG. 7**. The fibers **21** are not all orientated in one direction, the main fiber direction **20**, nevertheless one can see that the majority of the fibers are orientated to the main fiber direction **20**. If more fibers were aligned to the main fiber direction **20**, the breaking length would increase in this direction, to be borne by the perpendicular herewith orientated breaking length. A breaking length ratio (breaking length along (=R_a) to breaking length cross (=R_c) will increase by a further shifting of the fibers **21** in the main fiber direction **20**.

[**0080**] In **FIG. 9 a** basic idea of the invention is presented. In order to better illustrate of the invention, **FIG. 9** (and partially in other FIGS.) wires **1, 2** and the fiber web **12** are magnified in comparison to other components. The fiber web **12**, which is between the wires **1, 2**, is penetrated by a (aligned perpendicularly to the plane of the wires) sound field **25**. This sound field **25** is generated by an emitter **22**, which consists of a power unit **23** and a housing **24**. In this embodiment the transmitting media **27** is enclosed between the housing **24**, the outer surface of the wire **2** and the surface of the power unit **23**, which is faced to the wire **2**. In this embodiment flat sound waves **26** of the sound field **25** start from the surface of the power unit. By the already explained principle of the Pohlman-Cell, the fibers **21** will orientate themselves parallel to the surface of the power unit **23**. Before the fibers **21** come into the sound field **25** (shown on the left side of the FIG.), they are orientated disorderly. In the sound field **25** the fibers **21** align themselves parallel to the planes of the wave fronts **26**. The dot-shaped illustrated fibers **21** in the sound field **25**—and also at the right side the FIG.—are fibers **21**, which are admittedly "stick-shaped", but are perpendicularly orientated to the plane of the FIG. and look therefore like a dot. The perpendicular arrangement of the sound field **25** causes a sound pressure, so water from the fiber web **12** will be pressed to the outer surface of the wire **1**. This surface water **31** can be skimmed off with a skimmer **6**. In spite of the porosity of a wire for a sound field **25**, a wire nevertheless has a resistance. The more porous a wire is realized, the more surface water **31** will produced.

[**0081**] The liquid transmitting media **27** is very similar to the suspension water in its compound and its composition. Because it is possible that the transmitting media **27** and the suspension water mix themselves together, is it sensible, if the transmitting media **27** consists of suspension water or clear water. In this respect, the transmitting media **27** is important to the invention, because a good acoustic-mechanical coupling occurs between the power unit **23** and the fiber web **12**. If there was—for example at least partly—an air cushion between the power unit **23** and the fiber web **12**, little of the energy of the power unit **23** would be transmitted to the fiber web **12**. An air cushion in the meshes of the wire in the dewatering zone of a former is unlikely, because these meshes are full of suspension water.

[**0082**] In contrast to **FIG. 9**, in **FIG. 10** the emitter **22** is inclined at an angle **30** to the plane of the fiber web **12**. The fibers **21** here don't orientate themselves parallel to the wires **1, 2**, but they orientate themselves parallel to the line of intersection A-A. **FIG. 11** shows the plane of intersection A-A and the orientation of the fibers in this plane. If the plane of intersection A-A runs further in the running direction **15** and the wires **1, 2** come closer to each other, so the fibers **21** will have an orientation crosswise to the running direction **15**. Because this orientation is often undesired, by changing the swivel angle **29** of the emitter **22** one can adjust—in relation to the running direction **15**—another alignment of the fibers **21**. By the inclining of the emitter **22** towards the fiber web **12**, the effect of squeezing out the suspension water will be reduced, but in **FIG. 10** an arrangement of a skimmer **6** nevertheless is possible.

[**0083**] By means of the arrangement of an inclined emitter **22** in **FIG. 10**, an alignment of the fibers **21** is possible, which affects the fiber orientation cross profile.

[**0084**] In **FIG. 13 a** further basic idea of the invention is shown. In view over the running direction **15**, the fiber web **12** will be consecutively influenced by two sound fields **25**. If the fibers **21** will at first be aligned by the left sound field **25**, so those fibers **21** will be aligned, by running through the right sound field **25**, which are crosswise orientated to the right sound field **25**. Finally after the running of the fiber web **12** through the right sound field **25**, all fibers are aligned crosswise to the running direction **15**. The alignment of fibers **21**, with two to each other intersecting sound fields **25** is then particularly effective, if the sound fields **25** are at right angles to each other. Because generally a fiber orientation in the running direction **15** is desired—in view over the running direction **15**—a consecutive influencing of the two sound fields **25** is not the best constructive solution. If the running direction in **FIG. 13** were to be vertical to the plane of the FIG., the sound fields **25** wouldn't cross each other.

[**0085**] In **FIG. 14** two sound fields **25** are arranged in such way that they interfere to each other in the fiber web **12**. The running direction **16** (vertical to the plane of the FIG.; the arrow is shown in and out of the plane) shows that the fibers are now parallel to the running direction **16**. Here also it is valid that a particularly effective alignment of the fibers **21** will occur, if the sound fields **25** are at a right angles to each other.

[**0086**] It is not necessary that the crossing sound fields **25** are act from one side of the fiber web **12**. In **FIG. 15 a** solution is shown, in which the sound fields **25** act from both sides of the fiber web **12**. This arrangement is constructively not very satisfying, because for any desired modification of the fiber orientation, both sound fields **25** must synchronically swiveled in angle **29**. This requires an adjust mechanism on both sides of the fiber web **12**.

[**0087**] A better solution is shown in **FIG. 16**. Here also two crossing sound fields **25** act to the fiber web **12**. The first sound field **25** is directly generated by the emitter **22**. In this sound field **25** a so called duplicator **32** is arranged. This duplicator **32** consists preferable of a flat wall. The form of the second sound field **25** results from the laws of reflection for sound at the surface of the duplicator-wall. The inclination of the duplicator **32** in relation to the first sound field **25** is chosen in such way that both sound fields are interfere at the fiber web **12** (the angle of the duplicator-wall to the median line of the first sound field is half as great as the angle between both sound field median lines). The advantage of this construction is that only one emitter **22** is necessary, but nevertheless two sound fields **25** are available and by swiveling the emitter **22** at an angle **29**, only one mechanism will be required.

[**0088**] In **FIG. 17** crossing sound fields are shown, which are generated by means of a duplicator **32**. The difference to **FIG. 16** is that, only one emitter **22** (in this case perpendicular to the fiber web **12**) and a plurality of duplicators **32** generate the sound fields **25**. The effect of levitation will supported by the perpendicularly orientated sound field **25** at the same time. Because of the here used plurality of the duplicator **32** (for reasons of geometry) the distance from the surface of the power unit **23** to the outer surface of the wire **2** can be shortened in design. By a suitable choice of the parameter a, b, c for the duplicator **32**, the width, the inclining angle of the duplicated sound fields can be influenced. Also the “free passages” for the non inclined sound field can be designed. The broken, vertical lines illustrate further emitters **22**, which are arranged, for example, in view over the running direction **16**, behind the plane of the FIG. The other broken lines show sound fields **25** and duplicators **32** for these further emitters **22**. Additionally, the emitter **22** could be designed revolving to the wire-normal. In a further embodiment the emitter **22** can—alone or together with its duplicators **32**—be inclined to the plane of the fiber web **12**.

[**0089**] In context of the invention, the wave fronts **26** need not always be flat. **FIG. 18** shows wave fronts **26** which are trough-shaped. This is achieved by a trough-shaped power unit surface. in this way the wave fronts **26** run towards a focus. Here there is a reflector **34** with a preferable parallel compensation. If the reflector is designed two-dimensionally and approximately parabolically-shaped and the focus of the trough-shaped wave fronts **26** coincides with the focus of the reflector **34**, then flat wave fronts **26** will be directed in the manner shown to the fiber web. At the given running direction **15**, the fiber orientation will be crosswise to it. If an additional reflector **33** is used, for example as a flat object, so the sound field would be reflected back to the fiber web **12** and could affect a further alignment of the fibers **12**, as shown in **FIG. 13**. The trough-shaped power unit **23** has the advantage that the energy of a perhaps weak, parabolic-shaped sound field will be focused. Because the trough-shaped wave fronts **26**—at least near the focus—do not affect a unified orientation of the fibers **21**, such a sound field will not be suitable for the alignment of fibers **21** without a reflector **34**. But these trough-shaped wave fronts **26** are suitable, for example, in order to press water out of the fiber web **12**, or in order to heat the fiber web **12** to support the dewatering or drying process.

[**0090**] In **FIG. 19** the surface of the power unit **23** is a hollow sphere-shaped design wherein the sound field is also hollow sphere-shaped. The reflector **34** has an advantageous three-dimensional parabolic-shaped design, so that the reflected sound field has substantially flat wave fronts **26**. The reflector **34** is mounted by means of holders **37** on a ring-shaped motor rotor **38**. The ring-shaped motor rotor **38** is supported by guides **39**, which are in the housing **24** of the emitter **22**. Outside the housing **24** a ring-shaped motor stator **35** is placed. It is advantageous, if this motor is a stepping motor. By means of a connecting cable **36**, a stepping frequency, controlling the turning direction and the number of steps, the stepping motor will be driven. So several revolution speeds, forward or backward runs, swivel movements (for example only parts of one degree) and specific angle positions are possible. In this way the sound field **25** in unfixed at a sectional position and is able—together with the movement of the fiber web **12** in running direction **15**, **16**—“to write”. Fibers, color particles or little plates—for example of metal—in the fiber web **12** will acquire an orientation defined by the sound field. This orientation can be seen as a signature **40** in the furnished paper or cardboard after a further approach of the wires at a further dewatering process.

[**0091**] With magnetizeable metal particles a magnetic signatures can also be produced.

[**0092**] A signature is also possible with particles, which have elastic volume. This has the advantage that, for example, a pimpled signature, which will be pressed together by the surface pressure of a drying cylinders, yankee dryers or calander rolls, afterwards can stretch these pimples.

[**0093**] In the context of the invention a veined metal strip, as for example in banknotes, also can be fixed in its position. This metal strip can Also prevented in a otherwise possible twisting along its longitudinal axis.

[**0094**] A optional reflector **33** is able to throw back the sound field to the fiber web. According to the dimensioning of the sound field in the fiber web **12**, either a parallel signature **40** will be generated, or at interfering sound fields, the signature will become more intensive. If the sound field **25** is operated intermittently, so by a control logic, which depends on the speed of the running direction **15**, **16** and depends on the speed of the motor rotor **38**, a signature **40** can be written into the paper (as a defined pattern or lettering/logo).

[**0095**] In contrast to **FIG. 19**, in **FIG. 20** the sound field is perpendicular to the fiber web **12**. This is possible, because the sound field coming from the power unit **23** by means of deflection **41** will be directed to the reflector **34**. This perpendicular sound field affects a—to the fiber web surface—parallel orientation of fibers, possible existing color particles or little metal plates, without following approach of the wires **1**, **2**. By means of an optional use of a reflector **33** and a coordinated wave length, the sound field in the fiber web can even be designed as a standing wave. A standing wave has fundamentally the constructive creative possibility that heavier matter will be collected in the wave antinode. Beside the wave antinodes the lighter matter will take place. Thus a well-directed lamination, which, together with the "writing" by means of a sound field **25**, creates the possibility of a three-dimensional signature. This three-dimensional signature will survive the drying of the paper and can be felt. The human sense of touch is able to feel unevenness of a hundredth of a millimeter. If at the described lamination the suspension water is the lighter matter, so the water will be brought near to the inner surface of the wires and the water can more easily leave the space between the wires. This method can also be used to open the meshes of the wires, because the little fibers, which block the meshes will be brought to the wave antinode. In this way cleaning the wires is possible. It is to be understood that the use of a standing wave can be used without a "writing" sound field. This will be explained at later FIGS.

[**0096**] In **FIG. 21 a** further variation to **FIGS. 19 and 20** is shown. In this example a flat sound field **25** comes from the power unit **23** and directly hits the fiber web **12**. In order to get a slim sound field for "writing", an aperture plate **42** is arranged in the motor rotor **38**, which has for example an eccentric hole. **FIG. 21** shows this embodiment only exemplary. In construction the relatively short distance from the surface of the power unit **23** to the fiber web **12** can be further reduced.

[**0097**] **FIG. 22** shows several signatures **40**. The signature in embodiment a) was generated by a rotating sound field **25** and the movement of the fiber web **12**. In example b) the sound field **25** made different swivelling movements, which were superpositioned with the movement of the fiber web **12**. In form c) the sound field **25** made a rotating movement, which was also superpositioned with the linear movement of the fiber web **12**, but here the sound field **25** was driven in an intermittent mode, so a "writing" with a liftable, fictitious pen can be realized. Naturally other FIGS. in the context of the invention are also possible, as for example Lissajous-figures, cycloids, epicycloids, lemniskates etc.

[**0098**] In the description of **FIG. 18** it was explained that trough-shaped wave fronts **26**—at least near the focus—for a fiber orientation are not very suitable. In **FIG. 23 a** trough-shaped sound field **26** is shown. The wave fronts **26**, which penetrate the fiber web **12**, correspond approximately to the middle distance of a sound field between the surface of the power unit **23** and the focus of the sound field **25**. In this distance the wave fronts **26** are sufficiently flat, so that additional to a levitation a limited fiber orientation is also possible. If the cited trough-shaped wave fronts **26** are from a region, which is closer to the surface of the power unit **23**, so this wave front can better be used for fiber orientation. If the emitter **22** is inclined to the plane of the fiber web **12** or the wires **1**, **2**, so one can indeed use this embodiment for the fiber orientation cross profile of a fiber web **12**.

[**0099**] **FIG. 24** shows a more detailed embodiment with an inclined dewatering line. In this embodiment on the left side two emitter **22** are arranged, which are facing to each other. Between the power units **23** of these emitters **22** supply and out pipes for the transmitting medias **27** are shown. The housings **24** of the emitters **22** at the interfaces to the wires **1**, **2** are equipped with a sliding surface **45** (preferably ceramic). The sliding surface **45** has an opening in the middle, with it the transmitting media **27** and therefore the wave fronts **26** are in a swinging mechanical connection to the fiber web **12**. By the movement of the wires **1**, **2** in running direction **15** transmitting media **27** can be swept away. The supply pipes exist for the loss of transmitting media **27**. In this current form the transmitters **22** operate in such a mode that between them a standing wave **49** will occur and because of that, suspension water will be pressed out of the fiber web **12** at the surfaces of the wires **1**, **2**, which are not facing to the fiber web **12**. Because of the pressed out suspension water, the spheres with the transmitting media **27** need outlet pipes **44**, thus a build-up of suspension water or respectively transmitting media **27** will be avoided. In the context of the invention, when used with sound fields, especially when used at a high frequency, little air bubbles occur in the transmitting media **27**. Therefore it is important that the outlet pipe is arranged at the highest point of the transmitting media **27**; so the bubbles are able to leave the transmitting media **27**. If there is at the same time a supply pipe, a continuous exchange of the transmitting media is possible. This has the advantage that the transmitting media **27** also serves as cooling media for the power unit **23**, the sliding surfaces and the wires **1**, **2**. Further, a possibly polluted transmitting media **27** can be replaced. When supply and outlet pipes are used simultaneously one should pay attention that in the transmitting media **27** there is no excess pressure toward the fiber web **12**, because otherwise the transmitting media **27** will press into the fiber web **12**. At the above shown arrangement in **FIG.**

24, a reflector 33 with a sensor 47 is linked to the emitter 22. This sensor 47 is provided with a sensor-measurement connection 48. This sensor-measurement connection is permitted by a control circuit to adjust the emitter 22 frequency, so that a desired wave form—here a standing wave 49—can be generated. The sliding surfaces 45 of the reflector 33 and the emitter 22, which are facing the wires 1, 2, are provided with a little radius or a wedge-shaped edge.

[0100] Therefore a small quantity of surface water will generate a water film. Therefore dry friction isn't possible between the sliding surfaces 45 and the wires.

[0101] **FIGS. 25 and 26** must be considered together. Already in **FIGS. 6 and 7** the conditions of the influencing of the fiber orientation cross profile were explained. Here **FIG. 25** shows a desired fiber orientation cross profile 18. **FIG. 26** illustrates a clipping of a fiber web 12 with the below arranged sound fields 25. The elliptical form of the sound fields 25 results from their inclined positioning to the fiber web 12 (a slanted line of intersection to a round object creates an elliptical form). The broken line, which is congruent with the smaller diameter of the ellipse, show the line of intersection of the wave fronts 26 with the fiber web 12 and at the same time this line is the adjusted main fiber direction. If by a lack of space, the sound fields 25—and therefore the emitters 22—are not positionable side by side crosswise to the running direction 15, so there would be no disadvantage to adjusting the fiber orientation cross profile, if the sound fields 25 (respectively emitter 22), are arranged in two rows. For this arrangement in two rows, it is advantageous, if the sound fields 25 are arranged with an overlap 51, because almost all fibers 21 influenced for approximately the same long period will respectively get approximately the same quantity of energy at their transition by the sound field 25. If between the former and the press section of a paper machine on every side of the fiber web 12 an edge strip 50 is cut down, a use of sound fields in this outer area of the fiber web 12 isn't necessary.

[0102] In **FIGS. 27, 28** and **29**, the running direction is perpendicular to the plane of the FIGS. These FIGS. relate to emitters 22, which are operate—for example—magnetostrictive. The transmitting media 27 in these embodiments are only a liquid film. In **FIGS. 27 and 28** there is a wedge-shaped gap between the emitter surface and the wire 2. Furthermore the emitter surface is inclined to the swinging direction 52. If the wave fronts 26 leave the emitter surface, so they will be diffracted as illustrated way by their transition from the thicker to the thinner matter (=liquid transmitting media 27). This represents a refraction of a sound field 25. A loss of transmitting media 27 by means of the movement of the wires 1, 2 and the fiber web 12 would be compensated by the surface water 31.

[0103] **FIGS. 30 and 31** show a writing head 53 for writing and drawing signatures 40. This writing head 53 is an alternative device to the devices of FIGS. 19 to 21. This device has the advantage that—except for the power unit 23 no mobile components are necessary. In **FIG. 30** the top view of the writing head 53 without the wire 1 is shown. This device is characterized by, a plurality of emitters 22—perhaps in planes one on top of the other—arranged star-shaped to the area of the fiber web 12, in which one will write. This star-shaped arrangement allows that sound fields 25 are very closely positionable to the area, where the fiber web 12 shall written. The sound fields 25 are led by means of conduits to the area, which is to be written. By means of the transition of the fiber web 12 stripe-shaped lines occur along the writing head 53, in which one emitter 22 will do its writing work. By means of a suitable control device—similar to a control device in a dot matrix or ink-jet printer—by individual sound field activities, a figure, a sign or a different signature can be generated. The diameters of the conduits 55 amount to only a few millimeters. The results is that the fiber web 12 is only at the conduits 55 for a fraction of a second in the transition. But these areas of the fiber web 12 by means of a appropriate frequency—preferably ultrasound—are sufficiently supplied with wave fronts 26 .

[0104] **FIG. 31** shows more clearly the path of the sound fields 25 from the emitter 22 to the fiber web 12 of **FIG. 30**. Deviation of the conduits 55 is achieved by means of the reflectors 33. The surface of the writing head 53 is either spaced to the wire 2 (wherein the gap is moistened with surface water 31), or the writing head 53 is provided with a sliding surface. Because of the regained energy of the sound field 25, which comes out of the wire 1, an arrangement of a reflector 33 is possible here. By a suitable tuning of the wave length, even a standing wave 49 between the reflector 33 and the surface of the power unit 23 (and therefore also in the fiber web 12) can be realized.

[0105] **FIG. 32** shows a reflector 33, which throws a sound field back on itself. The sound field 25 is inclined to the wire surfaces and the fiber web 12. For this it is necessary that the reflecting surfaces of the reflector 33 are parallel to the wave fronts 26. By means of the inclined saw-shaped cross section, the reflector is able to be designed very low. Here principle of a Fresnel-lens is used. The intimated (drawn with broken lines) form of the reflector 23, has a simple structure, but it has greater height and is therefore in construction not so suitable.

[0106] The top view of **FIG. 32** is shown in **FIG. 33**. The incompletely presented emitter 22 is below the wires and the fiber web 12. In the center of **FIG. 33** one can see an ellipse. This is the cut surface of the sound field 25 with the plane of the wires and the fiber web 12. The vertically broken lines show the edges of the ribs of the saw-shaped reflector 33. Therewith the space between the wire 1 and the reflecting surfaces can filled, rinsed and/or cooled, because the reflector 33 has a supply and a outlet pipe for the transmitting media. If for a correction of the fiber orientation cross profile another swivel angle 29 for the sound field 25 is necessary (and one will keep the reflection in itself) a simultaneous correction of the swivel angle of the reflector 54 is necessary.

[0107] Another embodiment of the reflector 33 is shown in the **FIGS. 34 and 36**. Here the reflecting surface consists of a plurality of mounted hollow triple-prisms. These hollow triple-prisms are known in optics and there they reflect a beam of light upon three mirror planes perpendicular to each other and after a triple reflection, back to its origin. This reflection is also valid for the wave fronts 26 of a sound field 25. This hollow triple-prism has a significant advantage in comparison to the saw-shaped reflector that even if the sound field 25 is swilled, a swiveling of the reflector isn't necessary. So one saves using an adjust mechanism and the handling is easier and faster. If a supply pipe 43 for the transmitting media 27 is arranged in the way shown and conduits **55** lead the transmitting media **27** in the extreme corner of each hollow triple-prism, so in this corners don't deposit rests of fibers or dirt.

[**0108**] **FIG. 35** is view A of **FIG. 34**. Here the slat-shaped structure of the triple-prism arrangement is visible. This slat-shaped structure is very advantageous, because otherwise treatment with a rotating tool (cutting by chip removal or grinding) in the tops of the corners of the "hollow" triple-prism would not be possible. By means of mounting elements **56**—for example bolts—the plurality of the slats can be fixed to large triple-prism plates. **FIG. 36** shows slats in a single view, wherein the first (top) slat has the same pattern of structure, as the last slat. If one imagines the third slat turned by 180 degree in the plane of the FIG., one can see that it is identical to the first and the last slat.

[**0109**] In **FIGS. 37 and 38** more realistic proportions of the wires **1, 2**—respectively the fiber web **12**—in comparison to the other components take place. Up to now—for reasons of clarity—in the FIGS., the wires and the fiber web were shown enlarged.

[**0110**] In **FIG. 37** there are two crossing sound fields **25**, which are generated by only one emitter. The angle drawn is preferably right-angled. After the first sound field **25** left the surface of the power unit **23** and has penetrated the wires **1**, **2** and the fiber web **12**, a horizontal reflector **13** reflects the sound field to an inclined reflector **33**. Already there are now two crossing sound fields in the fiber web **12**. The fibers **21** are orientated parallel to the running direction **16**. In order to use the reflected sound field more energetically, the inclined reflector is aligned in such a way, that the sound field will be thrown back in its incoming direction. Therewith the sound field returns again to the horizontal reflector **33** and then to the surface of the power unit **23**. By means of a suitable wave length and the distances, a standing wave can be generated, whose antinode is in the layer of the fiber web.

[**0111**] The space between the wire **2** and a—preferably extending over the whole width of the paper machine—traverse **57** is filled with the transmitting media **27**. The emitter **22** and the inclined reflector are preferably arranged on a mounting disc **58**. Therefore the swivel angle **29** of the emitter and the swivel angle **54** of the—here inclined—reflector **33** are the same. Therefore only one align mechanism is necessary. The traverse **57** is in this embodiment a mounting plane, on which other components can be arranged. The mounting disc **58** is supported swiveling at the traverse **57** by means of a holder **60**. A seal **59** prevents leakage of the transmitting media **27** to the lower part of the housing **61**, which has to be kept dry because of electric connectors **46**. Between the circle of the mounting disc **58** (which is, for example, provided with a gear) and the holder **60**, an adjusting motor for the swivel angles **29, 54** can be positioned.

[**0112**] The device in **FIG. 38** shows a improved version of the device in **FIG. 37**. In **FIG. 37** the diameter of the holder **60** is about three times larger than the width of the crossing sound fields in the fiber web **12**. By this, at the traverse **57** three mounting discs **58** should be staggered in view over the running direction **16** and over the working width. So one can realize a full treatment of a fiber web by sound fields in this section of the working width. By use of a further reflector **33**—here shown vertically—another arrangement of the emitter **22** is realizable. So the diameter of the holder can clearly be reduced. At a desired overlap **51** (see **FIG. 26**) in **FIG. 38**, an arrangement of two rows with crossing sound fields is sufficient. So a two row arrangement is positionable between two slats **5** of a former. Although in **FIG. 38** the distance drawn (in the course of the broken line=the middle of the wave beam) from the inclined to the horizontal reflector is different to the distance from the horizontal reflector to the surface of the emitter **22**, it is still possible to position an antinode in the plane of the fiber web by producing several antinodes (=standing waves) throughout the entire distance and by laying one of those antinodes in the plane of the fiber web **12**.

[**0113**] The indicated section line A-A in **FIGS. 37 and 38** can be realized in the embodiments shown in **FIGS. 39 and 40**. The course of the sound field **25** in **FIGS. 37 and 38** was generated with the reflector in **FIG. 39**. In order to emphasize the course of the incoming sound field **25** to the outgoing sound field **25**, a small swivel angle **29** of the emitter, respectively a small swivel angle **54** of the reflector was assumed.

[**0114**] Because of the recess of the reflector **33** of **FIG. 40, a** shifting of the reflection plane will occur. So that the reflection of a sound field takes place with the least energy loss, this recess must be filled with transmitting media **27**. Because the sound fields **25** are able to press suspension water out of the wires **1, 2**—respectively out of the fiber web **12**—an outlet pipe **44** would be advantageous, because in this way the suspension water can be drained. Additionally, the planes, which are facing to the wire **1**, represent a slat **5** or a double slat **9** with the aforementioned discussed advantages. Depending on the hydrodynamic given facts, the transmitting media **27** will be added by a supply pipe **43**. Over the width of the paper machine there are possibly numerous of such supply **43** and outlet pipes **44**, which can be used for rinsing off the recess and for cooling the reflector **33**.

[**0115**] At this point it should be mentioned that wires with narrow meshes—depending on the energy of a sound field field—can be so dense, that they too can function as a flat reflector.

[**0116**] In FIGS. **41** to **43** a further field of application of directed sound fields is shown. It was already explained that not only fibers, but also additives of paper production can be aligned with directed sound fields. FIGS. **41** to **43** show an application in a coating machine, but the described solution can also be used for the gluing of a fiber web in a size press.

[**0117**] In **FIG. 41 a** backing roll **62** of a coating machine rotates in the indicated direction. So the fiber web **12**, which partly covers the backing roll **62**, moves in the same direction. In a color sump **64** an applicator roll **63** is partly immersed into the color. The fiber web **12** runs through the nip between the applicator roll **63** and the backing roll **62** and takes the color from the applicator roll **63**. As the backing roll **62** moves further along, the surplus color will be doctored from the fiber web **12** by means of a doctor element **67**. The doctor element **67** can be designed as a blade as well as a doctor rod.

[**0118**] If—as shown in **FIG. 41**—an emitter **22** is arranged between the doctor element **67** and the applicator roll **63**, the color particles will be aligned parallel to the wave fronts (in this case the fluid of the coating color is the transmitting media **27** for the wave fronts) . Because of the large diameter of the backing roll **62**, the color particles are essentially parallel to their surface and to the surface of the fiber web **12**. All color particles, which have a lamella like basic structure—as for example kaolin—after their parallel alignment will be laid in layers. If then the doctor element doctors the surplus color, so the parallel color particles slide better to each other. The shearing stress will obviously reduced. Because of this, a color film thickness might be possible to the thickness of only one color lamella. This saves coating color and technical effort of drying—respectively of energy. The color particles might also be orientated below the surface **65** of the color sump **64** near to the applicator **63** by means of an emitter **22**. So the emitter **22** between the applicator roll **63** and the doctor element **67** might be canceled. The emitter **22** in the color sump, furthermore, has the advantage that color lumps might be dissolved and/or the coating color might be degassed.

[0119] The backing roll **62** and the applicator roll **63**, in relation to the emitter **22** shown, are reflectors. Additionally if the surfaces of the power units **23** are convex-shaped and they form a parallel gap with the rolls, so standing waves might be generated.

[0120] **FIG. 42** shows the magnification of view A and the **FIG. 43** shows the magnification of the view B. Both are parts of **FIG. 41**. These FIGS. don't need any further description, because they are self-explanatory in the context of the list of references.

List of References

[0121]

1	wire
2	wire
3	headbox
4	curved forming shoe
5	ledge (slat)
6	skimmer
7	suction roll
8	suction box
9	double ledge (double slat)
10	forming roll
11	dragging blade
12	fiber web/suspension
13	foil
14	register roll
15	running direction in the plane of the drawing
16	running direction perpendicular to the plane of the drawing
17	measured fiber orientation cross profile
18	desired fiber orientation cross profile
19	angle of the main fiber direction
20	main fiber direction
21	fiber
22	emitter
23	power unit
24	housing
25	sound field (acoustic field)
26	wave front
27	transmitting media
28	spreading direction of a sound field
29	swivel angle of the emitter
30	inclination of the emitter to the wire-normal
31	surface water (suspension water)
32	duplicator
33	reflector

-continued

34	reflector with parallel compensation
35	ring shaped motor stator
36	connecting cable
37	holder
38	ring shaped motor rotor
39	guide for the motor rotor
40	signature
41	deflection
42	aperture plate
43	supply pipe for the transmitting media
44	outlet pipe for the transmitting media
45	sliding surface
46	electric connector
47	sensor
48	sensor-measurement connection
49	standing wave
50	edge strip
51	overlap
52	swinging direction
53	writing head
54	swivel angle of the reflector
55	conduit
56	mounting element
57	traverse
58	mounting disc
59	seal
60	holder
61	housing
62	backing roll
63	applicator roll
64	color sump
65	surface of the color sump
66	coating film
67	doctor blade/element

1. Method for the processing of a fiber web or a suspension layer **(12)** in a paper-, cardboard- or coating-machine or a size press for influencing of a profile of properties, characterized in that,

said influencing of a profile of properties uses at least one sectional, directed sound field **(25)**, which means that the sound field is narrower than the width of the fiber web or the suspension layer **(12)** and that the sound field affects, under a defined angle, the components of the fiber web or suspension layer **(12)**.

2. Method as in claim 1, characterized in that,

said profile of properties is a profile—a so called Z-profile—which is perpendicular to the plane of the fiber web or suspension layer **(12)**.

3. Method as in at least claim 1 or **2**, characterized in that,

said profile of properties is a cross profile, which means, that this profile is orientated crosswise to the running direction **(15, 16)** and to the plane of the fiber web or suspension layer **(12)**.

4. Method according to any of the claims 1 to 3, characterized in that,

an emitter **(22)** generates said sound field by means of a liquid transmitting media **(27)**.

5. Method according to any of the claims 1 to 4, characterized in that,

at least one further sectional, directed sound field **(25)** affects the components of the fiber web or suspension layer **(12)** of this section, wherein this further sound field **(25)**—in view of the running direction **(15, 16)**—can be offset to the first sound field **(25)**.

6. Method as in claim 5, characterized in that,

the first sound field (**25**) and the second sound field (**25**) simultaneously affect the components of the fiber web or suspension layer (**12**) and interfere—at least partly—with each other.

7. Method according to any of the claims 1 to 6, characterized in that,

the second sound field (**25**)—at least partly—will generated by the first sound field (**25**) by means of reflection.

8. Method according to any of the claims 1 to 7 characterized in that,

a standing wave (**49**) affects the components of the fiber web or suspension layer (**12**).

9. Method as in claim 8, characterized in that,

the standing wave (**49**) consists of a sound field (**25**) and of its—at least partly—reflection.

10. Method according to any of the claims 1 to 9, characterized in that,

the direction of the sound field (**25**) will be deflected by means of refraction at its transition from solid to liquid matter.

11. Method according to any of the claims 1 to 10, characterized in that,

by means of at least one sound field (**25**) the lamination of the fiber web or the suspension layer (**12**) will be influenced in its Z-direction.

12. Method according to any of the claims 1 to 11, characterized in that,

by means of at least one sound field (**25**) the orientation to the spatial axis of the components of the fiber web or suspension layer (**12**) will be influenced.

13. Method according to any of the claims 1 to 12, characterized in that,

by means of at least one sound field (**25**) the fiber orientation—this means the fibers in the plane of fiber web or suspension layer (**12**)—will be influenced.

14. Method according to any of the claims 1 to 13, characterized in that,

by means of at least one sound field (**25**), the dry content of a fiber web or suspension layer (**12**) will be influenced.

15. Method according to any of the claims 1 to 14, characterized in that,

by means of at least one sound field (**25**), the breaking length ratio of a fiber web or suspension layer (**12**) will be influenced.

16. Method according to any of the claims 1 to 15, characterized in that,

by means of at least one sound field (**25**), the flocculation of a fiber web or suspension layer (**12**) will be influenced.

17. Method according to any of the claims 1 to 16, characterized in that,

by means of at least one sound field (**25**), the color coat thickness of a fiber web or suspension layer (**12**) will be influenced.

18. Method according to any of the claims 1 to 17, characterized in that,

by means of at least one sound field (**25**), the liquid thickness of a size press of a fiber web or suspension layer (**12**) will be influenced.

19. Method according to any of the claims 1 to 18, characterized in that,

by means of at least one sound field (**25**), at least two layers of fiber webs or suspension layers (**12**) will be woven together.

20. Method according to any of the claims 1 to 19, characterized in that,

at least one sound field (**25**) will operate intermittently.

21. Method according to any of the claims 1 to 20, characterized in that,

the vibrations of at least one sound field (**25**) are generated by superposition of at least two vibrations, which have several frequencies.

22. Method according to any of the claims 1 to 21, characterized in that,

the frequency of the sound field (**25**) amounts to more than 20,000 Hertz.

23. Paper or cardboard according to any of the claims 1 to 22, characterized in that,

at least one profile of properties of a web influenced by means of one sectional, directed sound field (**25**).

24. Paper or cardboard as in claim 23, characterized in that,

the fiber web or the suspension layer (**12**) contains at least one signature (**40**) which is generated by means of at least one sound field (**25**).

25. Paper or cardboard as in claim 23 or **24**, characterized in that,

the fiber web or suspension layer (**12**) contains magnetizeable particles.

26. Paper or cardboard to any of the claims 23 to 25, characterized in that,

the fiber web or suspension layer (**12**) contains volume elasticated particles.

27. Paper or cardboard to any of the claims 23 to 26, characterized in that,

a metal strip in the fiber web or suspension layer (**12**) will be fixed in its position by means of least one sound field (**25**).

28. Device for the processing of a fiber web or suspension layer (**12**) in a paper-, cardboard- or coating-machine or size press of influencing of a profile of properties, characterized in that,

at least one sectional emitter (**22**) generates a sound field (**25**),

between the emitter (**22**) and the components of the fiber web or suspension layer (**12**) a liquid transmitting media (**27**) is arranged.

29. Device as in claim 28, characterized in that,

the emitter (**22**) is arranged in a wire section (former).

30. Device as in claim 28, characterized in that,

the emitter (**22**) is arranged in a press section for dewatering or heating of the water, wherein the surface of the emitter (**22**) is directly directed to the press felt or to the fiber web.

31. Device as in claim 28, characterized in that,

the emitter **(22)** is arranged in a drying section for heating of the water, wherein the surface of the emitter **(22)** is directly directed to the fiber web.

32. Device as in claim 28, characterized in that,

the emitter **(22)** is arranged in the coating station of a coating machine.

33. Device as in claim 28, characterized in that,

the emitter **(22)** is arranged in a size press.

34. Device to any of the claims 28 to 33, characterized in that,

the emitter **(22)** is provided with a supply pipe **(43)** for the transmitting media **(27)**.

35. Device to any of the claims 28 to 34, characterized in that,

the emitter **(22)** is provided with an outlet pipe **(44)** for the transmitting media **(27**, wherein the outlet pipe **(44)** is arranged preferable at the highest point of the transmitting media **(27)** at the emitter **(22**

36. Device to any of the claims 28 to 35, characterized in that,

at least one reflector **(33)** is related to the emitter **(22)**.

37. Device as in claim 36, characterized in that,

the reflector **(33)** substantially is designed flat.

38. Device as in claim 36, characterized in that,

the reflector **(33)** is designed concavely, preferably parabolic.

39. Device as in claim 36, characterized in that,

the reflector **(33)** is designed like a sawtooth.

40. Device as in claim 36, characterized in that,

the reflector **(33)** is designed like a hollow triple-prism.

41. Device as in claim 40, characterized in that,

the at least one hollow triple-prism consists of individual lamella.

42. Device to any of the claims 28 to 41, characterized in that,

the housing **(24)** of the emitter **(22)** has at its end, which is facing to the fiber web **(12)** or to the wire **(1, 2)**, a sliding surface **(45)**.

43. Device to any of the claims 28 to 42, characterized in that,

the sound field **(25)** will moved by means of a motor, preferably moved by a stepping motor.

44. Device to any of the claims 28 to 42, characterized in that,

few sound fields **(25)** are, by means of conduits **(55)** with a—preferably star-shaped—writing head **(53)**, aligned to the fiber web or suspension layer **(12)**.

45. Device to any of the claims 28 to 42, characterized in that,

the—at least—one emitter **(22)** is mounted at a traverse **(57)** and that the traverse **(57)** is preferably cross directionally orientated to the machine.

46. Device as in claim 45, characterized in that,

* * * * *