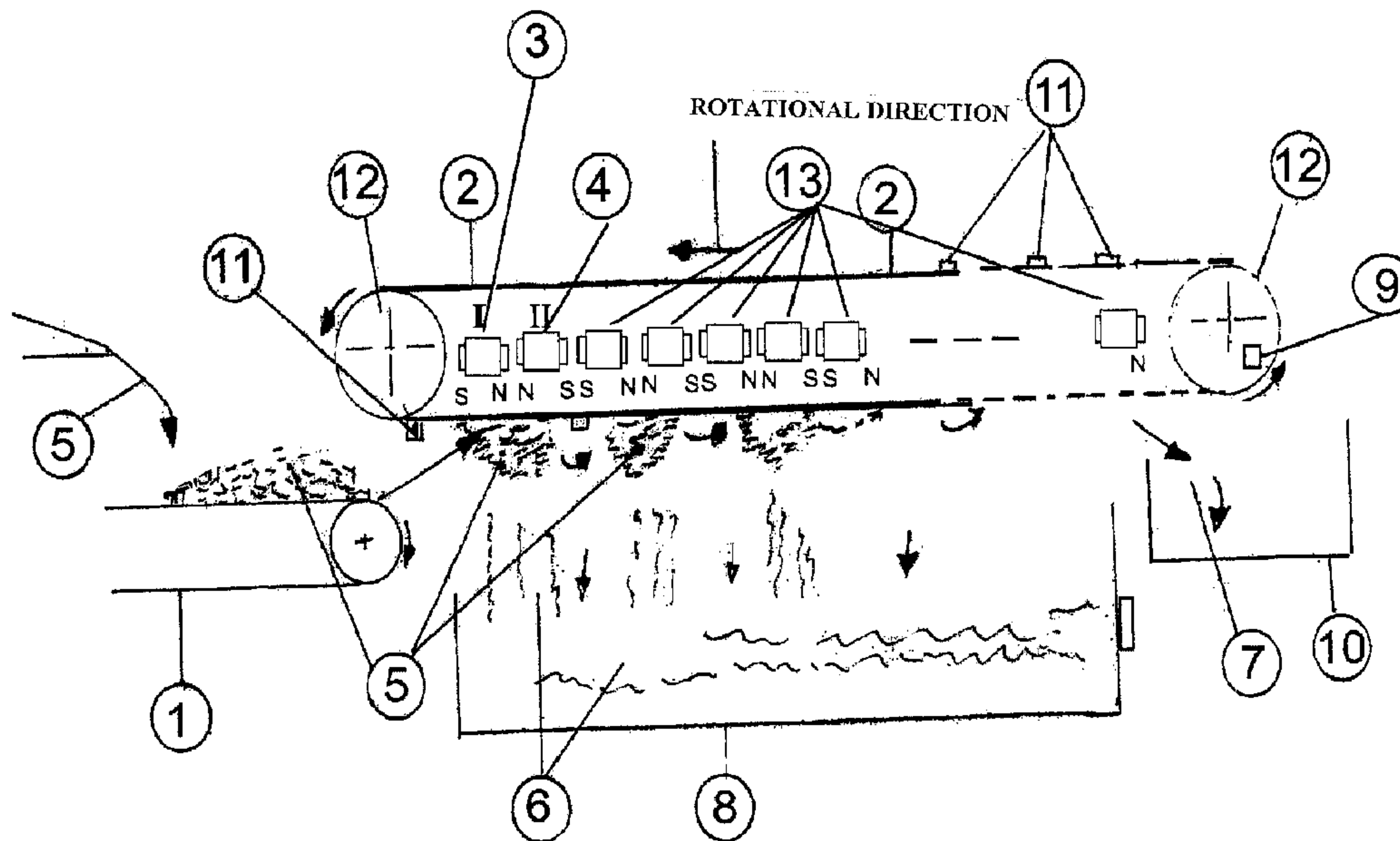




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(54) **Titre : PROCÉDE ET DISPOSITIF DE SEPARATION DE TOUS LES CONSTITUANTS NON MAGNETIQUES D'UN MELANGE DE DECHETS METALLIQUES EN VUE D'OBTENIR DES DECHETS PUREMENT FERREUX**
 (54) **Title: PROCESS AND DEVICE FOR SEPARATION OF ALL NON-MAGNETIC PARTICLES FROM A CONGLOMERATE OF METAL SCRAP IN ORDER TO ACHIEVE PURE IRON SCRAP**



(57) **Abrégé/Abstract:**

This invention relates to a process and a device for dry separation of a conglomerate of metal scrap of non-magnetic particles from magnetic ones. It is known by the state of art to use a so called magnet separator for separation of magnetic material from non-magnetic particles out of a conglomerate of metal scrap. Such a one dimensional process does not any more meet the requirements of today to produce quality-steel from scrap. On the contrary scrap which should be smelt again must consist of pure magnetic material. The production of such material is task of this invention. Even dry separation equipment for metal scrap which have a sequence of magnets placed in line, the poles of which is north-pole to south-pole are unable to meet this requirement. This insufficiency is due to the fact that the conglomerate of metal scrap is not sufficiently shook. This procedure does mean that at the end of transportation there is still non-magnetic material and other stuff fixed to the magnetic material. Intensive motion necessary is achieved by this invention by locating magnets adjacent to one another with equal poles, north-pole to north-pole and south-pole to south-pole and so on.

Abstract:

This invention relates to a process and a device for dry separation of a conglomerate of metal scrap of non-magnetic particles from magnetic ones. It is known by the state of art to use a so called magnet separator for separation of magnetic material from non-magnetic particles out of a conglomerate of metal scrap. Such a one dimensional process does not any more meet the requirements of today to produce quality-steel from scrap. On the contrary scrap which should be smelt again must consist of pure magnetic material. The production of such material is task of this invention. Even dry separation equipment for metal scrap which have a sequence of magnets placed in line, the poles of which is north-pole to south-pole are unable to meet this requirement. This insufficiency is due to the fact that the conglomerate of metal scrap is not sufficiently shook. This procedure does mean that at the end of transportation there is still non-magnetic material and other stuff fixed to the magnetic material. Intensive motion necessary is achieved by this invention by locating magnets adjacent to one another with equal poles, north-pole to north-pole and south-pole to south-pole and so on.

Translation into English of

"Process and device for separation of all non-magnetic particles from a conglomerate of metal scrap in order to achieve pure iron scrap"

Conglomerates of metal scrap are normally delivered by industry as waste and contain magnetic and non-magnetic particles as well as other residues. Since interest for further treatment is focused solely on pure metals of one type, e.g. magnetic particles as iron or non-magnetic particles as copper, recycling enterprises are charged with the task to separate such conglomerates into each component in accordance with their individual material related characteristics. This creates significant problems since individual components of materials contained in the conglomerate are often attached together by adhesive forces to such an extent or by loose connection that a normal magnet sorter cannot clearly separate magnetic from non-magnetic components. Small non-magnetic particles mostly are still combined with magnetic particles or combined by adhesion and enter together with magnetic parts to a follow-up melting process. Steel obtained from such a material composition does not meet the existing standards for high quality steel since steel quality suffers from such a mixture of different components. In order to meet the standards for high quality steel requested today, scrap released for melting must consist of pure iron and is not allowed to contain non-magnetic particles as copper, not even in form of copper dust.

A clear separation of magnetic and non-magnetic material components is task of this invention.

Until now for such separation so called magnet sorters were used. Such magnet separators consist of a conveyer belt of non-magnetic material above which magnets are placed. That apparatus is fed by a conglomerate consisting of metal scrap that contains differing components of metal. Magnets attract magnetic particles and allow only part of the non-magnetic particles to fall into a collection container for residues. This kind of separation of magnetic particles contained in a conglomerate of metal is not sufficient since non-magnetic particles still adhere to magnetic particles in a loose way.

A known embodiment recommends for such handling to transport a conglomerate of metal scrap by using a conveyer belt, the belt of which is guided at both ends across deflection pulleys. In the space between the upper trunk and lower trunk of the conveyer belt close to the lower part of the conveyer belt magnets are arranged in a row one following the next one. These magnets may be activated and deactivated intermittently. This known dry separating machine for non-magnetic particles out of a conglomerate of metal scrap does not meet anymore the existing requirements. That conglomerate of metal scrap is guided along a row of magnets, nonetheless the conglomerate of metal scrap is not sufficiently kept in motion along the conveyer belt (DE Patent specification 311 387), to enable separation of magnetic particles from non-magnetic particles, even though additional means may be attached to the conveyer belt. Pole orientation at this known embodiment is chosen in the following way that a south pole is subsequently followed by a north pole and so on. In this way a permanent change between south and north pole no real motion is achieved, however such a change in pole direction does not result in sufficiently needed motion to separate a conglomerate of metal scrap. Such an orientation of magnets north-south only creates an insufficient motion of the conglomerate of metal scrap transported by the conveyer belt, if any motion at all is reached.

This is the task this invention to solve that problem. Following the process according to my invention motion along the conveyer belt is intensified by choosing a placing of the magnets in the following way: a north pole is followed by a north pole and a south pole is followed by a south pole. That

arrangement means that a north pole is always followed by a north pole and a south pole is followed by a south pole and so on. This magnet arrangement results in the fact that the material at the conveyer belt is permanently in a rotating and shaking motion in order to separate all non-magnetic particles. The number of magnets placed above the conveyer belt in a row depends from the grade of a desired extent of cleanness that means the more magnets are arranged in a row the better is the achieved level of purity. In order to enable the effect of magnet forces to achieve their full power technical means are provided for dressing the conglomerate of metals prior to feeding it on the conveyor belt of a magnetic separator, e.g. to homogenize to seize by using a shredder or hammer mill. In order to support transportation and motion the belt of the magnetic sorter may be equipped on the side of the belt on which material is fed with a kind of naps, hucksters or transportation supporting strips. Designed in such a manner the conglomerate of metals will be attracted by magnetic forces to that side of the belt which is opposite to the placing of the magnets, pulled away and additional motion is stimulated. For this purpose naps are designed and placed in a variable way and positioned all over the complete width of the conveyer belt. It is solely important to keep the conglomerate of scrap permanently in intensive motion in order to make non-magnetic particles separating from magnetic ones. Since material attracted by the first magnet contains besides magnetic particles still non-magnetic ones that are attached to the magnetic particles or loosely combined with them, such material will be transported further downstream out of the range of the first magnet by naps on the conveyer belt and so taken to the range of influence of the follow-up magnet. Even when for intensifying motion on the conveyer belt alternating poling of the magnets has been chosen it is essential that poles of adjacent magnets must be identical, that does mean north pole to north pole and south pole to south pole. This pole orientation creates the motion wanted and results in the fact that non-magnetic material detaches from magnetic material and makes them fall down. This process will be repeated as often as necessary for achieving pure iron free of non-magnetic particles. Magnets of the permanent type can be used as well as electrical magnets. Electrical magnets adjacent in row to one-another have the advantage in relation to permanent magnets that a control device may deactivate a magnet up-stream and at the same time activate a magnet that is adjacent next downstream and vice-versa. That facilitates transferring from one magnet to the following one since adhesion forces vary and non-magnetic particles more easily detach from magnetic ones. Non-magnetic particles detach more easily from magnetic particles that already has passed a first separation process. This process may be repeated as often as necessary for achieving purified iron, which means iron free of any components of non-magnetic material.

A further development proposes to attach to the magnets vibration producing elements in order to keep material already attached to a magnet in intensive motion in order to enable non-magnetic material to separate.

The pulleys at the ends of the conveyer belt may as well be equipped with vibration devices, in order to keep the total conveyer belt in motion to facilitate separation of non-magnetic particles from magnetic ones.

In addition or separately separation from non-magnetic particles of a conglomerate of metal scrap may be supported by treating the conglomerate with a gas stream, e. g. airstream or stream of a liquid preferable also under pressure, e. g. water-shower with or without added chemical components, thus liberating magnetic particles as part of the conglomerate from non-magnetic particles.

All these additional measures may be used separately or combined with others in order to achieve an optimal situation for separation of magnetic particles from non-magnetic materials.

According to an embodiment, there is provided a method of separating non-magnetic parts from a mixture of comminuted metal scrap by means of over-belt magnets, the non-magnetic conveyor belt of which exhibits, on the side facing the mixture to be separated, an increased level of roughness and the mixture is transported along a magnet track with a first and further magnets arranged in a row in the direction of transport, wherein, the mixture is guided along the magnet track, the magnets of which are, with their magnetic axis, aligned in the feeding direction and each correspondent pole of neighboring magnets are positioned opposite one another.

According to another embodiment, there is provided a device for separating non-magnetic parts from a mixture of comminuted metal scrap, comprising: a plurality of magnets arranged in a row over the non-magnetic conveyer belt; wherein the non-magnetic conveyer belt is configured to transport the mixture along the plurality of magnets; and wherein the non-magnetic conveyor belt, on its side facing the metal scrap to be separated, exhibits an increased level of roughness; wherein: the magnetic axis of each magnet of the plurality of magnets is aligned in the feeding direction of the non-magnetic conveyor belt; and each correspondent pole of neighboring magnets of the plurality of magnets are positioned opposite one another.

Description of the figures:

A conveyer belt (1) transports a conglomerate of metal scrap, comminuted by a shredder or hammer-mill, into the magnetic field of a first magnet of a rotating with magnets operating dispositive. The magnet of the first magnetic block I (3) attracts the conglomerate of metallic scrap (5) that is carried on a non-magnetic transportation belt (2) underneath of magnets arranged in row in direction of transport. Detachable non-magnetic material (6) easily falls down into a collection bin (8). The non-magnetic transportation belt (2) possesses on the side showing to the conglomerate of metal scrap (5) naps (11) or humps (11), however may only possess a rough surface in order to improve transportation of metal scrap (5) and to take it from a preceding magnet I to the next following magnet block II. When transporting conglomerate of metal scrap from a preceding magnet block I to the next following magnet block II the conglomerate of metal scrap shortly is unsettled, that enables non-magnetic material to get off from magnetic materials and to fall into a collection bin. This process can only occur if the relation of the poles from successively following magnets I chosen in such a way, that a north-pole is followed by a north-pole and a south-pole is followed by another south-pole. This process is as often as necessary repeated to purify magnetic material from non-magnetic stuff. The number (n) of successively following magnet-blocks (m) is only guided by the desired level of purity of the magnetic materials. The non-magnetic transportation belt (2) runs at both ends over rotary wheels (pulleys) (12) one of them may at least be equipped with an electrical drive, the revolution of which may be controlled. Driving forces transmitted to the non-magnetic belt originate at least from an electrical drive. In order to further improve separation of non-magnetic stuff from magnetic material the magnet blocks (m) are equipped with vibration elements (9).

Bibliographic data

- 1 Conveyer belt
- 2 Transportation facility
- 3 Magnet bloc I
- 4 Magnet block II
- 5 Conglomerate of metal scrap
- 6 Scrap of iron (purified)
- 7 Collection bin
- 8 Vibration device
- 9 Collection bin for iron
- 10 Naps and further humps
- 11 Pulleys (equipped with an electrical drive)
- 12 Number of blocks of magnets

CLAIMS:

1. A method of separating non-magnetic parts from a mixture of comminuted metal scrap by means of over-belt magnets, the non-magnetic conveyor belt of which exhibits, on the side facing the mixture to be separated, an increased level of roughness and the mixture is transported along a magnet track with a first and further magnets arranged in a row in the direction of transport,

wherein,

the mixture is guided along the magnet track, the magnets of which are, with their magnetic axis, aligned in the feeding direction and each correspondent pole of neighboring magnets are positioned opposite one another.

2. A device for separating non-magnetic parts from a mixture of comminuted metal scrap, comprising:

a plurality of magnets arranged in a row over the non-magnetic conveyor belt;

wherein the non-magnetic conveyor belt is configured to transport the mixture along the plurality of magnets; and

wherein the non-magnetic conveyor belt, on its side facing the metal scrap to be separated, exhibits an increased level of roughness;

wherein:

the magnetic axis of each magnet of the plurality of magnets is aligned in the feeding direction of the non-magnetic conveyor belt; and

each correspondent pole of neighboring magnets of the plurality of magnets are positioned opposite one another.

3. The device according to claim 2, wherein the side of the non-magnetic conveyor belt facing the mixture exhibits nubs or humps or other types of protrusions.

4. The device according to claim 2 or claim 3, wherein a feeding belt is provided in order to feed the conveyor belt a mixture that was processed in a grinding mill.

5. The device according to claim 2 or claim 3, wherein a feeding belt is provided in order to feed the conveyor belt a mixture that was processed in a shredder.

6. The device according to claim 2 or claim 3, wherein a feeding belt is provided in order to feed the conveyor belt a mixture that was processed in a hammer mill.

7. The device according to any one of claims 2 to 6, wherein each magnet of the plurality of magnets is an electromagnet that cooperates with an electrical control device which is configured to respectively switch one of the successive magnets in the feed direction of the plurality of magnets magnetically active and simultaneously the preceding magnet of the plurality of magnets magnetically inactive.

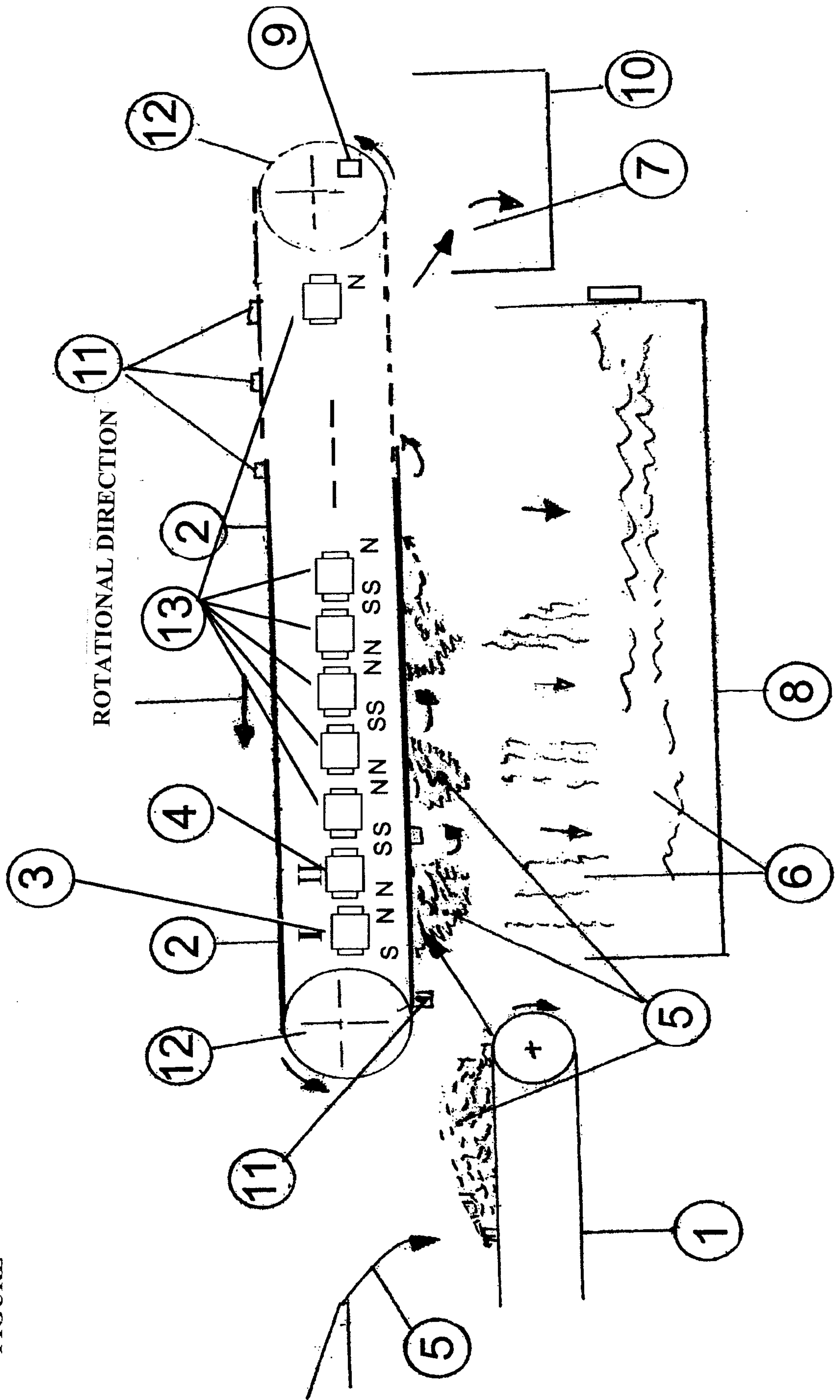
8. The device according to any one of claims 2 to 7, wherein the non-magnetic conveyor belt is guided by at least two guide rollers, of which one is configured to transmit driving forces of a controllable electrical drive to the non-magnetic conveyor belt.

9. The device according to claim 8, wherein the magnets and/or the rollers are equipped with vibrators.

10. The device according to any one of claims 2 to 9, wherein nozzles are provided, the outlet ports of which are directed towards the mixture attracted by one

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of the magnets in order to blow a gas stream on the mixture under high pressure and/or to squirt liquid under pressure.



FIGURE

