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(54) **PROTEINE COAGULEE**
(54) **COAGULATED PROTEIN**

(57) L'invention concerne un procédé de fabrication d'un morceau de protéine coagulée, caractérisé en ce qu'on ajoute des ions de métaux de transition et un agent d'oxydation à une protéine, et on comprime le produit issu de la réaction obtenu, de manière à former un morceau ayant une structure stratifiée. L'invention concerne également un morceau comestible renfermant en majeure partie une protéine et ayant une structure interne stratifiée fibreuse.

(57) The invention provides a method of manufacturing a coagulated protein chunk. The method comprises adding transition metal ions and an oxidising agent to a protein, compressing the resulting reaction product to form a chunk having a laminar structure. An edible chunk comprising a major proportion of protein and having a fibrous laminar internal structure is also described.

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(54) Title: COAGULATED PROTEIN

(57) Abstract

The invention provides a method of manufacturing a coagulated protein chunk. The method comprises adding transition metal ions and an oxidising agent to a protein, compressing the resulting reaction product to form a chunk having a laminar structure. An edible chunk comprising a major proportion of protein and having a fibrous laminar internal structure is also described.

COAGULATED PROTEIN

The present invention relates to the preparation of a chunk of coagulated protein, and to the coagulated protein chunk itself.

Conventionally, protein can be coagulated in a variety of ways, for example by heating it or treating it with acid. It has now been found that a protein may be coagulated by adding transition metals ions and an oxidising agent to a protein and compressing the reaction product of the transition metal ions, the oxidising agent and the protein. A textured solid mass is produced which may have an internal texture similar to that of cooked meat.

According to the invention there is provided a method of forming coagulated protein chunk comprising adding transition metal ions and an oxidising agent to a protein and compressing the resulting reaction product to form a chunk having a laminar structure.

It is believed that the transition metal ions and the oxidising agent react to form free radicals and that the free radicals then react with the protein to coagulate it.

According to the invention there is also provided a method of forming a coagulated protein chunk which comprises: generating free radicals by reacting transition metal ions with an oxidising agent; reacting the free radicals with a protein; and compressing the reaction product of the free

radicals and the protein to form a chunk having a laminar structure.

The reaction of transition metal ions with the oxidising agent and/or the reaction of free radicals with the protein may be heated.

Preferably the oxidising agent is present at least 0.5% by weight of the protein.

Preferably the transition metal ions are present at least 0.5% by weight of the protein.

Preferably the protein comprises at least about 5%, preferably at least about 10% by weight of the reaction mixture.

Preferably the transition metal ions are ferrous ions.

Preferably the oxidising agent is hydrogen peroxide.

In a preferred embodiment of the invention there is provided a method of forming a blood chunk comprising heating a blood fraction (as defined below); treating the heated blood fraction with hydrogen peroxide; and compressing the reaction product of the blood fraction and hydrogen peroxide. The blood fraction is defined herein as comprising from about 14% to about 40% protein and about 35% to 45% red blood cells. The blood fraction may be formed in any way. The blood fraction may be the hæmoglobin fraction of blood (as defined below). Alternatively, the blood fraction may be formed by removing water from whole blood to concentrate it so that it comprises from about 14% to about

40% protein and about 35% to 45% red blood cells. The blood fraction may be reconstituted from purified protein and red blood cells. By the haemoglobin fraction is meant the residue from whole blood once the plasma, or most of the plasma, has been removed. The haemoglobin fraction consists of red and white blood cells with a residue of plasma. The haemoglobin fraction typically contains from about 14% to about 40% protein and about 35% to about 45% red blood cells. The remainder is mainly water together with other blood components.

It will be appreciated that the blood fraction is a source of protein and ferrous ions. When a blood chunk is formed according to this preferred embodiment of the invention, no addition of transition metal ions is required for coagulation of the protein. When other sources of protein are used, it may be desirable to add additional transition metal ions.

Preferably the hydrogen peroxide is added to the blood fraction at at least 0.5% by weight. There does not appear to be a significant upper limit to the concentration of hydrogen peroxide in the reaction mixture which is effective to cause the desired reaction to take place; concentrations of up to 3% (by weight) have been found satisfactory.

Preferably, compression is carried out at a temperature greater than 60°C.

Preferably the blood fraction is heated to between 60°C and 80°C before addition of the hydrogen peroxide.

Preferably the blood fraction comprises at least about 10%, more preferably at least about 15%, by weight protein. At lower protein concentrations, the reaction product does not absorb all the water present in the reaction mixture. Such products are useful and their manufacture falls within the scope of the present invention; however, it will usually be necessary to remove the proteinaceous material from the unabsorbed water before it is used.

Additives may be included in the blood fraction to modify the nutritional content and flavour of the chunks. It is preferred that the pH of blood fraction is no less than 4, and that it is no greater than 9.

Compression of the reaction product of the blood fraction and hydrogen peroxide can be carried out on the reaction product as it is formed, or the reaction product can be stored and then subjected to heating, for example by microwave radiation, prior to compressing. Alternatively, the reaction product may be steamed to give a product having a jelly-like texture. The steaming can be carried out with meat juices or other flavoured aqueous media to impart particular flavours to the product.

The product can be dried, preferably at about 60°C, to produce hard, crunchy chunks, which are useful as a dry pet food.

The reaction product of the blood fraction and hydrogen peroxide can be compressed under its own weight.

The reaction product may be compressed as a result of restriction of any expansion of the reaction product caused

by evolution of gas as the transition metal, oxidising agent and protein react.

The pressure at which the reaction product of the blood fraction and the hydrogen peroxide is compressed to achieve the laminar internal structure is not critical; a pressure of up to about 400 kPa is preferred.

Also according to the invention there is provided an edible chunk comprising a major proportion of protein, preferably blood protein, and having a fibrous, laminar internal structure.

The invention will be further described, by way of example, with reference to the drawings in which;

Figure 1 shows schematically a method according to a first embodiment of the invention;

Figure 2 shows schematically a method according to a second embodiment of the invention; and

Figure 3 shows schematically a method according to a third embodiment of the invention.

The methods according to the invention shown in the drawings include the following common features. The hæmoglobin fraction of blood is pumped from a tank 10 by a peristaltic pump 12 to a steam infuser 14 where the hæmoglobin is heated to about 75°C. The heated hæmoglobin passes from the steam infuser 14 to a high shear mixer reactor 16, such as a Dispax reactor. In the Dispax reactor, the hæmoglobin is reacted with hydrogen peroxide pumped from a hydrogen

peroxide tank 18 by a hydrogen peroxide pump 20. In the reactor 16, the hæmoglobin and the hydrogen peroxide are mixed efficiently. Preferably, the reactor is a high shear, low volume mixer to ensure adequate mixing of the two components.

In the first embodiment of the invention, shown in Figure 1, the foam reaction product 22 is deposited in a tray 24. The reaction product 22 can be allowed to be compressed by its own weight, in which case the solid mass produced is elastic and can be cut up to provide elastic chunks. Alternatively, pressure can be applied to the reaction product 22 in the tray by application of a pressure plate 26. On release of the pressure plate a solid product 28 having a fibrous, laminar internal structure is produced, which can then be cut into chunks 30 as at 32.

In the second embodiment of the invention, shown in Figure 2, the reaction product 22 from the reactor 16 is passed to a piston pump 40 in which the reaction product is compressed. As the reaction product 22 leaves the piston pump 40, it is diced as at 42 to produce chunks 44 having a fibrous, laminar internal structure.

In the third embodiment of the invention, shown in Figure 3, the reaction product 22 leaves the reactor 16 through a disperser 50, from where it passes into a mouth formed by the widely separated ends of two converging continuous belts 52, 44. The reaction product is compressed between the two continuous belts, and the resulting solid sheet 56 is cut into chunks 58 as it leaves the continuous belts 52, 54, as at 60. Again, the chunks produced have a fibrous, laminar internal structure.

The chunks have a fibrous, laminar internal structure, similar to that of meat chunks, so that the chunks can be readily used in canned food stuffs such as pet foods to provide a protein source which is analogous in appearance and texture to meat.

CLAIMS

1. A method of forming a coagulated protein chunk comprising adding transition metal ions and an oxidising agent to a protein and compressing the resulting reaction product to form a chunk having a laminar structure.

2. A method of forming a coagulated protein chunk comprising: generating free radicals by reacting transition metal ions with an oxidising agent; reacting the free radicals with a protein; and compressing the reaction product of the free radicals and the protein.

3. A method according to claim 1 or 2 in which the compression is carried out at a temperature greater than 60°C.

4. A method according to any preceding claim in which the compressed product is dried.

5. A method according to any preceding claim further comprising steaming the reaction product of the transition metal ions, the oxidising agent and the protein.

6. A method according to any preceding claim in which a blood fraction (as herein defined) is reacted with transition metal ions and the oxidising agent.

7. A method according to any preceding claim in which the transition metal ions are ferrous ions.

8. A method according to any preceding claim in which the oxidising agent is hydrogen peroxide.

9. A method according to any preceding claim in which the oxidising agent is present at at least 0.5% by weight of the protein.

10. A method according to any preceding claim in which the transition metal ions are present at at least 0.5% by weight of the protein.

11. A method according to any preceding claim in which the protein comprises at least about 5%, preferably at least about 10%, protein by weight of the reaction mixture.

12. Coagulated protein formed by a method according to any of claims 1 to 11.

13. An edible chunk comprising a major proportion of protein, preferably blood protein, and having a fibrous, laminar internal structure.

14. A method substantially as described.

15. A chunk substantially as described.

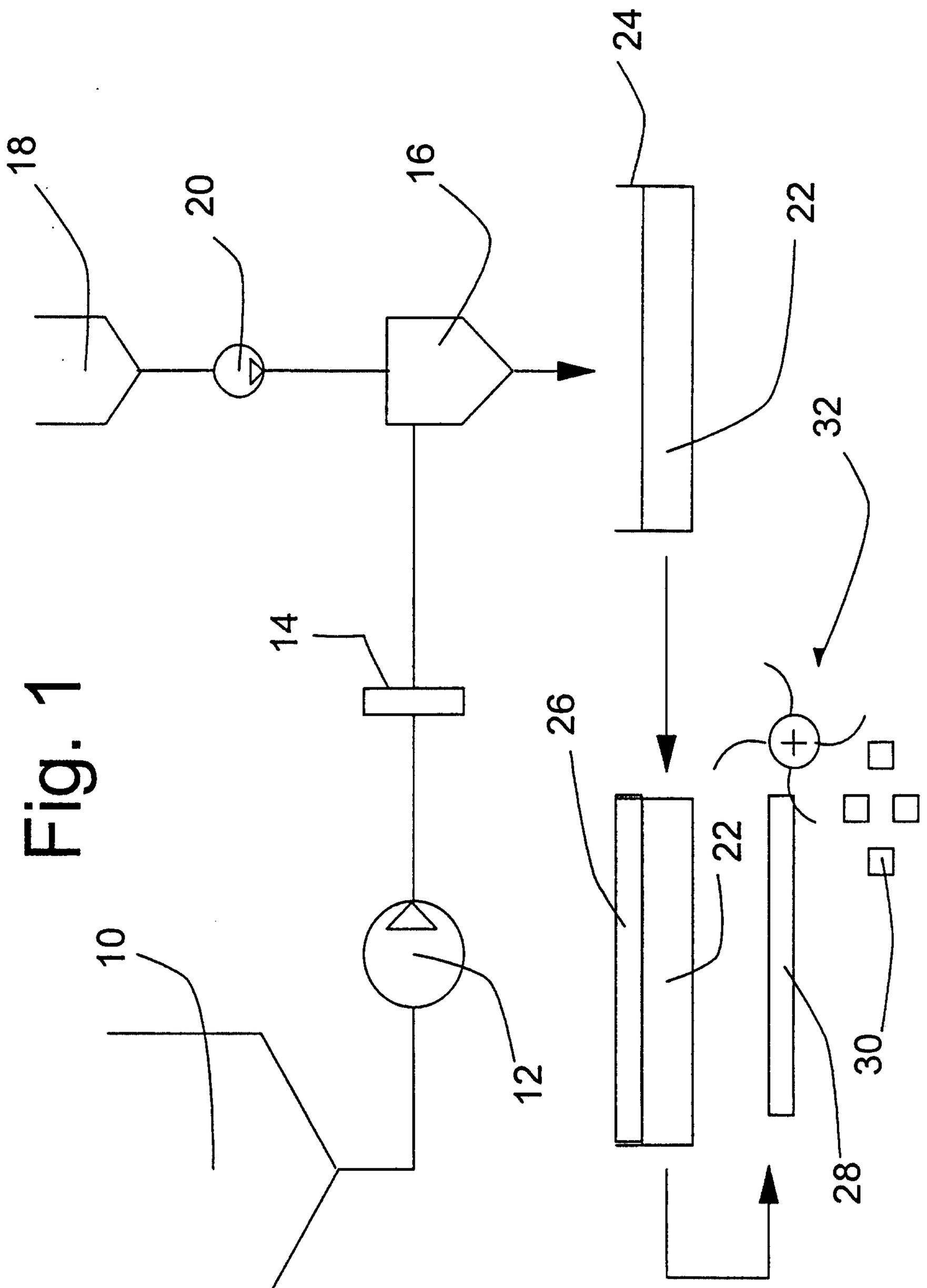

Fig. 1

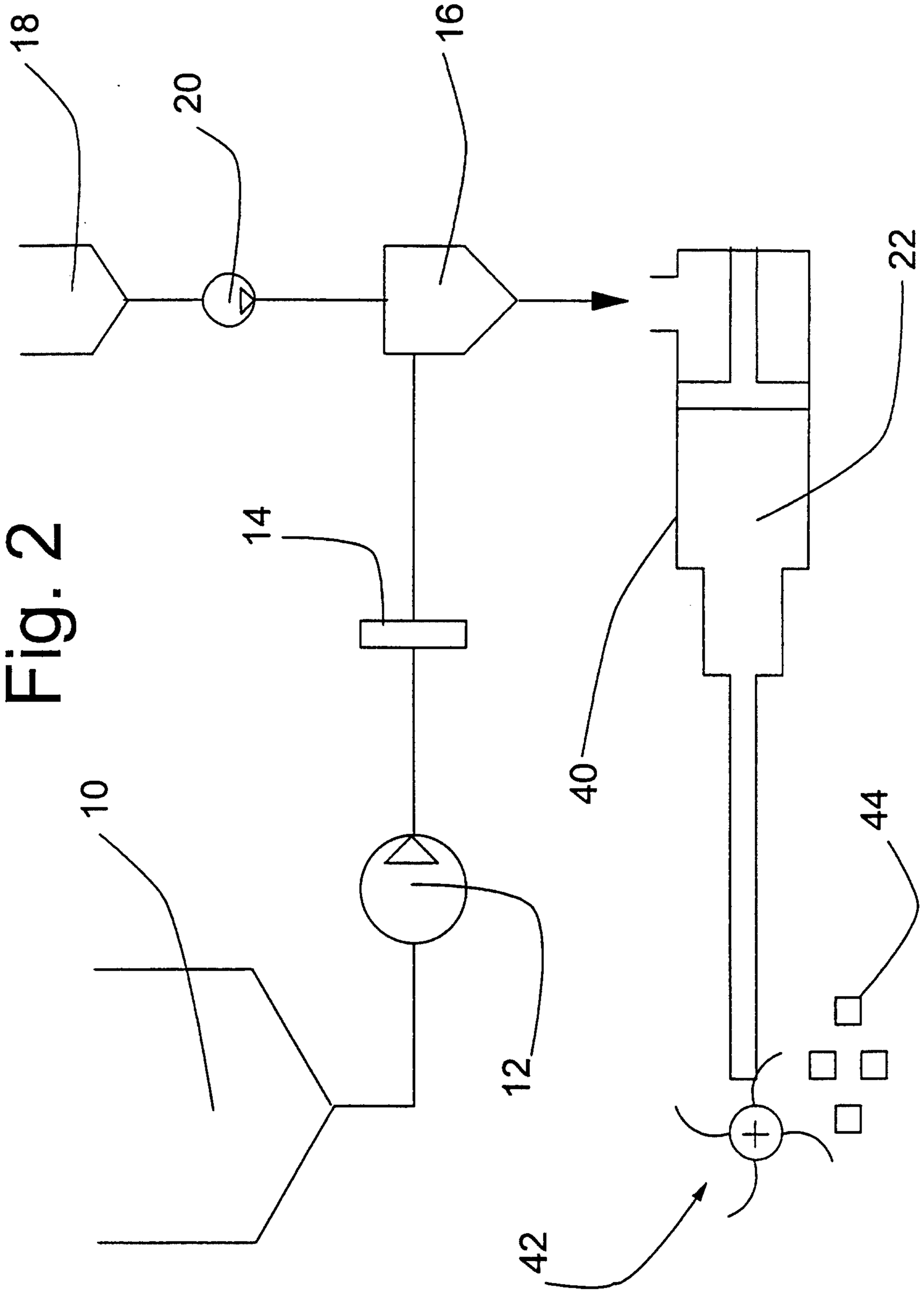

Fig. 2

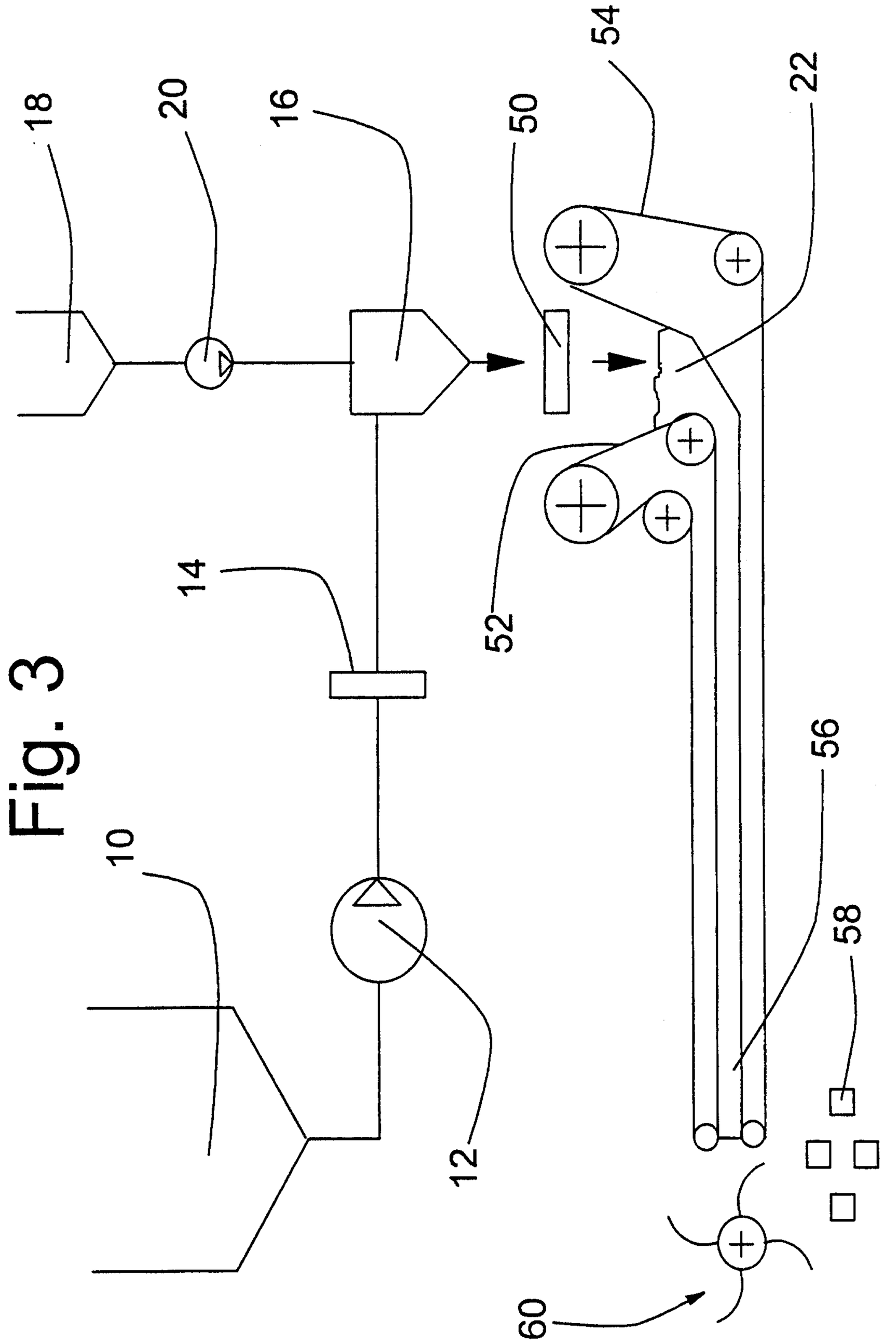
Fig. 3
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