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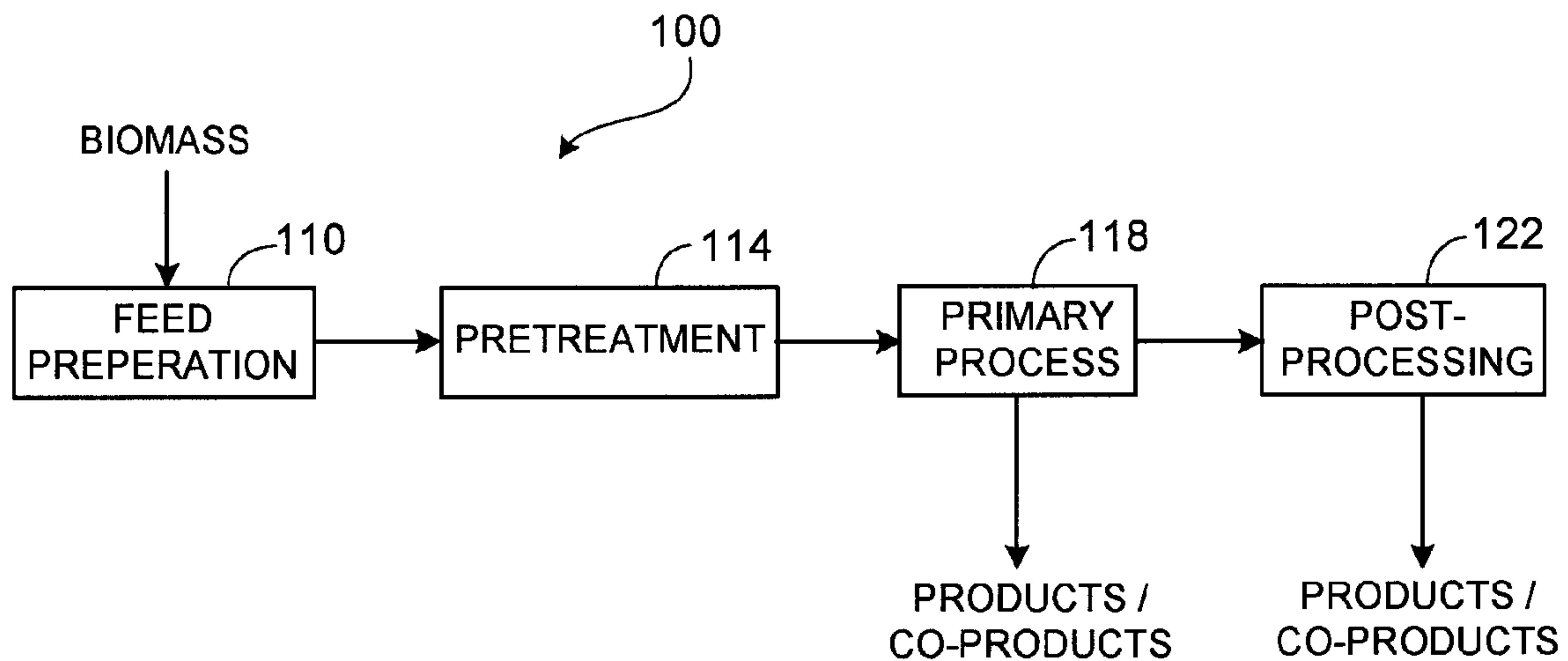
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A23J 1/00 (2006.01), *A23K 20/142* (2016.01),
A23L 13/00 (2016.01), *A23L 33/17* (2016.01),
C12N 9/00 (2006.01), *C12N 9/24* (2006.01),
C12N 9/42 (2006.01), *C12P 19/00* (2006.01)

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(54) Titre : TRAITEMENT DE LA BIOMASSE
(54) Title: PROCESSING BIOMASS



(57) **Abrégé/Abstract:**

Biomass (e.g., plant biomass, animal biomass, microbial, and municipal waste biomass) is processed to produce useful products, such as food products and amino acids.

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ABSTRACT

Biomass (e.g., plant biomass, animal biomass, microbial, and municipal waste biomass) is processed to produce useful products, such as food products and amino acids.

CLAIMS:

1. A method of producing an amino acid or a derivative thereof, the method comprising:
converting a processed material, using a microorganism, to produce an amino
5 acid or a derivative thereof, wherein the processed material has been provided by processing a biomass comprising polysaccharides in the form of cellulose, hemicellulose, or starch, and having a first recalcitrance level, using at least one of radiation, sonication, pyrolysis, and oxidation, to produce a processed material having a recalcitrance level lower than the
10 recalcitrance level of the biomass, wherein recalcitrance is determined by incubating in the presence of a cellulose.
2. The method of claim 1, wherein the amino acid or derivative thereof is selected from the group consisting of L-amino acids and D-amino acids such as L-glutamic acid (monosodium glutamate (MSG)), L-aspartic acid, L-phenylalanine, L-lysine, L-threonine, L-tryptophan, L-valine, L-leucine, L-isoleucine, L-methionine, L-histidine, and L-
15 phenylalanine, L-lysine, DL-methionine, and L-tryptophan.
3. The method of claim 2, wherein the microorganism is selected from the group consisting of lactic acid bacteria (LAB), E. coli, Bacillus subtilis, and Corynebacterium glutamicum.
4. The method of claim 1, wherein the processed material has been provided by
20 irradiating the biomass.
5. The method of claim 4, wherein irradiation is performed with an electron beam.
6. The method of claim 1 wherein the biomass comprises a cellulosic or lignocellulosic material.

7. The method of claim 1, wherein the biomass comprises a material selected from the group consisting of okra seed, *Lipinus mutabilis*, nuts, *Jessenia bataua*, *Oenocarpus*, *Stokesia laevis*, *Veronia galamensis*, and *Apodanthera undulate*.
8. The method of claim 4, wherein the biomass has been exposed to a plurality of showers of electron beam radiation.
9. The method of claim 4, wherein the biomass has been irradiated with a total dose of at least 10 Mrad of radiation.
10. The method of claim 9, wherein the total dose is from about 10 Mrad to about 150 Mrad.
- 10 11. The method of claim 4, wherein the biomass has been irradiated at a dose rate of from about 1 Mrad/s to about 10 Mrad/s.
12. The method of claim 1, wherein converting comprises forming an amino acid, and the method further comprises combining the amino acid with a nitrogen source to form an amino acid derivative.
- 15 13. The method of claim 1 wherein converting comprises forming glucose and biosynthesizing the aromatic amino acids tryptophan, phenylalanine, and tyrosine from the glucose through the shikimic acid pathway.
14. The method of claim 1 further comprising isolating the amino acid or amino acid derivative.
- 20 15. The method of claim 1 further comprising combining the amino acid or amino acid derivative with an excipient.
16. The method of claim 1 wherein converting comprises expressing the amino acid or derivative using a fed-batch fermentation process.

17. The method of claim 1 wherein the amino acid derivative comprises an amino alcohol, amino aldehyde, or amino lactone.
18. A product comprising recalcitrance reduced lignocellulosic biomass in densified form and an enzyme.
- 5 19. The product of claim 18 wherein the lignocellulosic biomass comprises corn cobs and/or corn stover.
20. The product of claim 18 wherein the enzyme comprises a cellulolytic enzyme.
21. The product of claim 18 wherein the enzyme comprises a multiple enzyme cocktail.
- 10 22. The product of claim 18 wherein the recalcitrance reduced lignocellulosic biomass has been pretreated with an electron beam.
23. The product of claim 18 wherein the enzyme is present at a dosage of between 5.0 and 50 Filter Paper Units (FPU or IU) per gram of cellulose.
24. The product of claim 18 wherein the enzyme comprises a dried enzyme.
- 15 25. The product of claim 18 wherein the enzyme comprises an enzyme requiring activation.
26. The product of claim 18 wherein the enzyme is selected from the group consisting of phytase, cellulase, lactase, lipase, pepsin, catalase, xylanase, pectinase, and mixtures thereof.
- 20 27. A method of making a feed material, the method comprising densifying a recalcitrance reduced lignocellulosic biomass and combining with an enzyme.
28. The method of claim 27 further comprising, prior to densifying, preparing the recalcitrance reduced lignocellulosic biomass by treating a lignocellulosic biomass with electron beam radiation.

- 29. The method of claim 28 wherein treating with electron beam irradiation comprises applying a dosage of greater than 5 Mrad of radiation to the biomass.
- 30. The method of claim 27 wherein the lignocellulosic biomass comprises corn cobs and/or corn stover.
- 5 31. The method of claim 27 wherein the enzyme comprises a cellulolytic enzyme.
- 32. The method of claim 27 wherein the enzyme comprises a multiple enzyme cocktail.
- 33. The method of claim 27 wherein densifying comprises pelletizing.
- 34. The method of claim 27 wherein densifying comprises applying a liquid to the
10 recalcitrance reduced biomass.
- 35. The method of claim 27 wherein the enzyme comprises a dried enzyme.
- 36. The method of claim 27 wherein the enzyme comprises an enzyme requiring activation.
- 37. The method of claim 27 wherein the enzyme is selected from the group
15 consisting of phytase, cellulase, lactase, lipase, pepsin, catalase, xylanase, pectinase, and mixtures thereof.

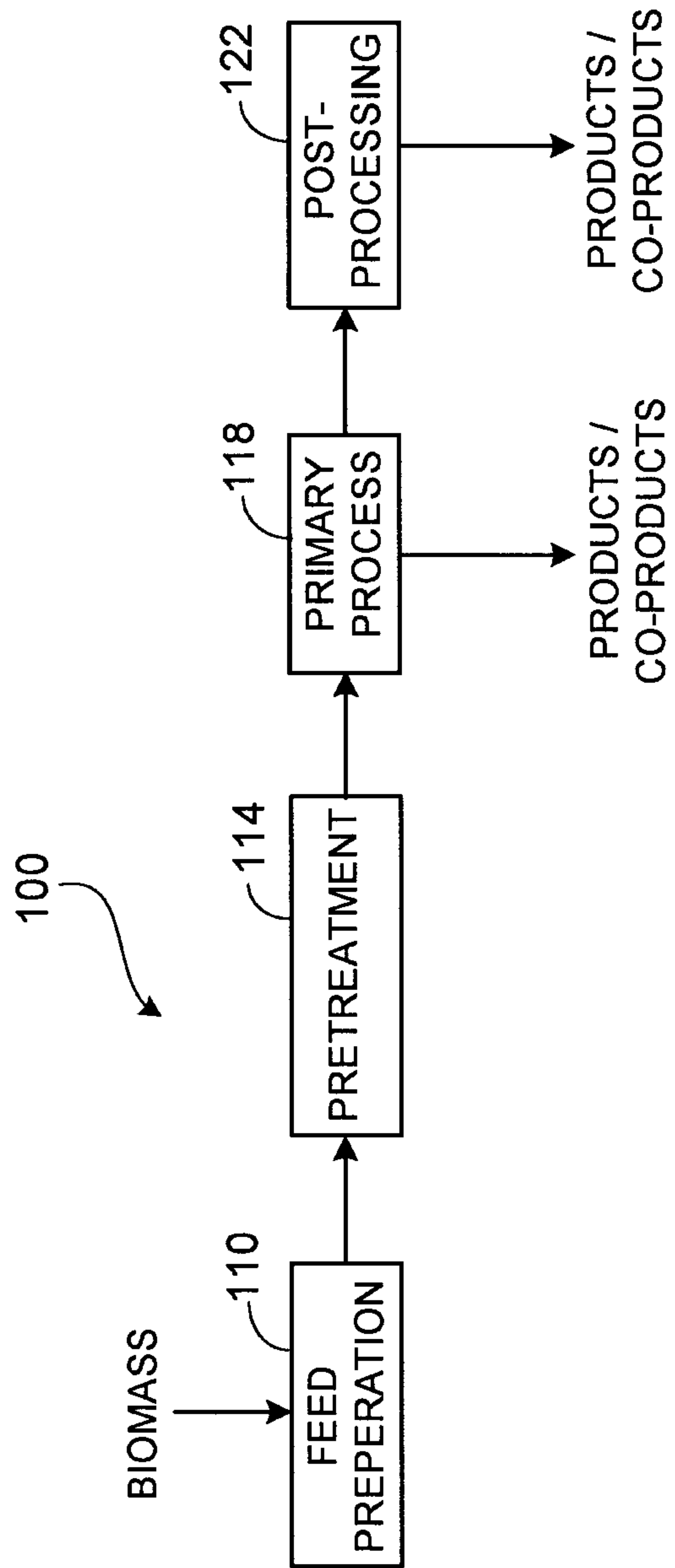


FIG. 1

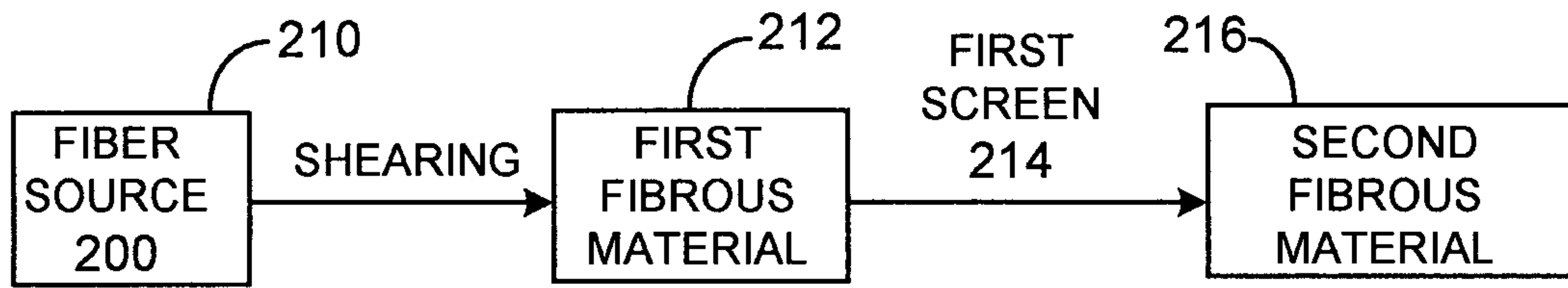
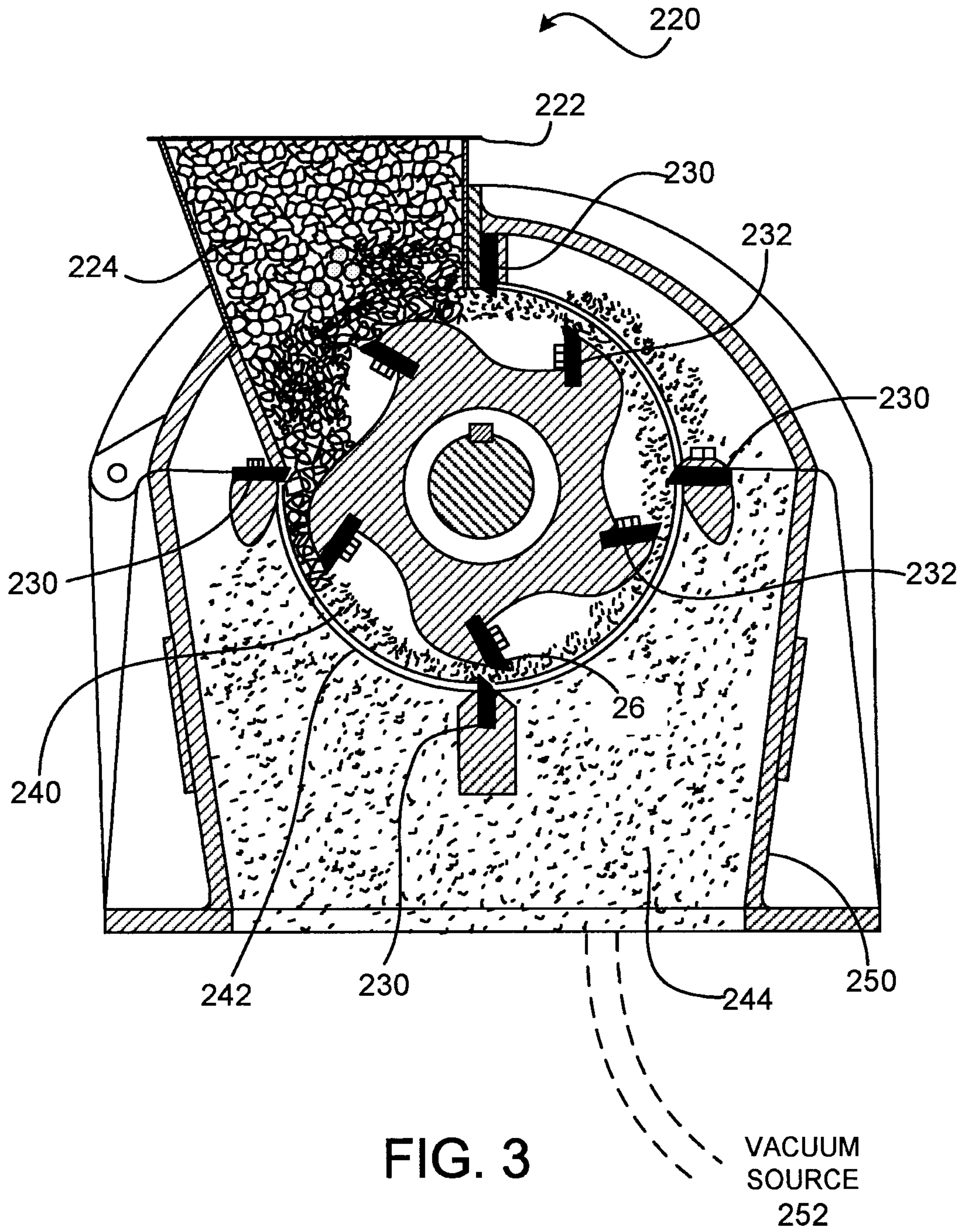


FIG. 2



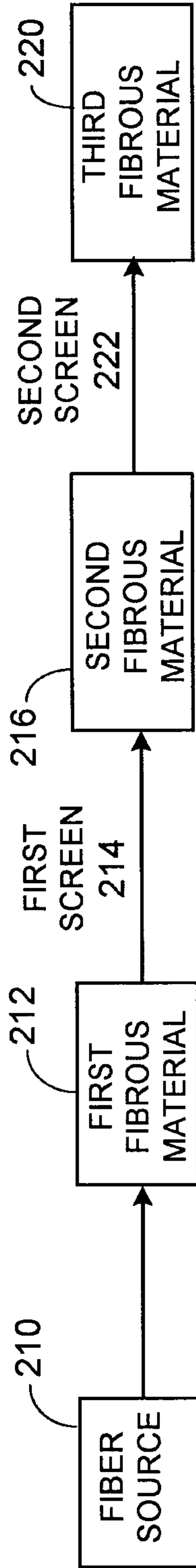


FIG. 4

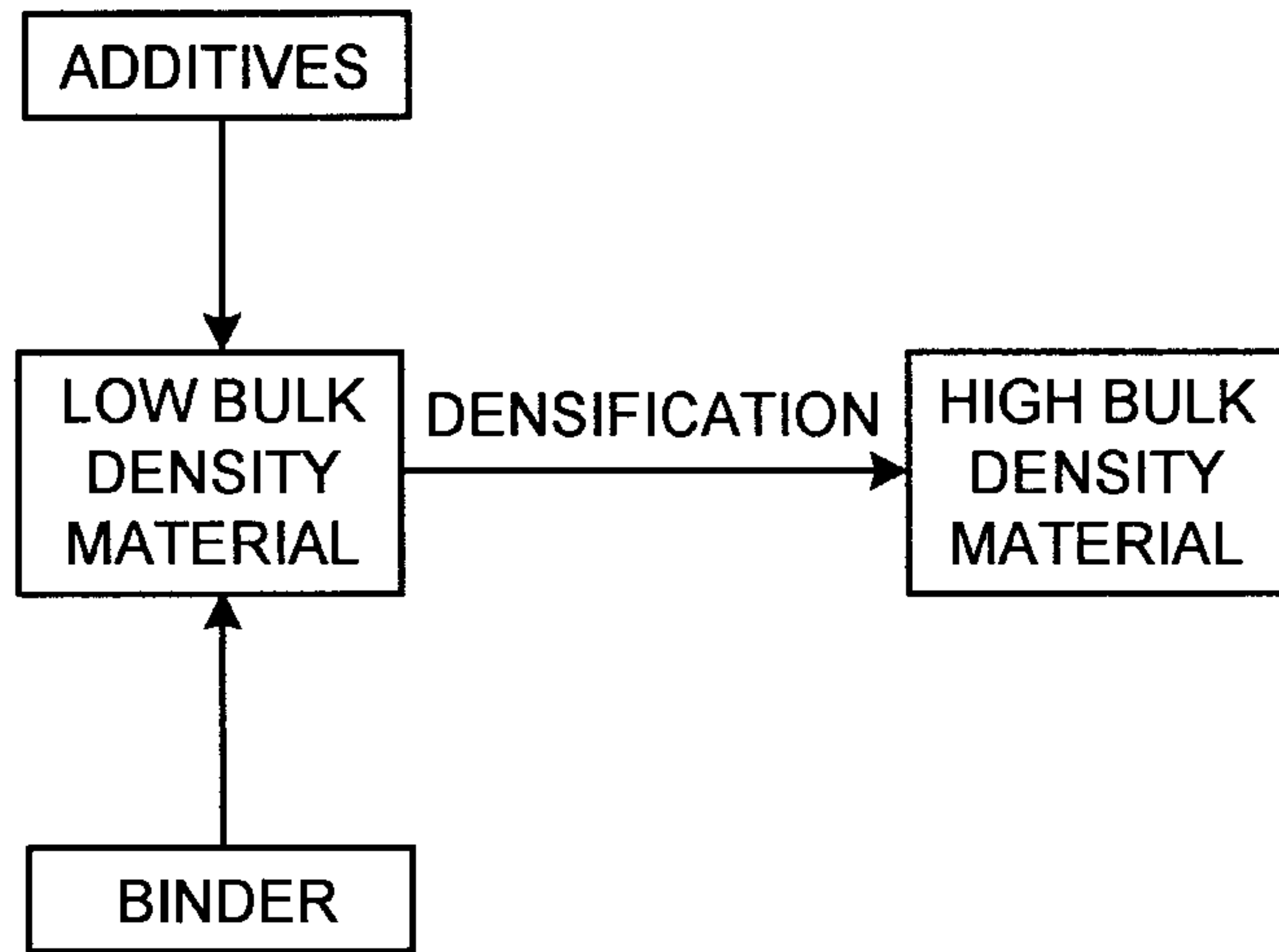


FIG. 5

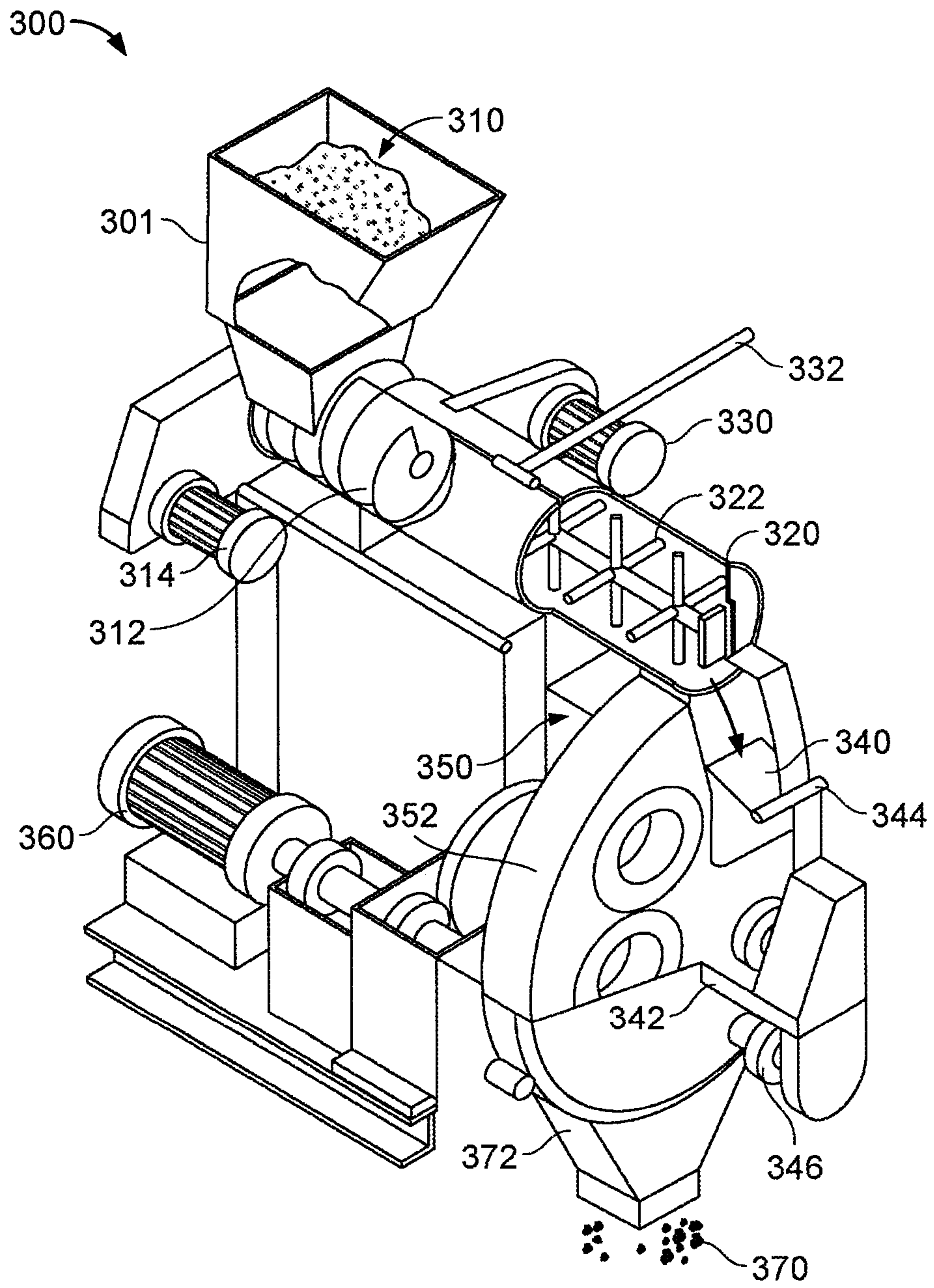


FIG. 6

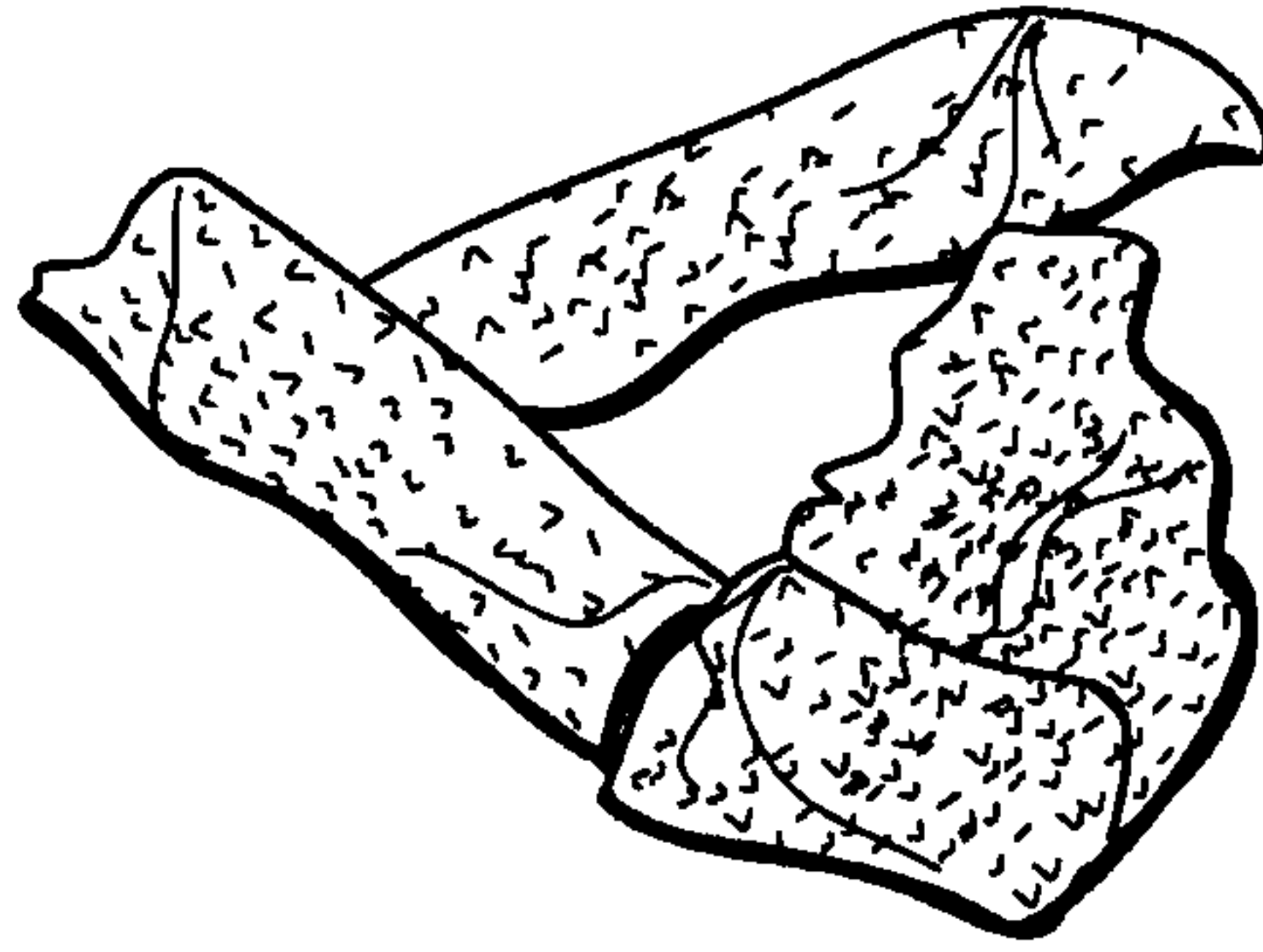


FIG. 7A

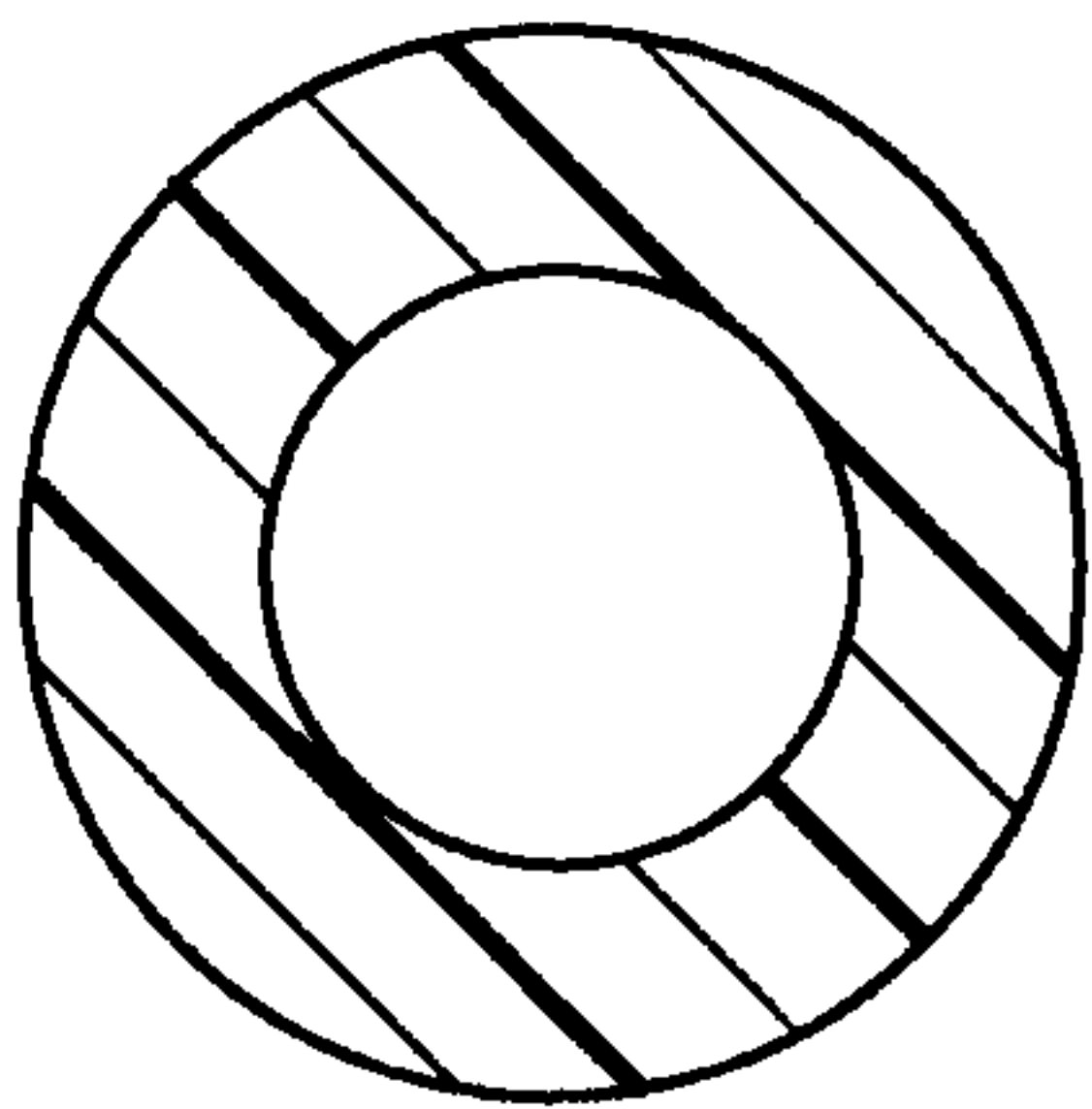


FIG. 7B

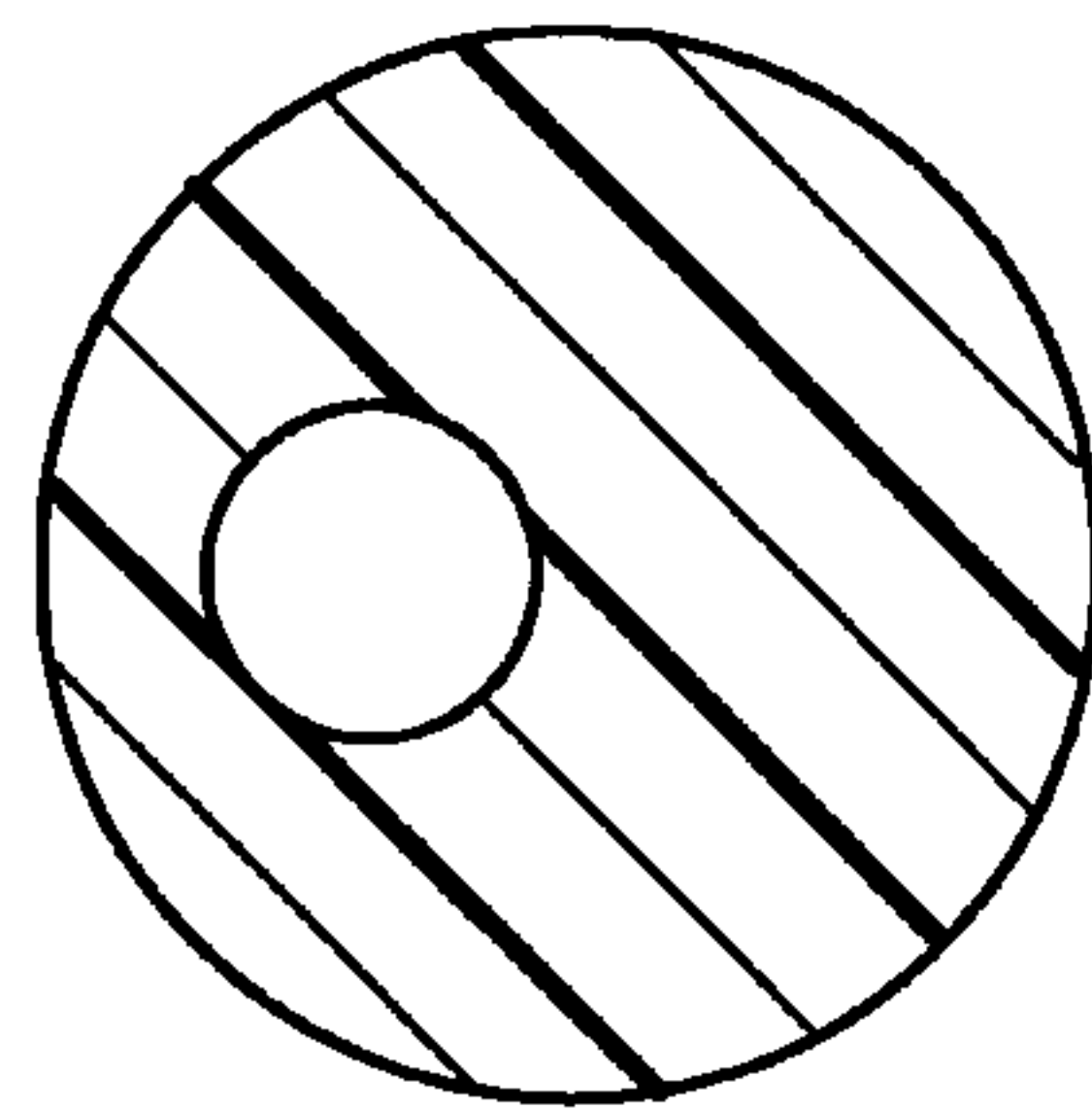


FIG. 7C

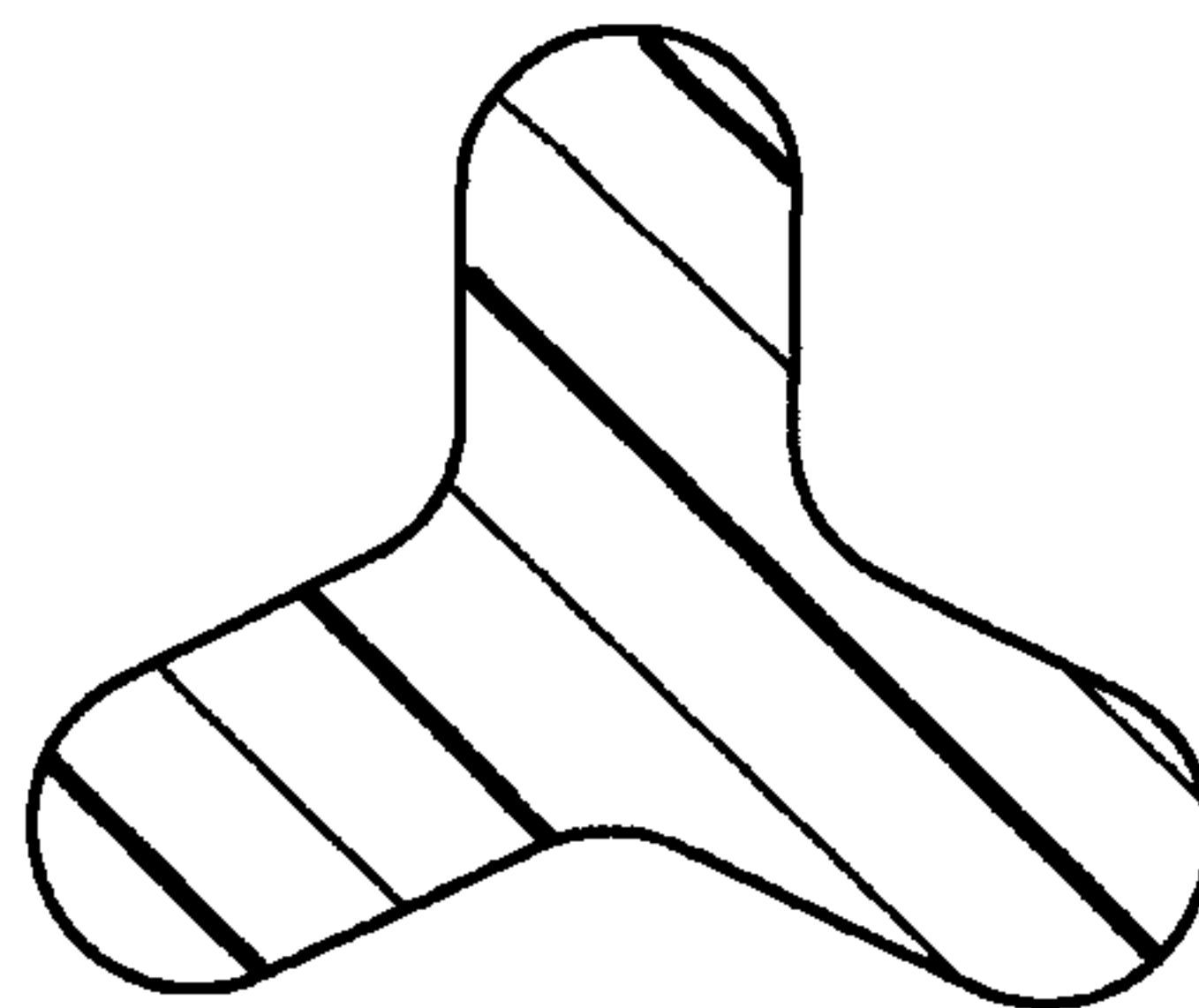


FIG. 7D

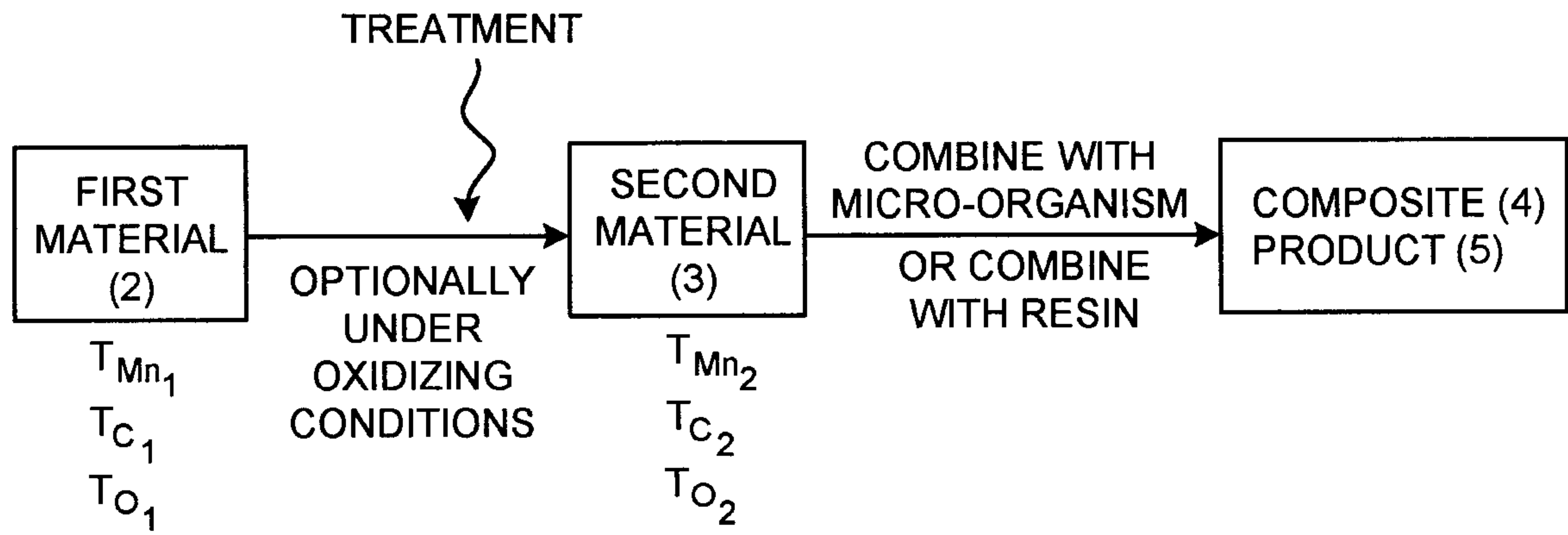


FIG. 8

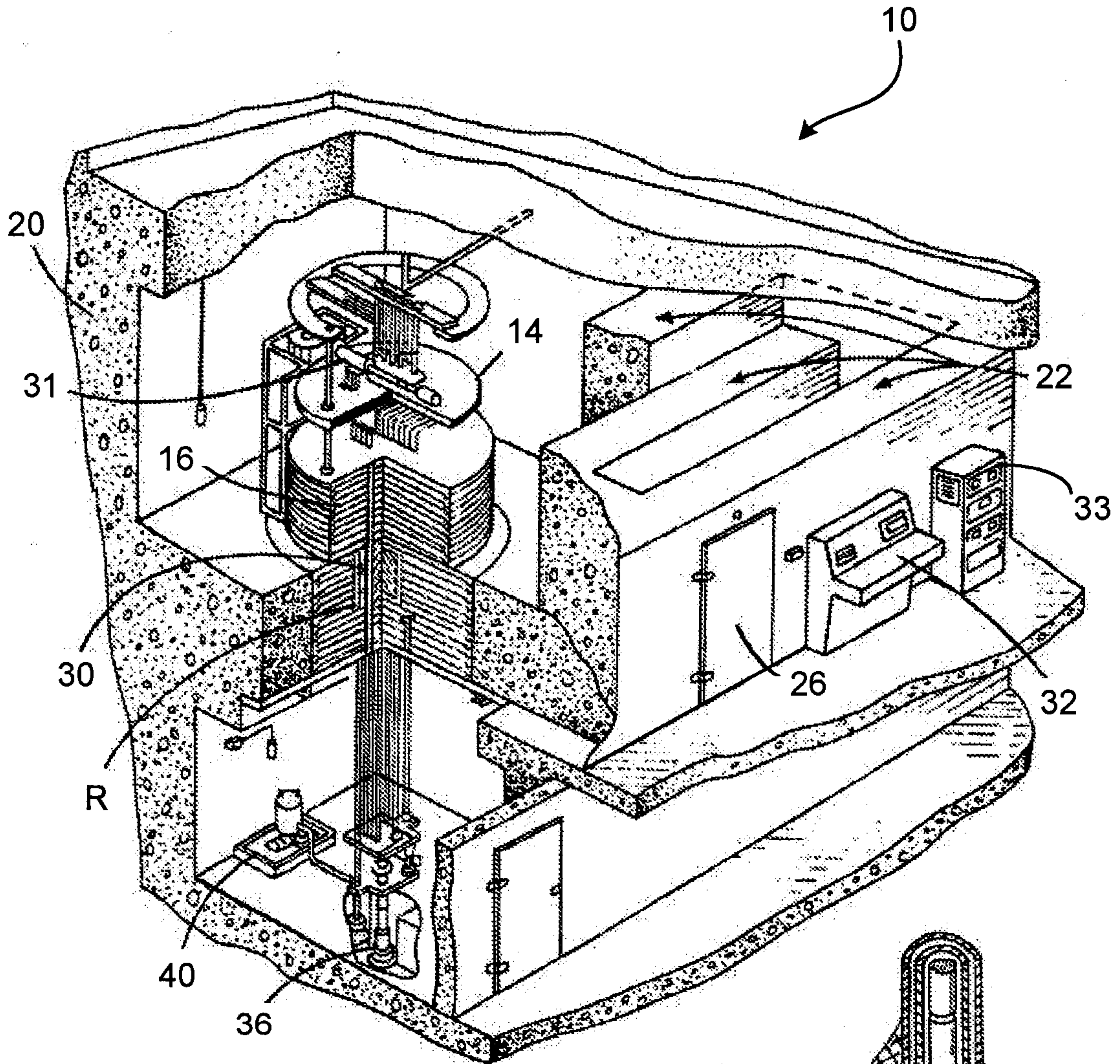


FIG. 9

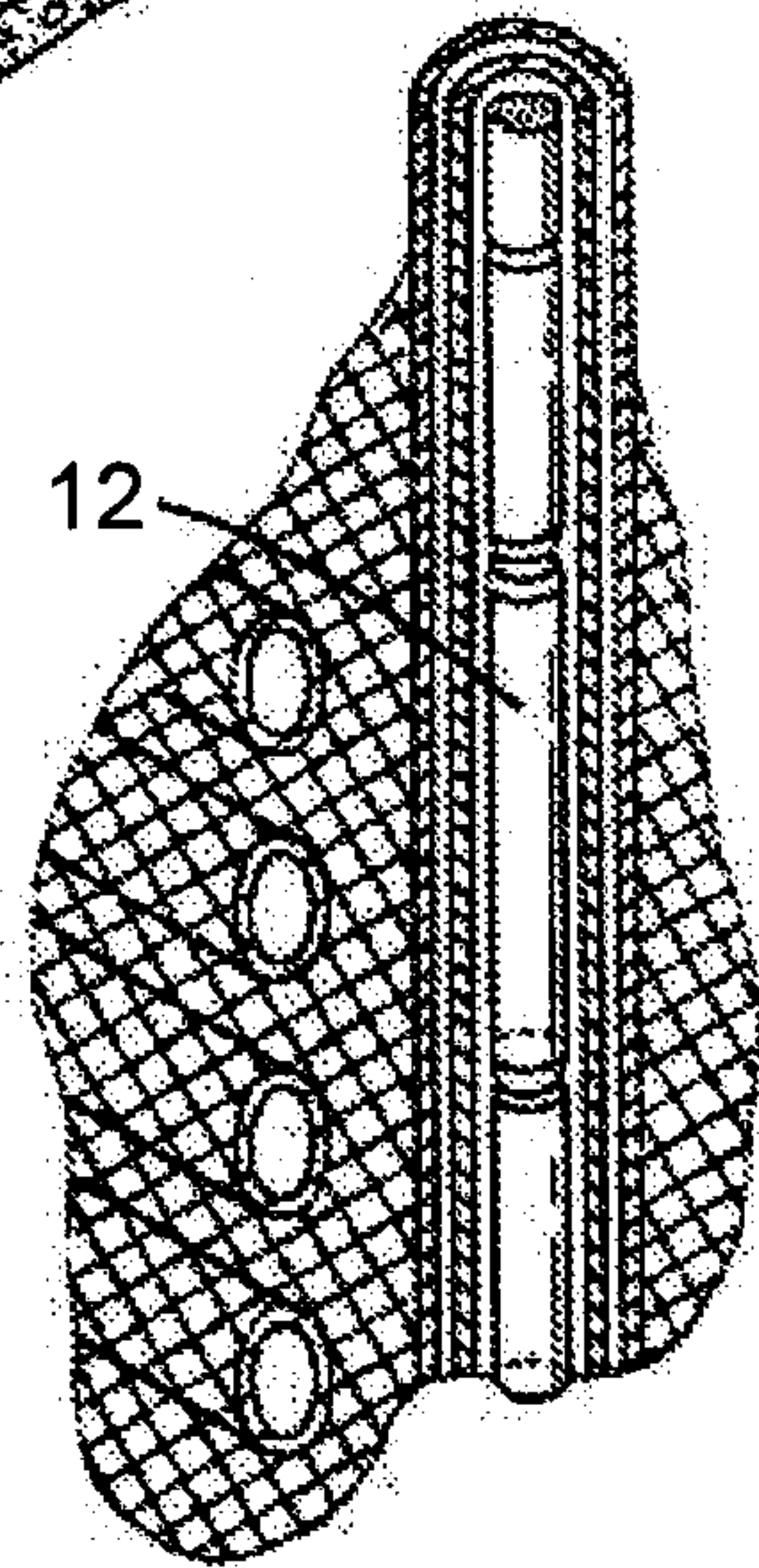


FIG. 10

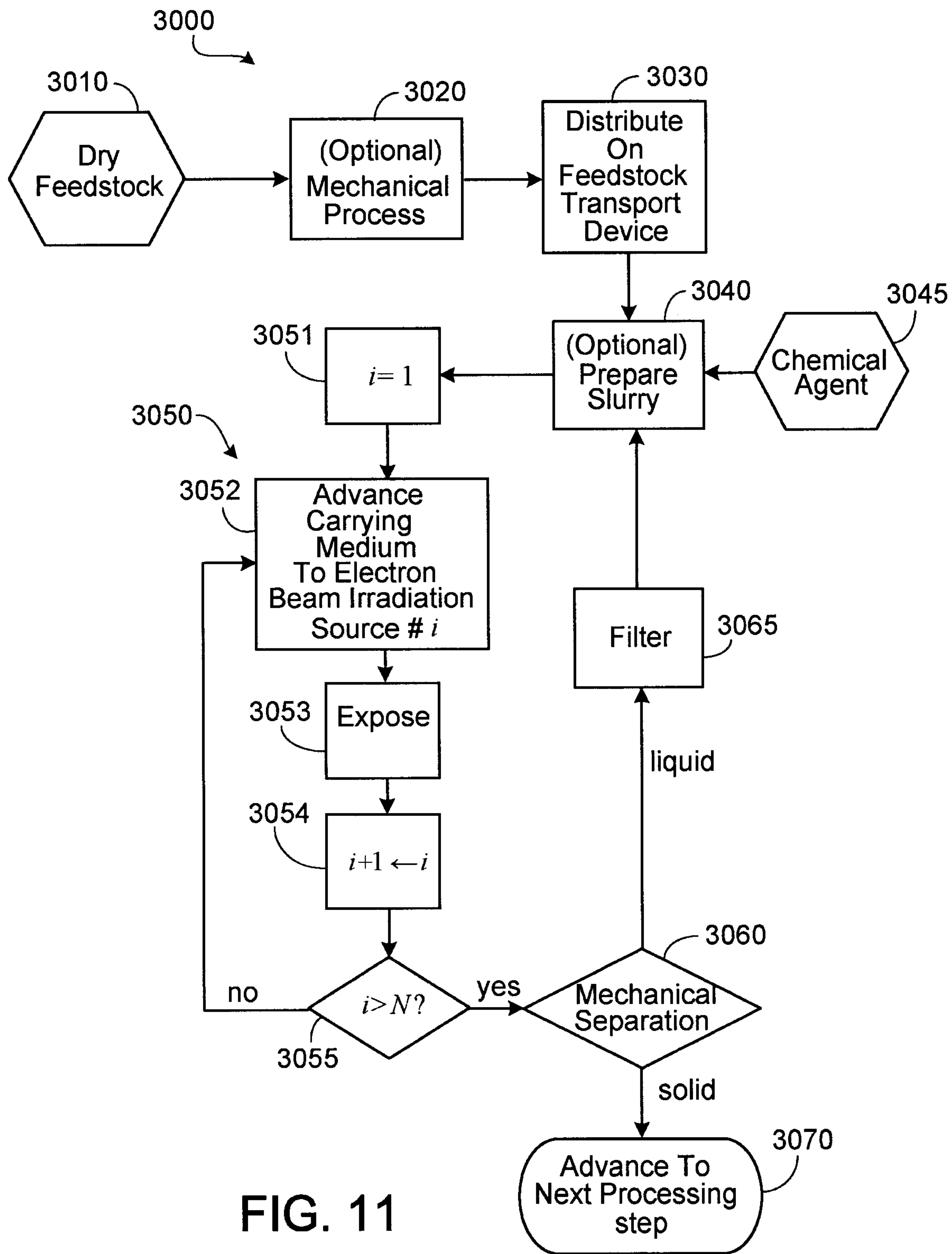


FIG. 11

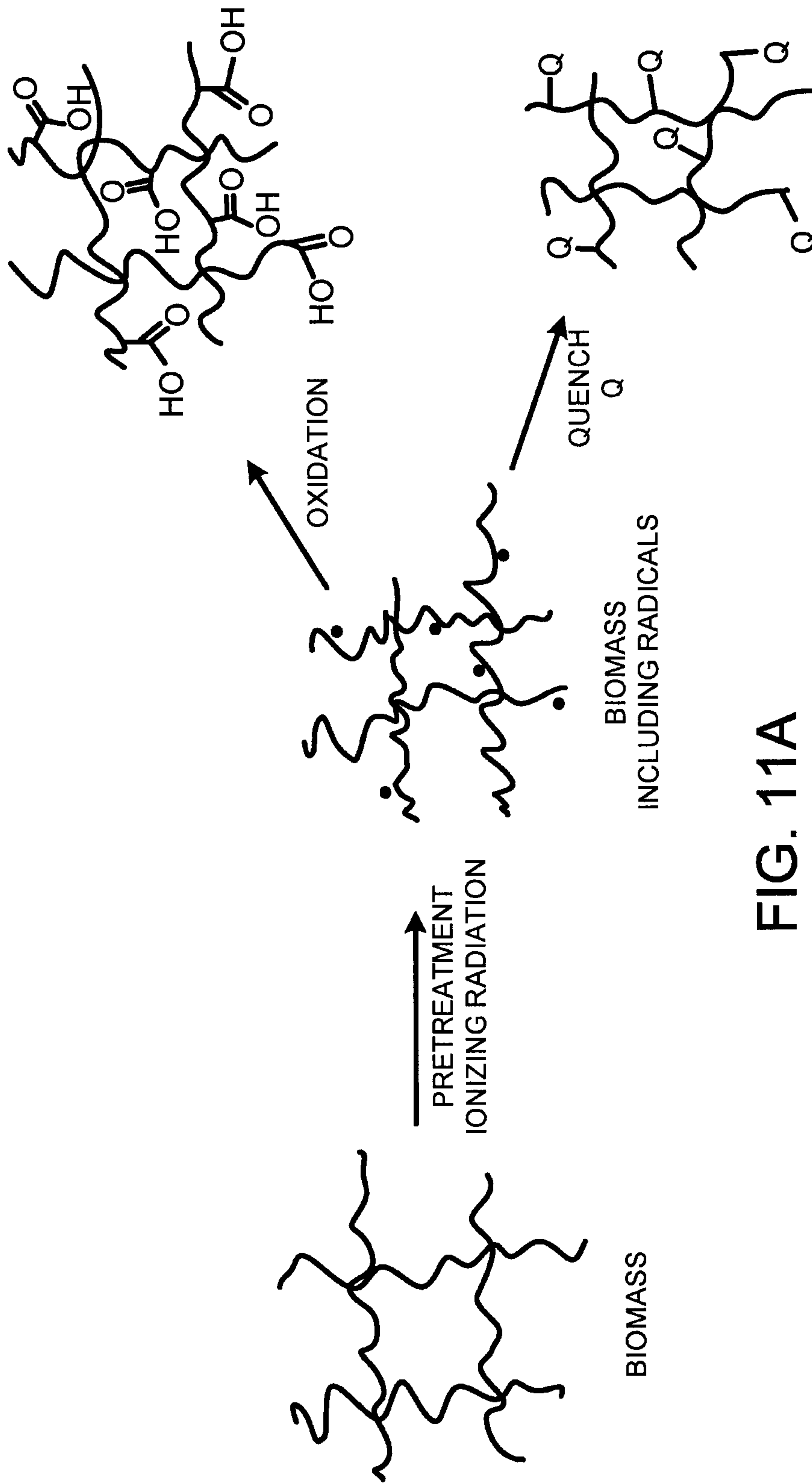
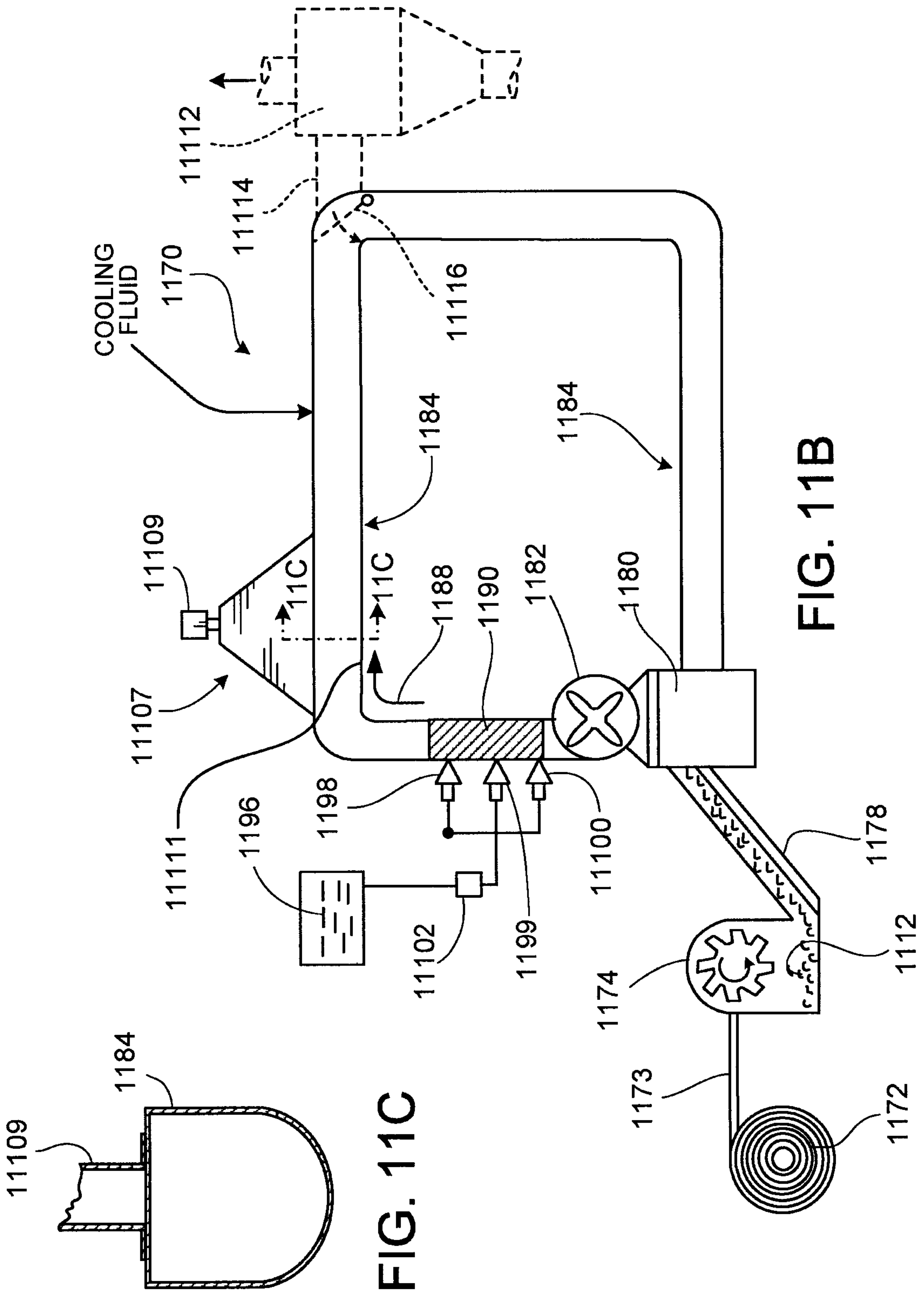


FIG. 11A



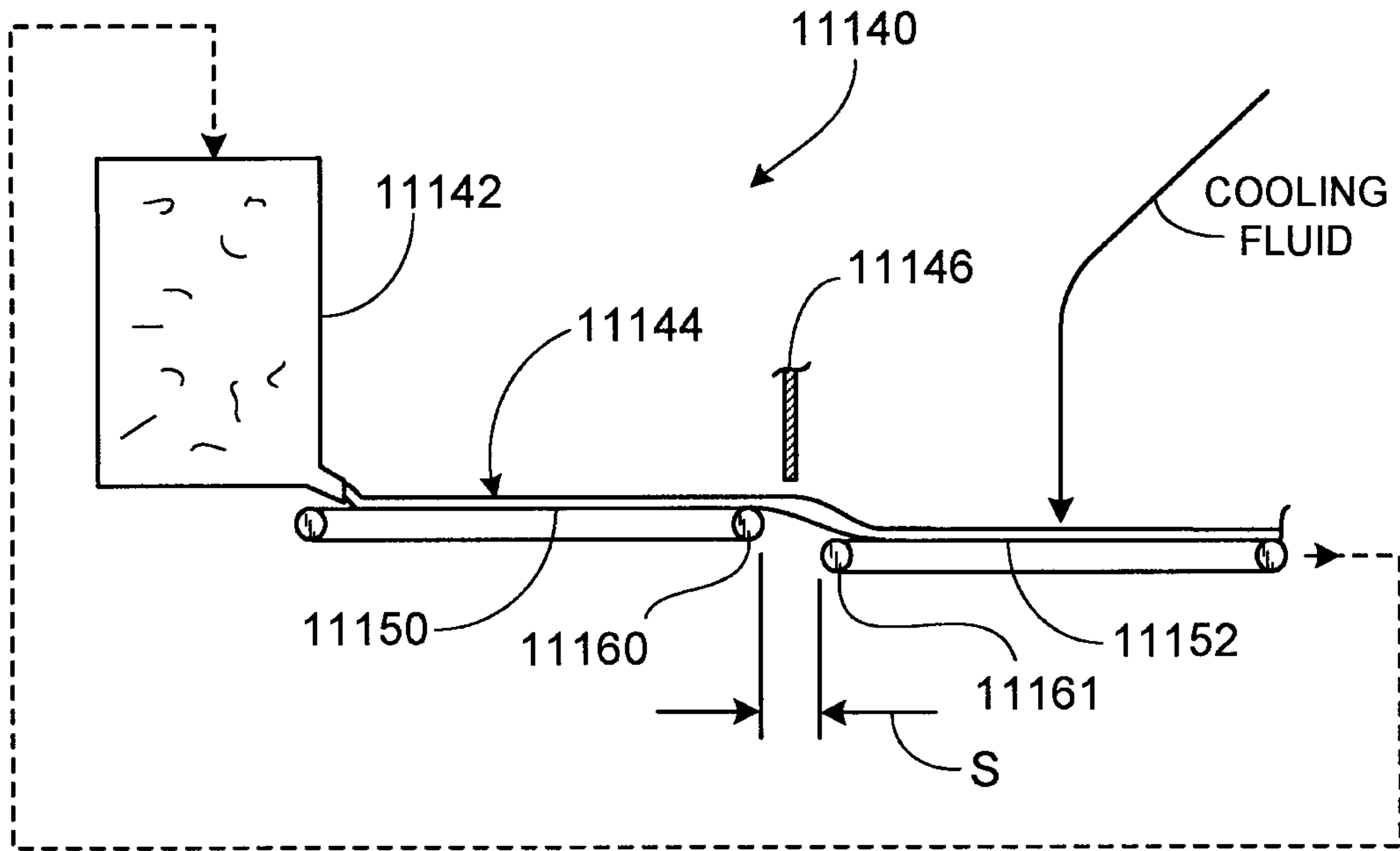


FIG. 11E

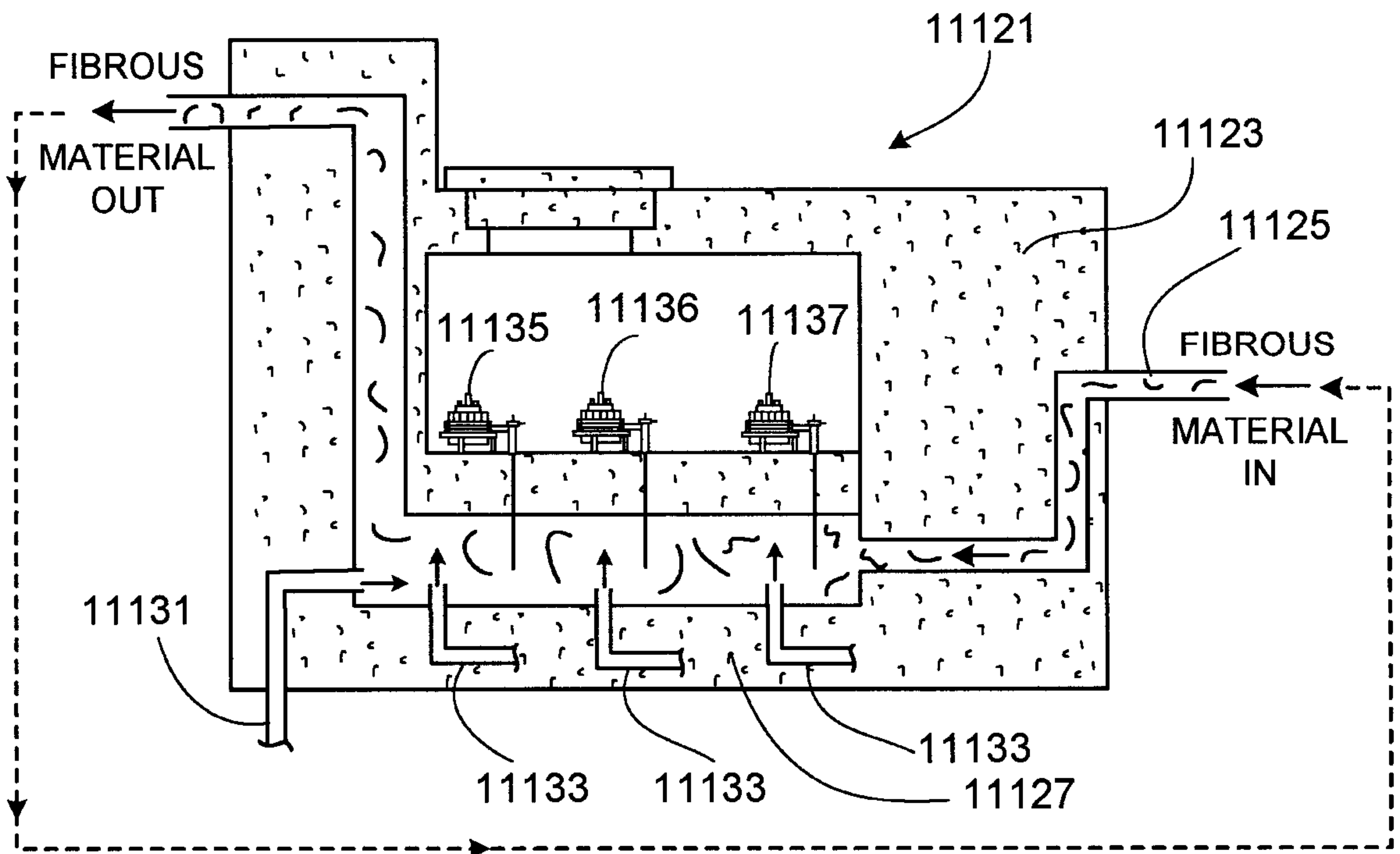


FIG. 11D

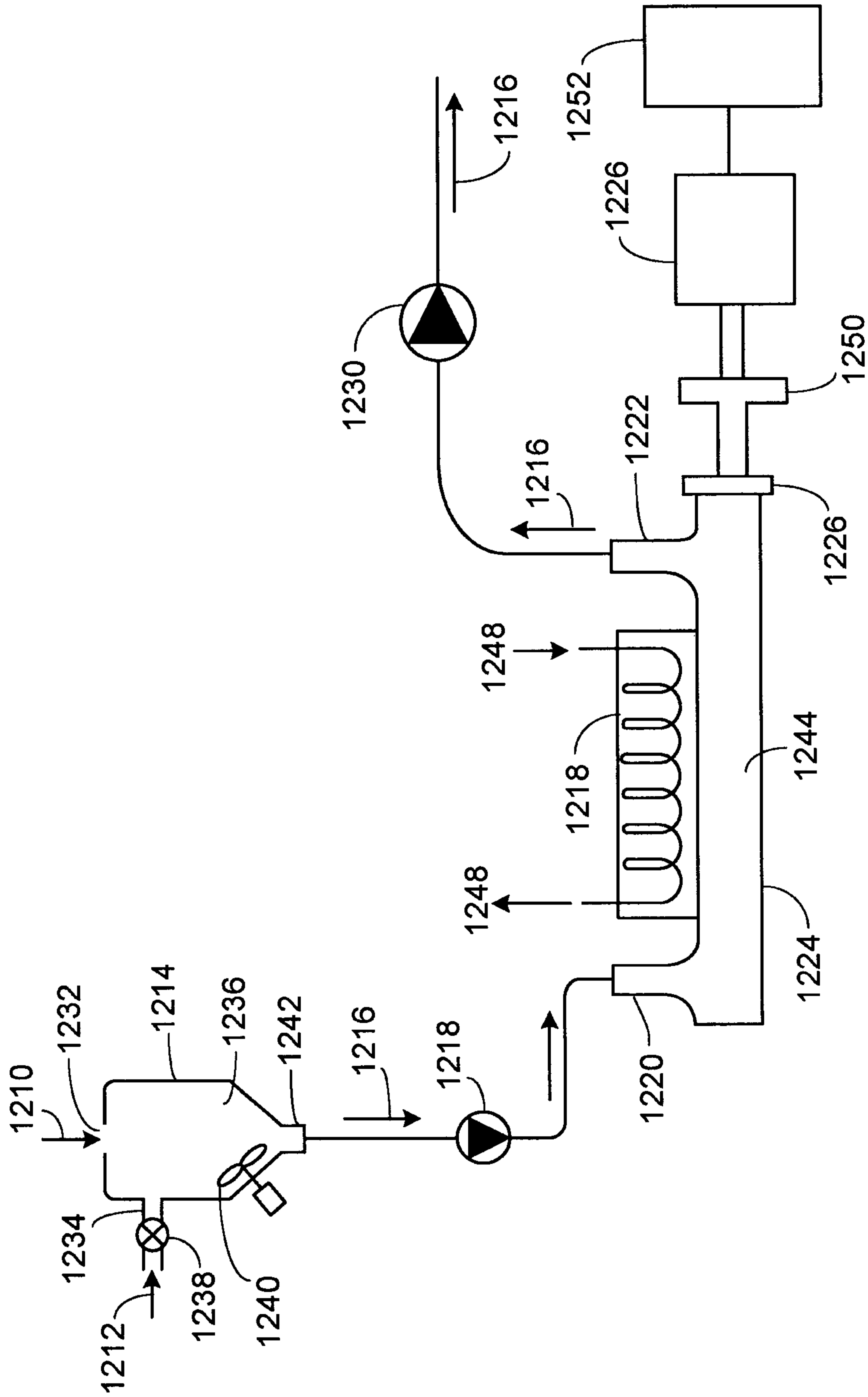


FIG. 12

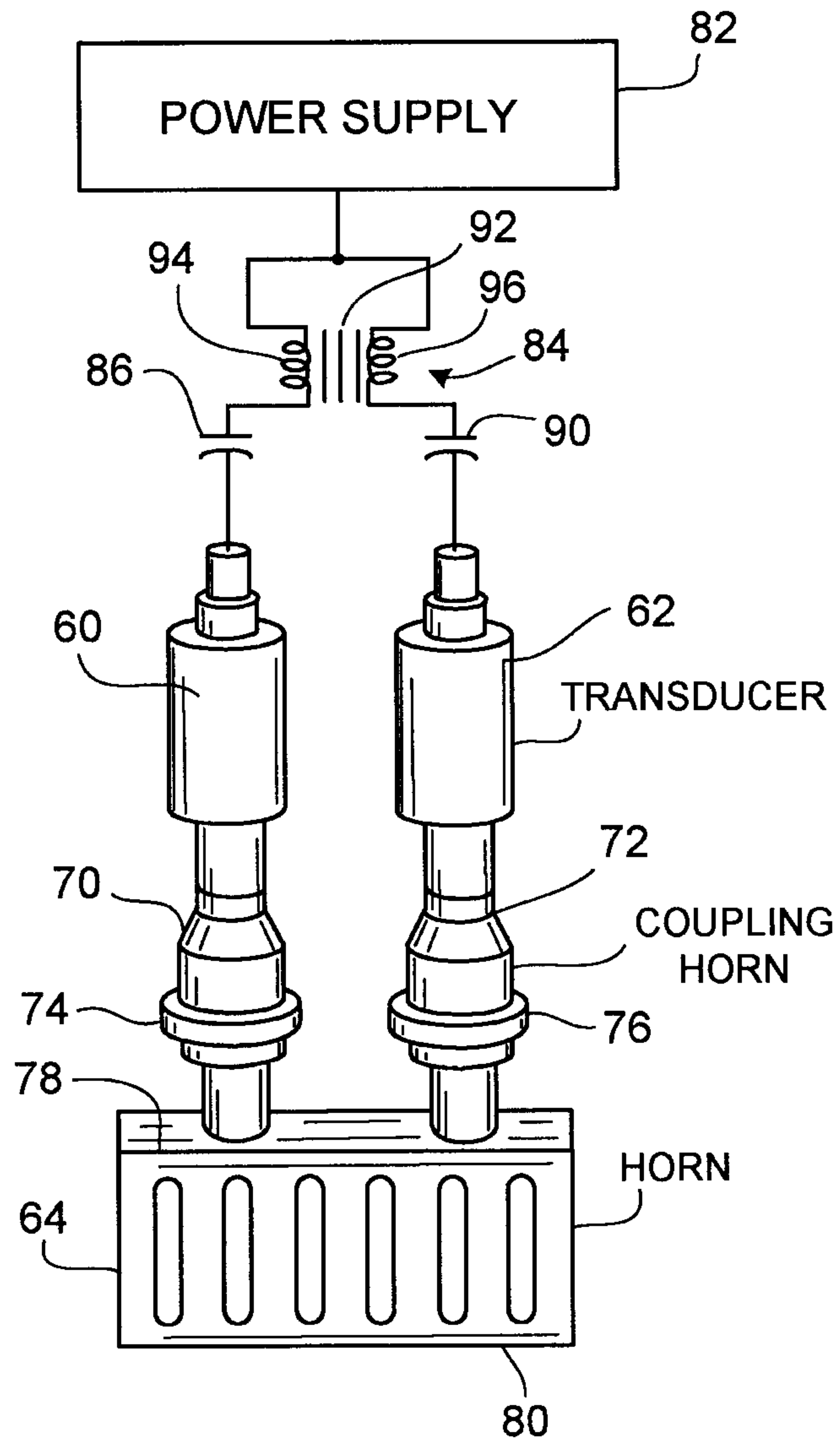


FIG. 13

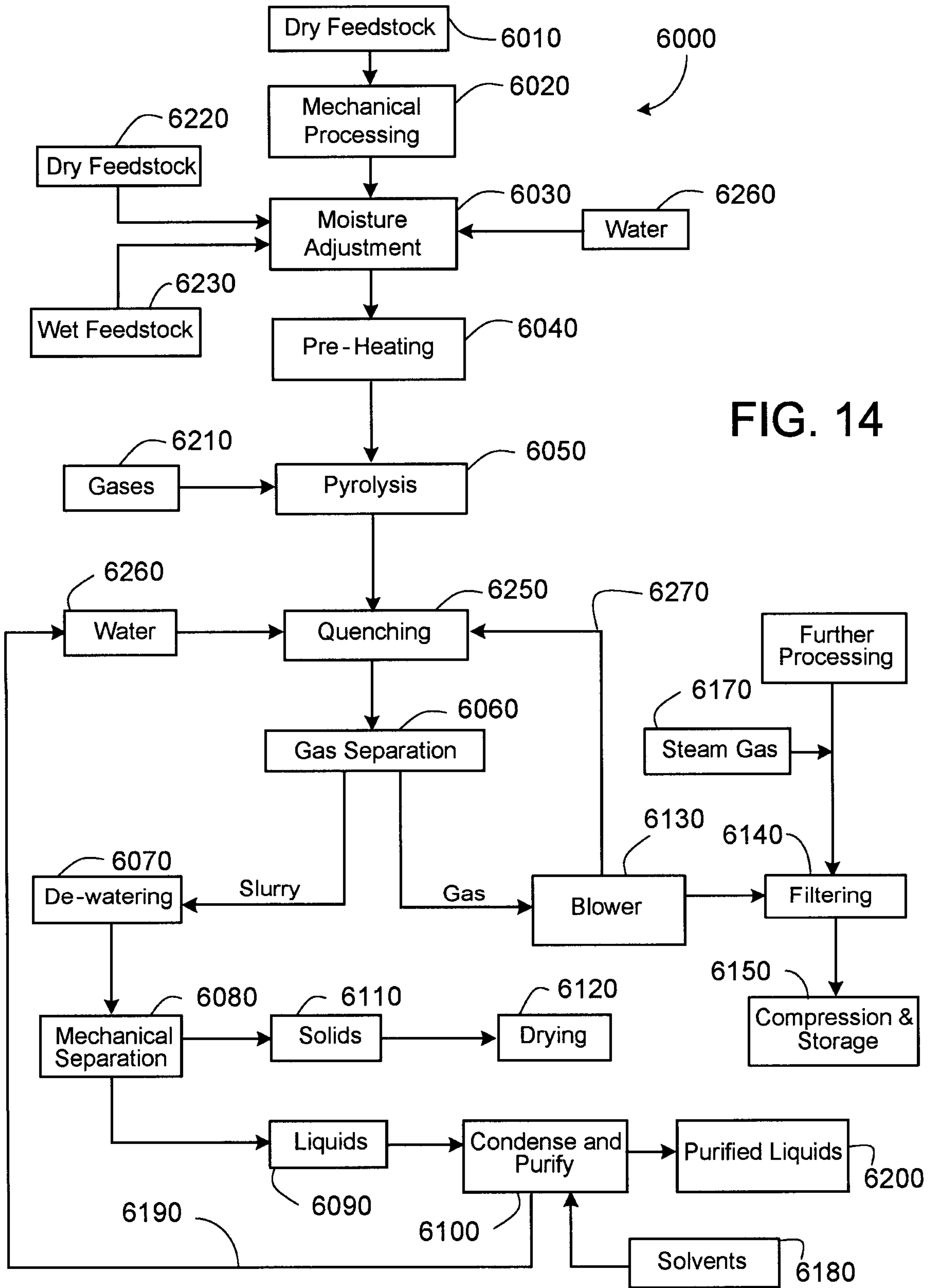


FIG. 14

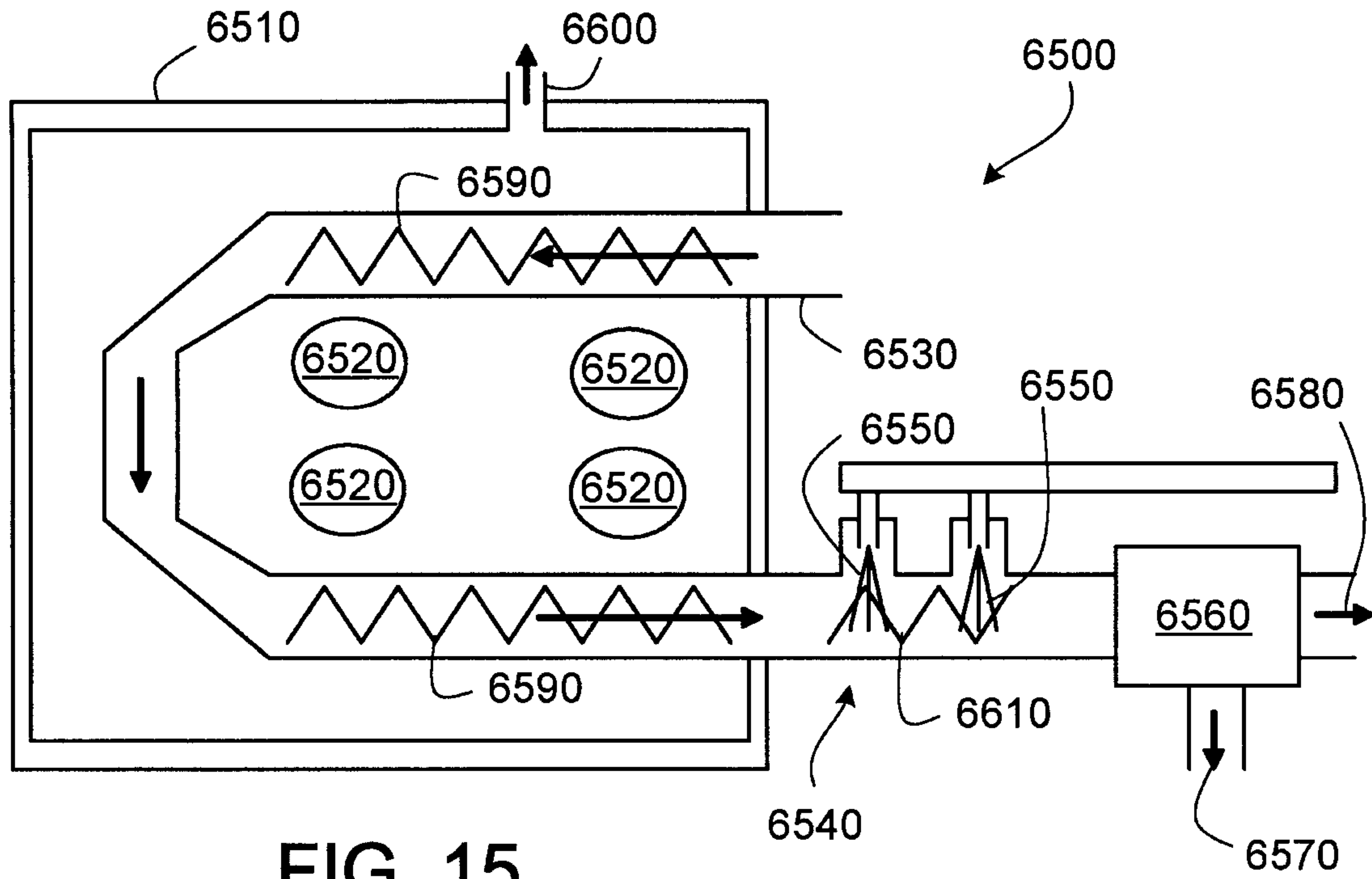


FIG. 15

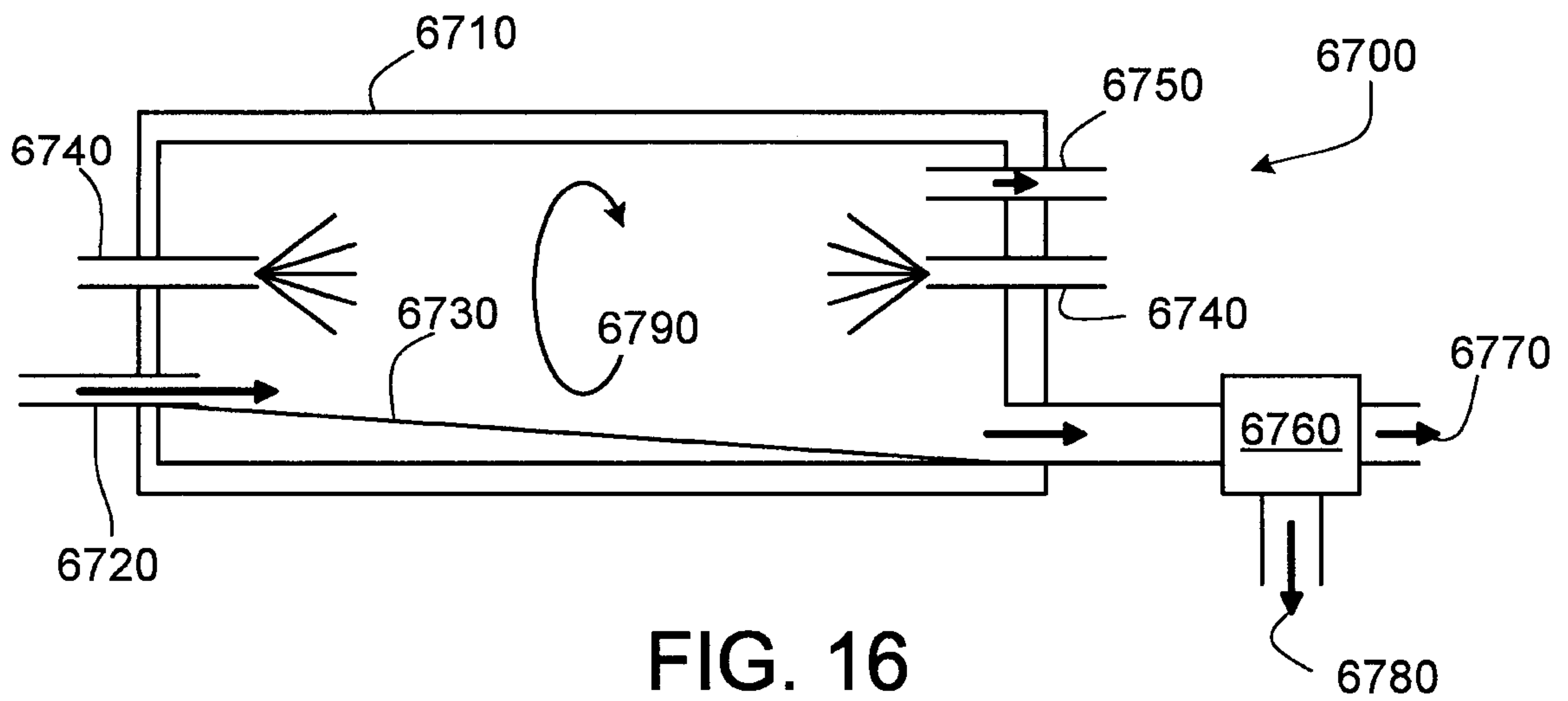


FIG. 16

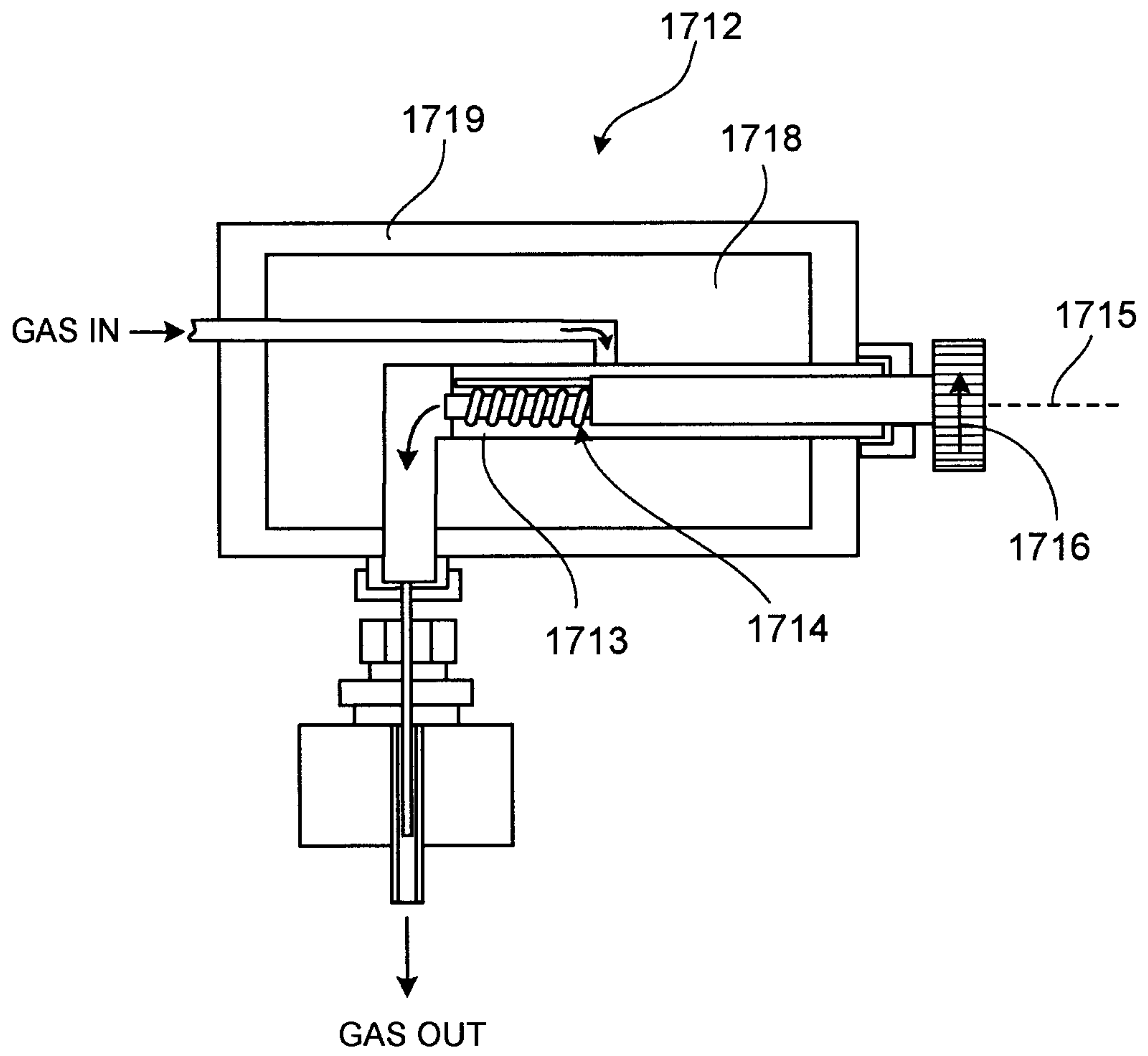


FIG. 17

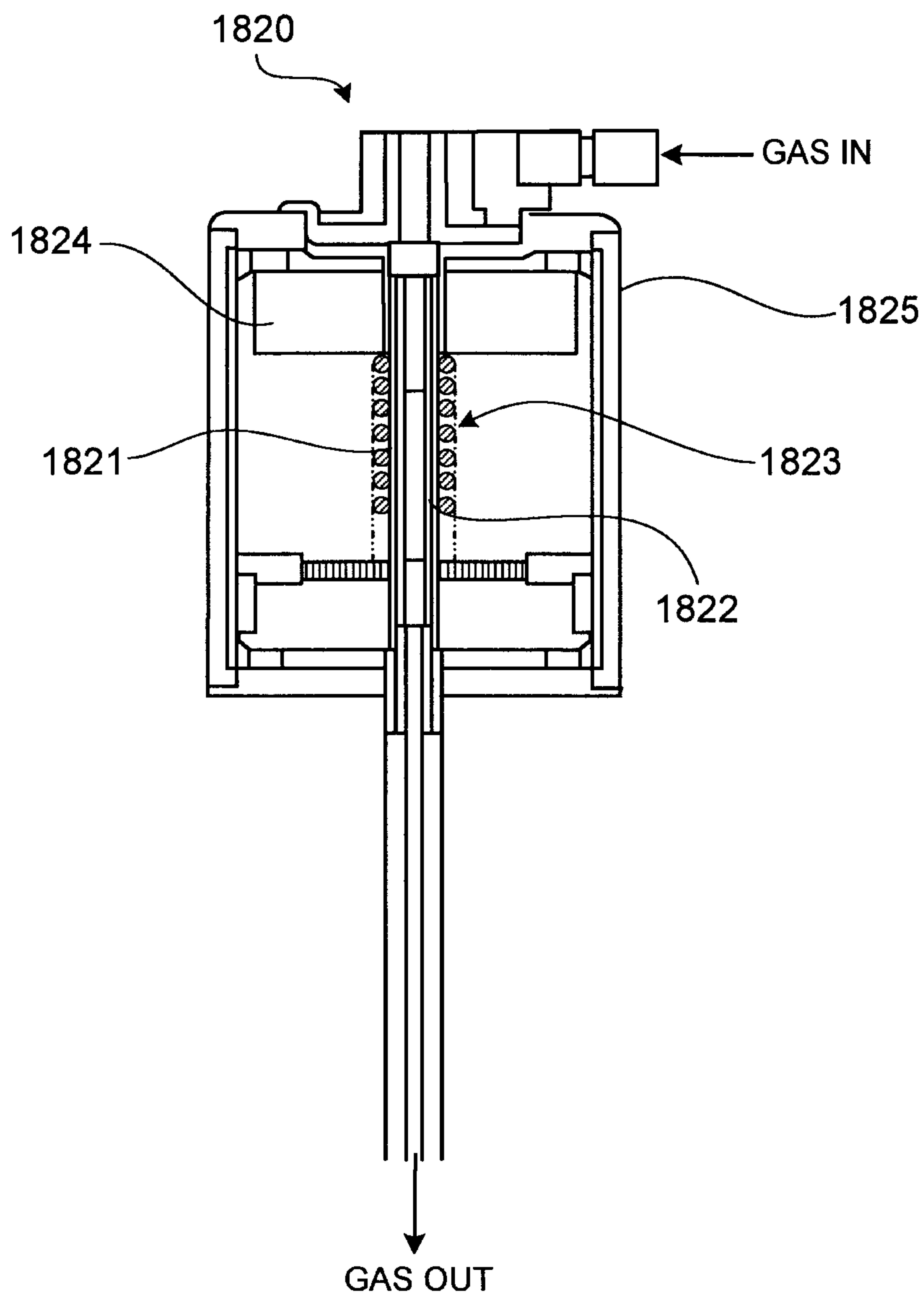


FIG. 18

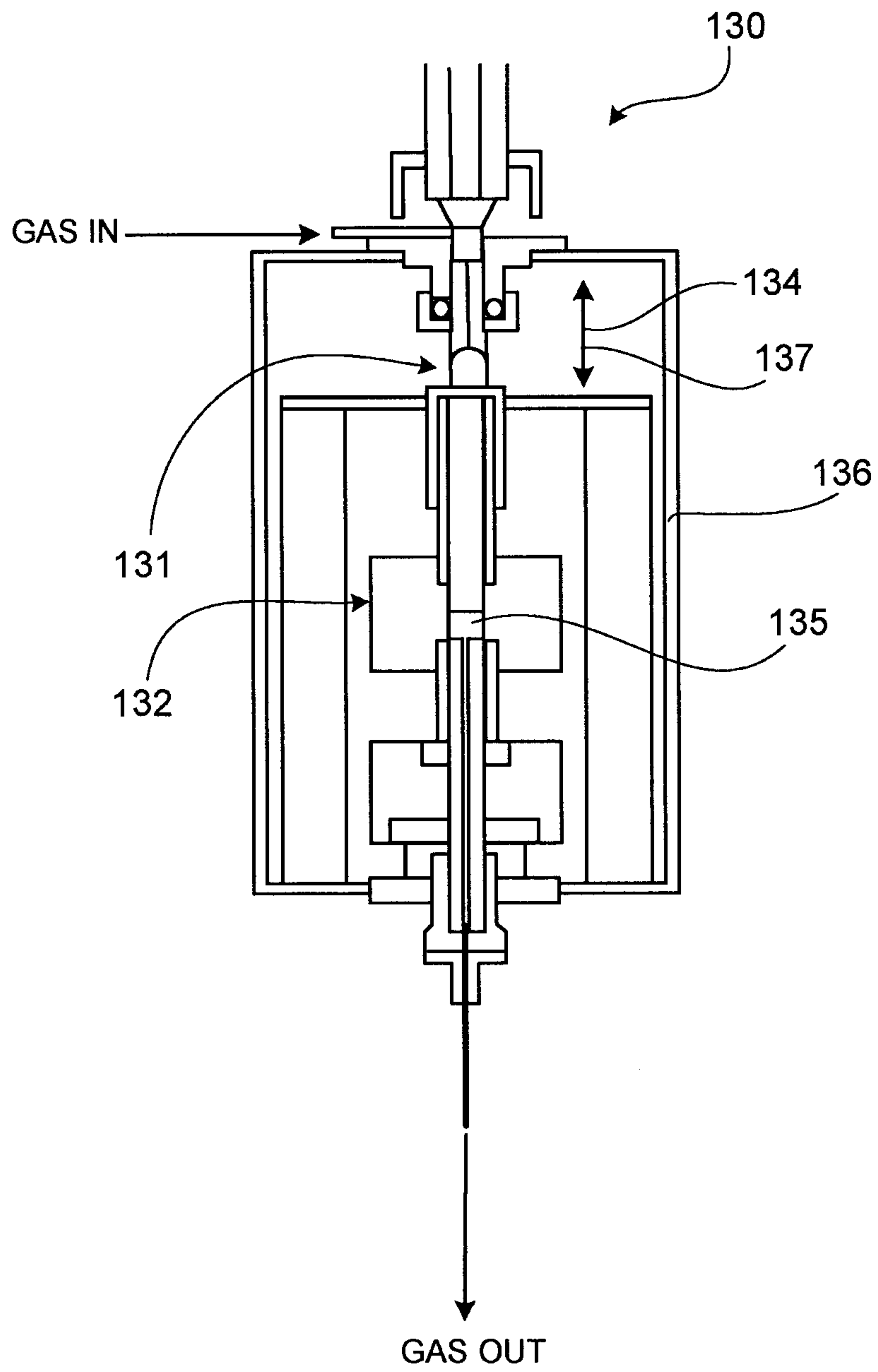


FIG. 19

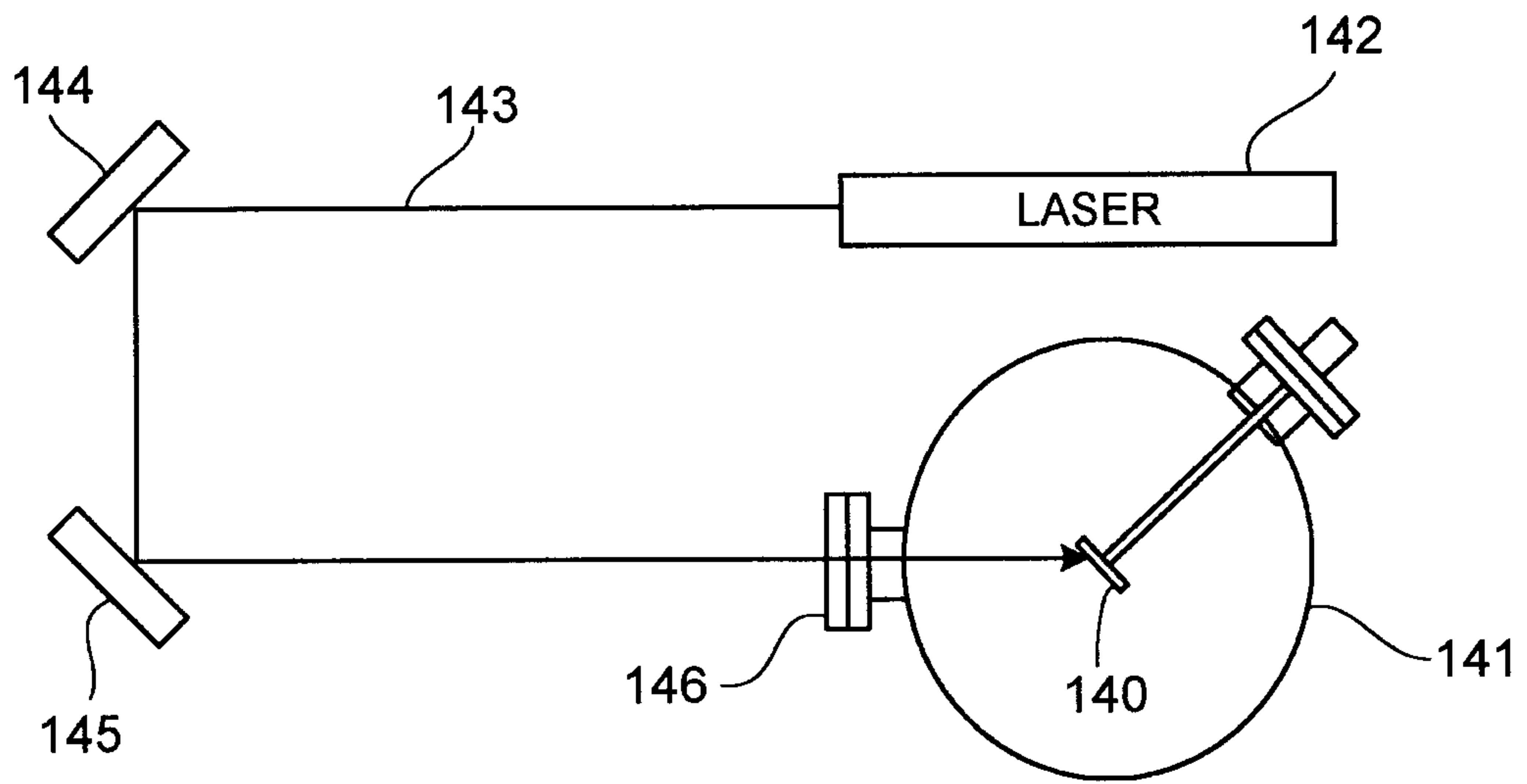


FIG. 20

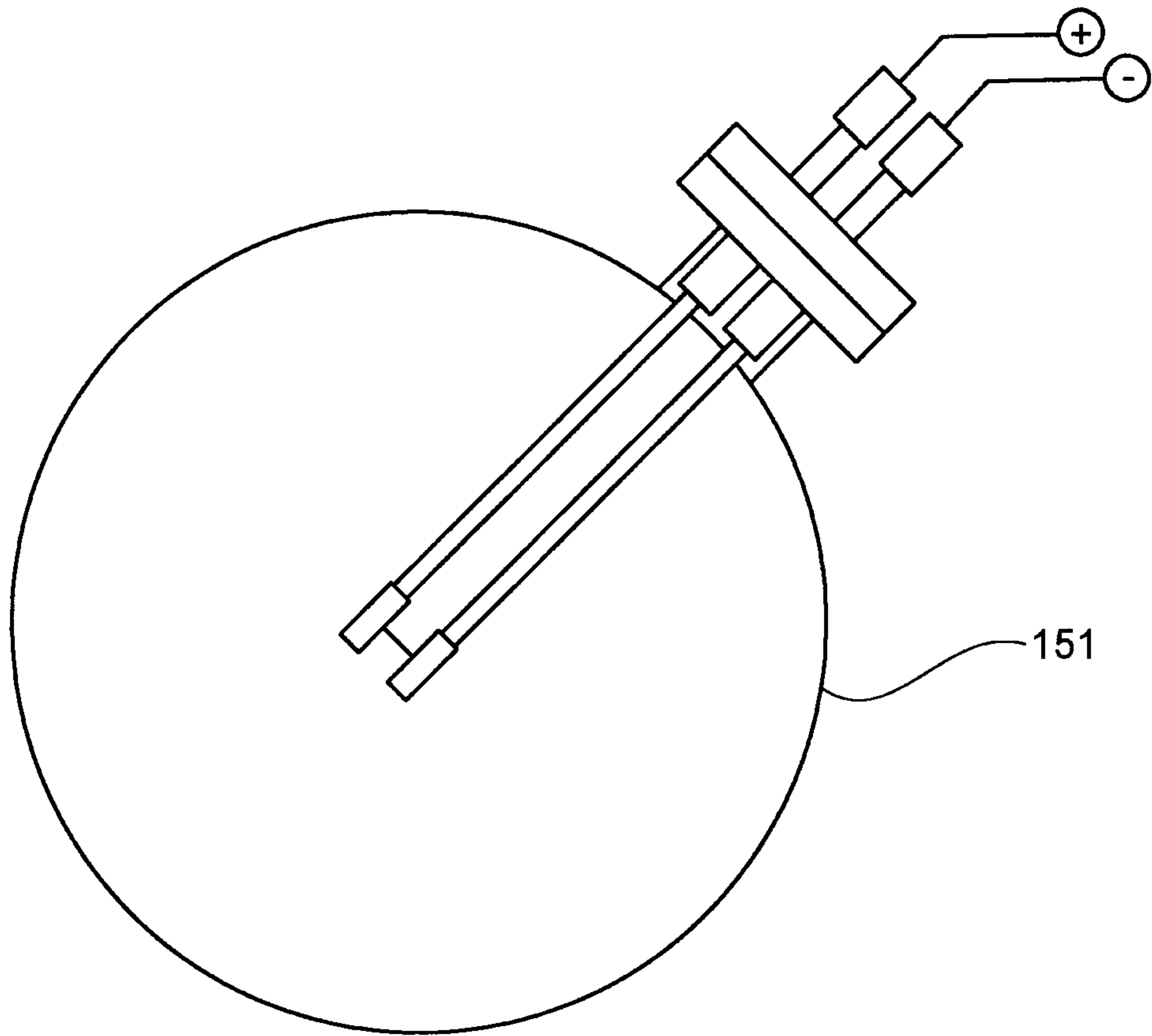


FIG. 21

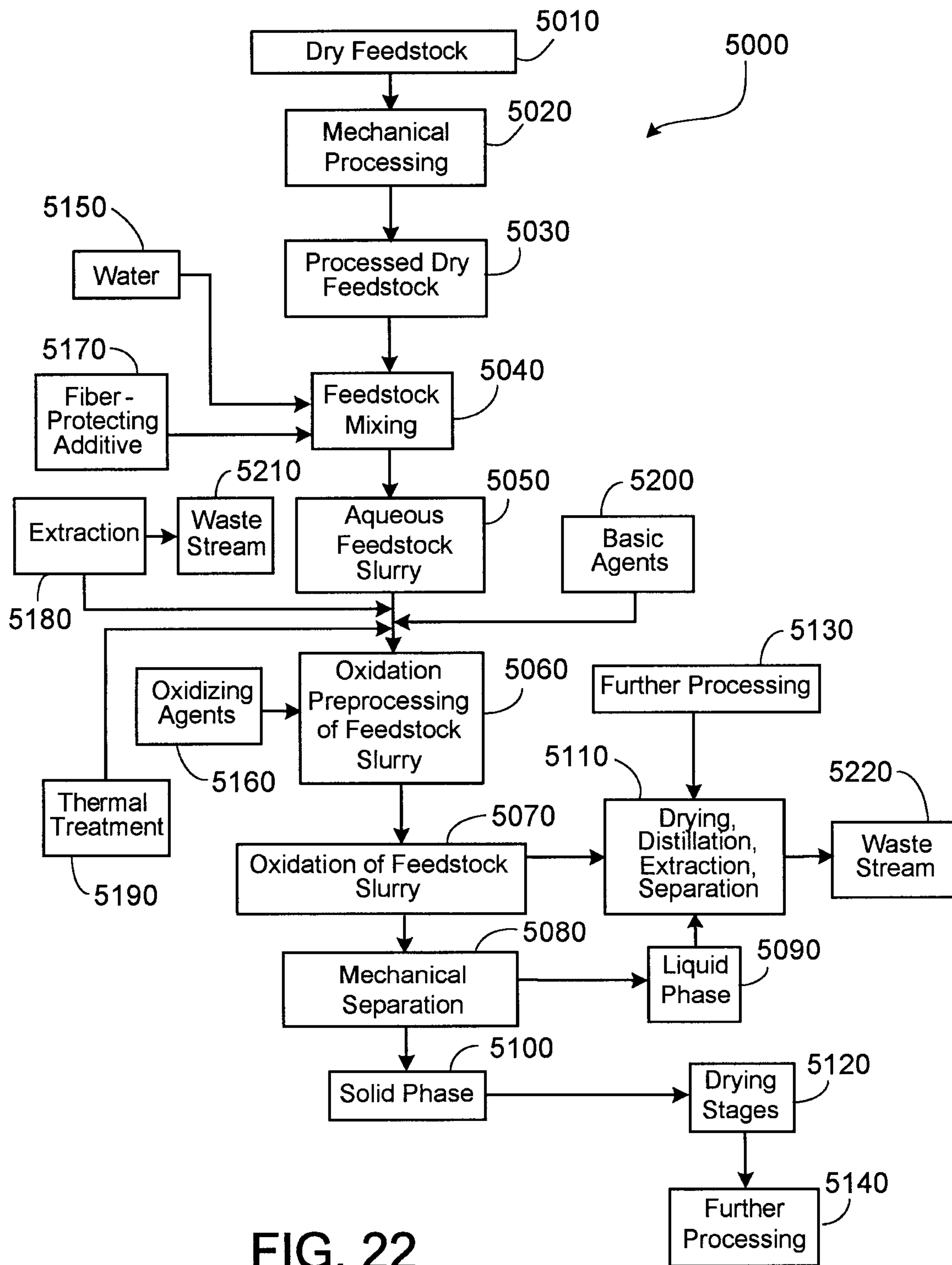


FIG. 22

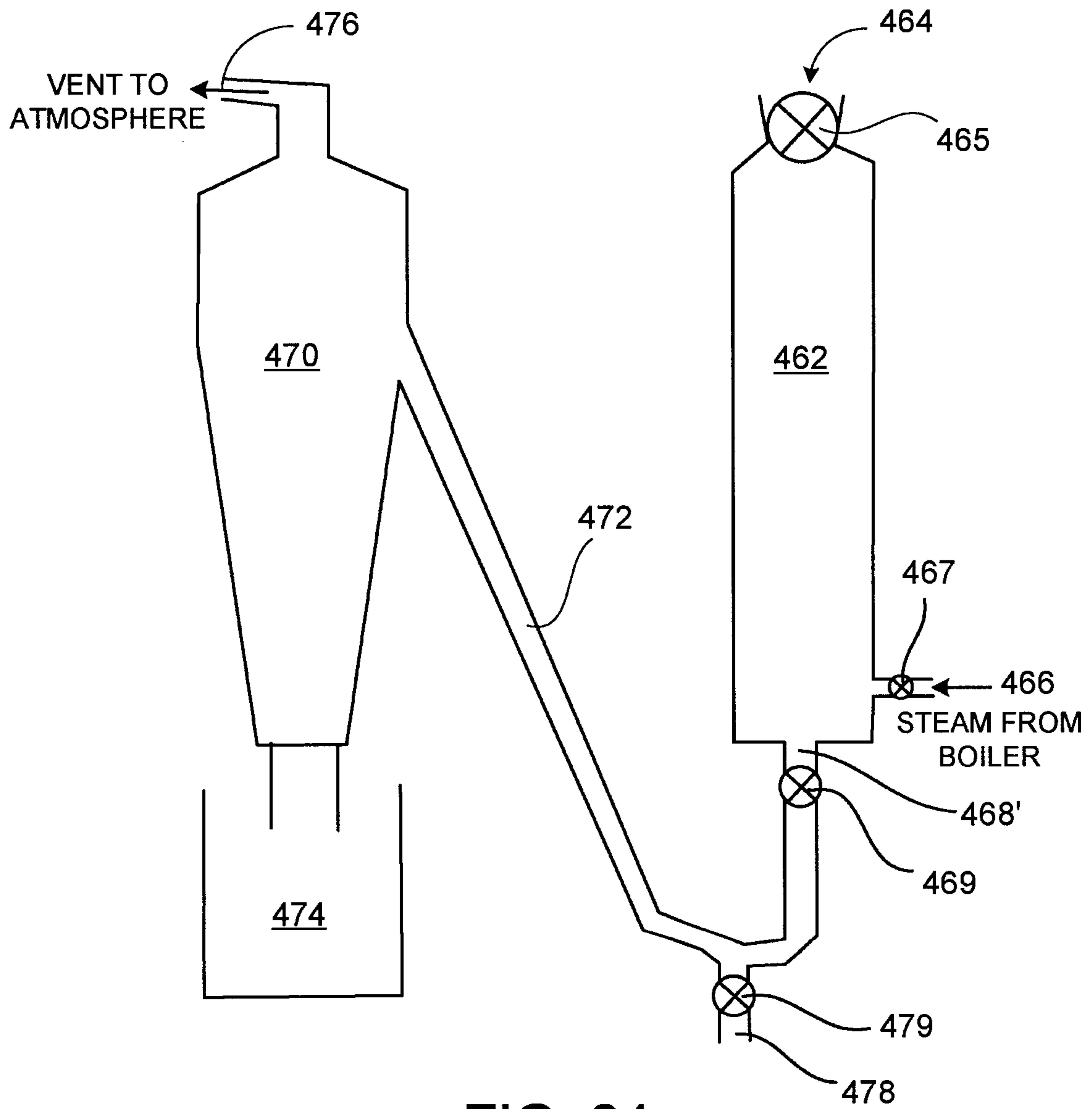


FIG. 24

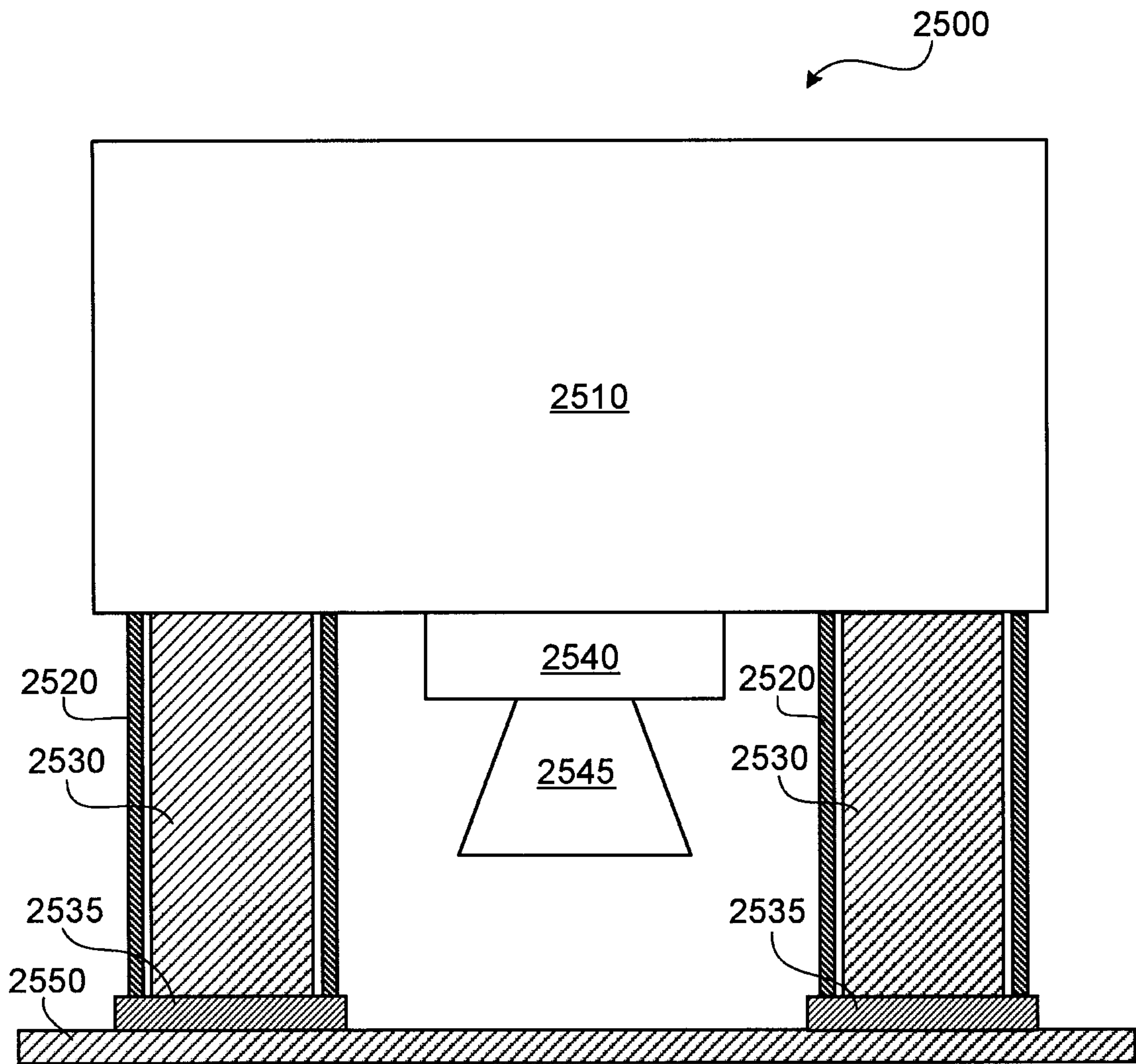


FIG. 25



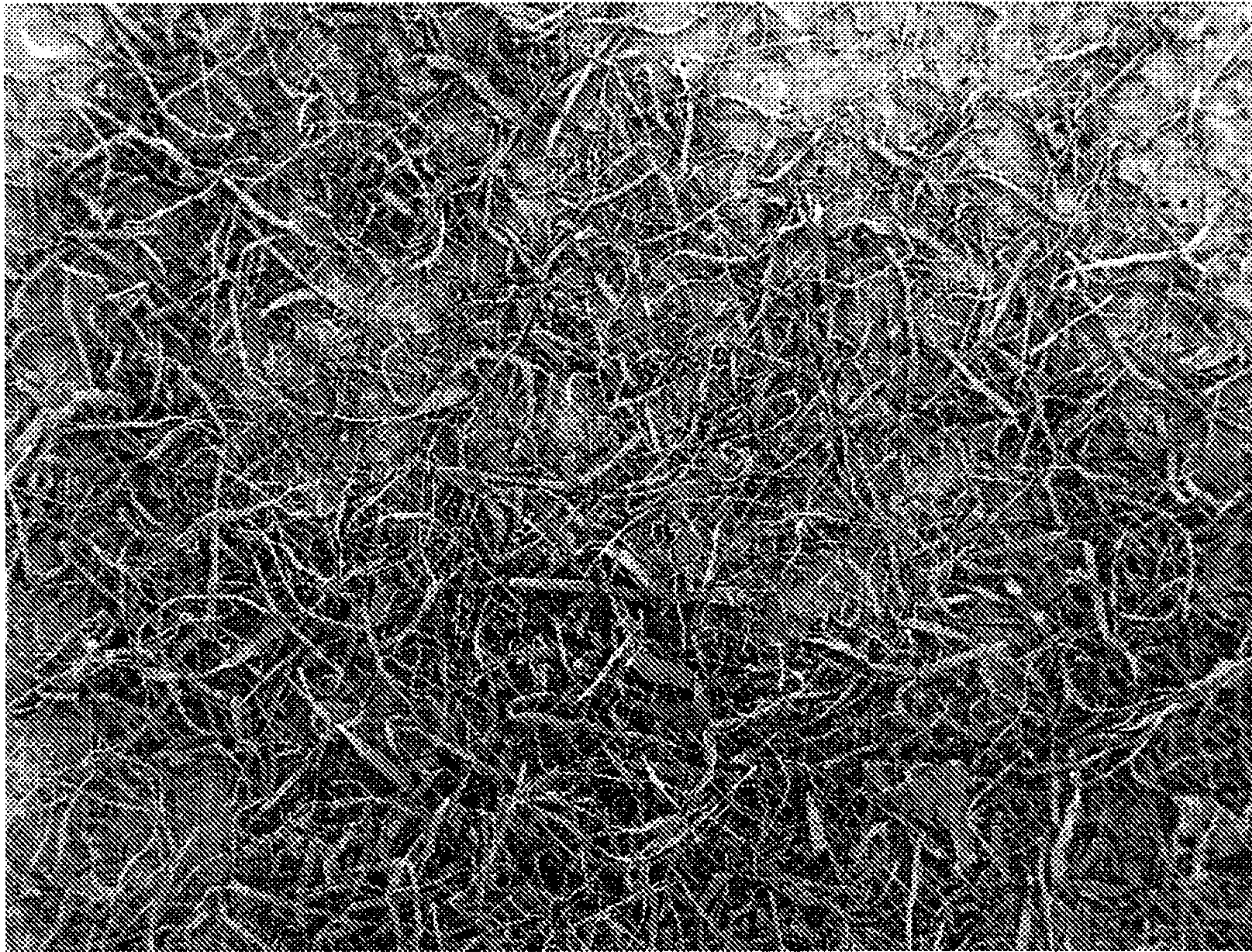
X25 1mm

FIG. 26



X25 1mm

FIG. 27



X25 1mm

FIG. 28



X25 1mm

FIG. 29

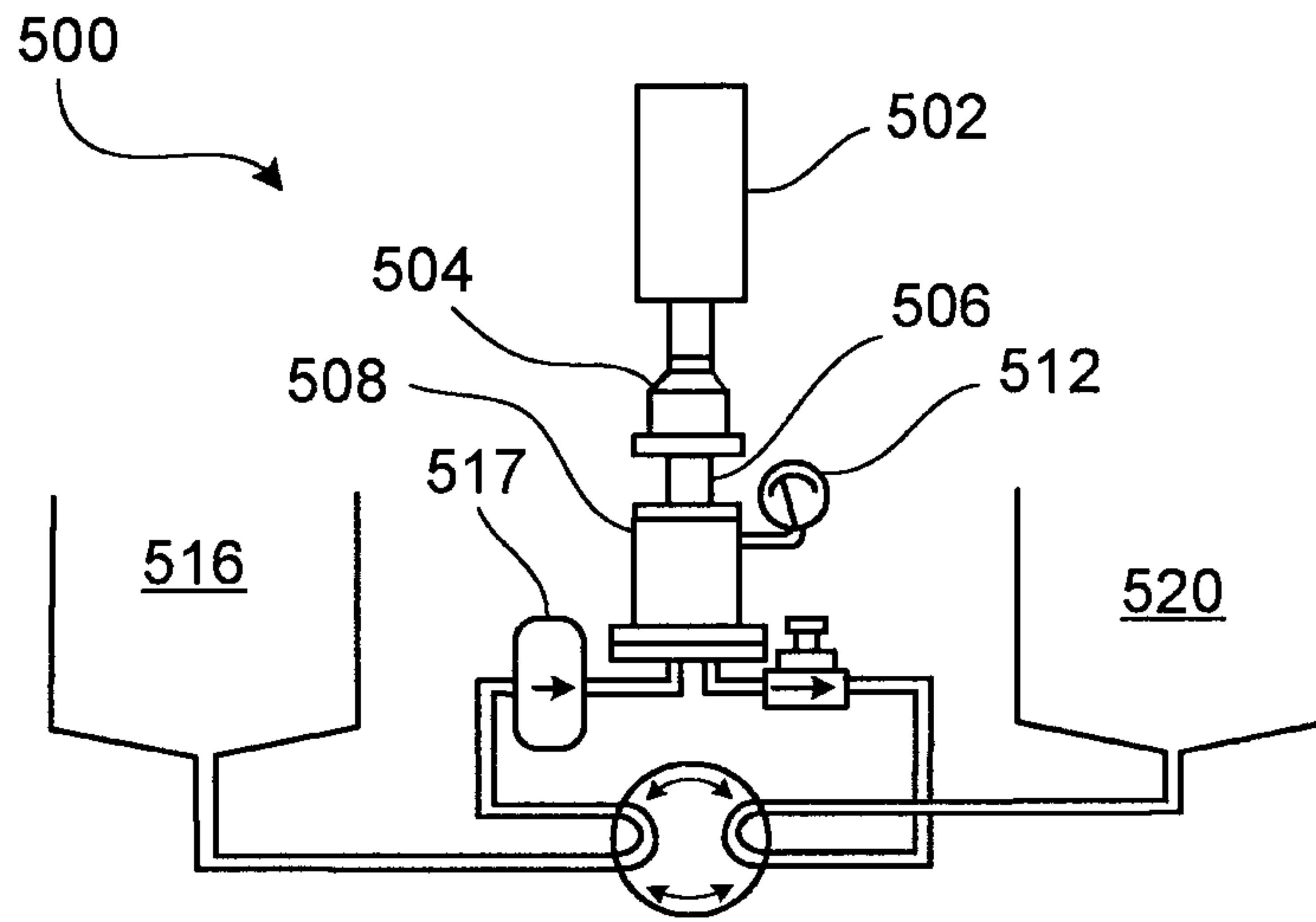


FIG. 30

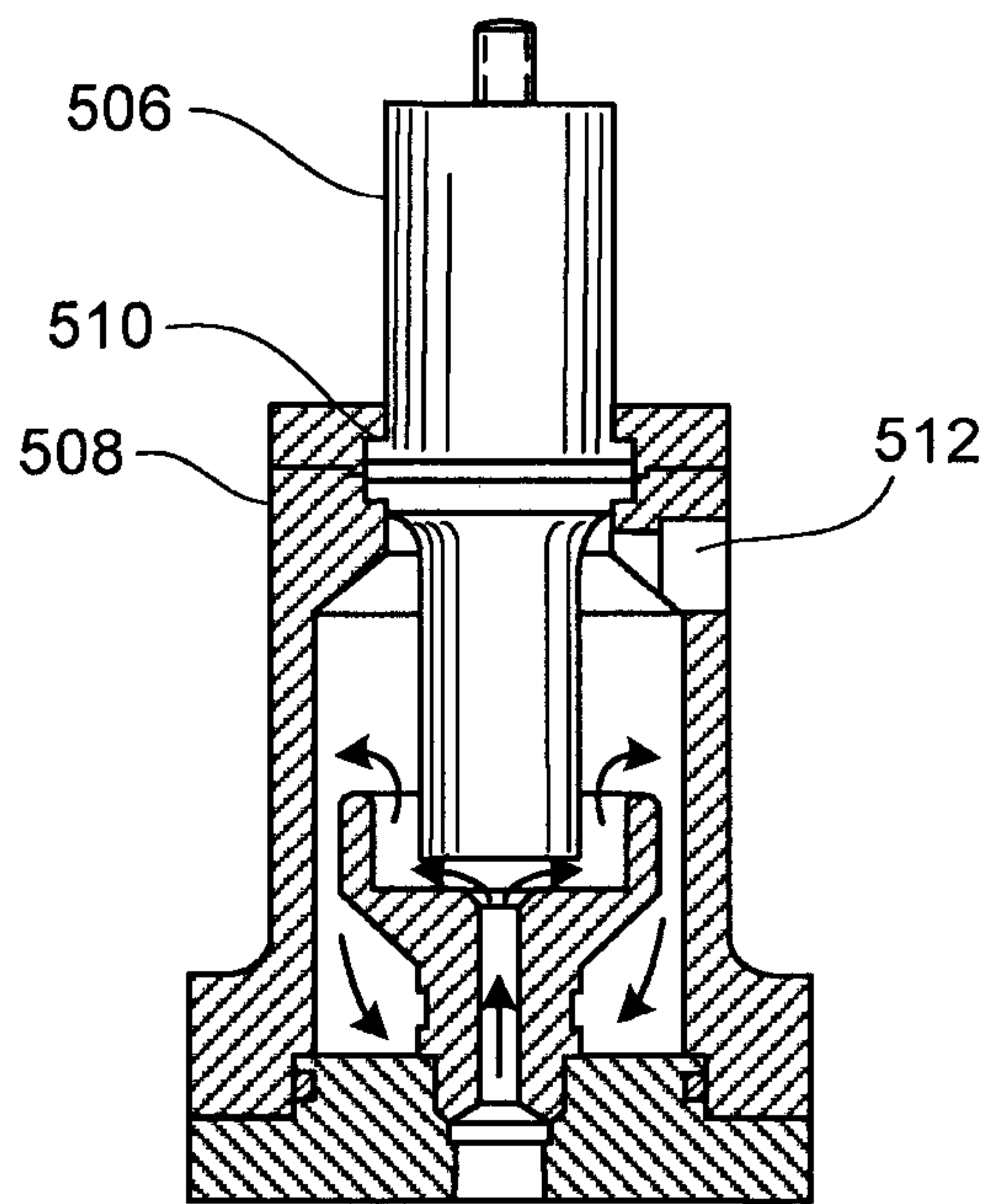


FIG. 31

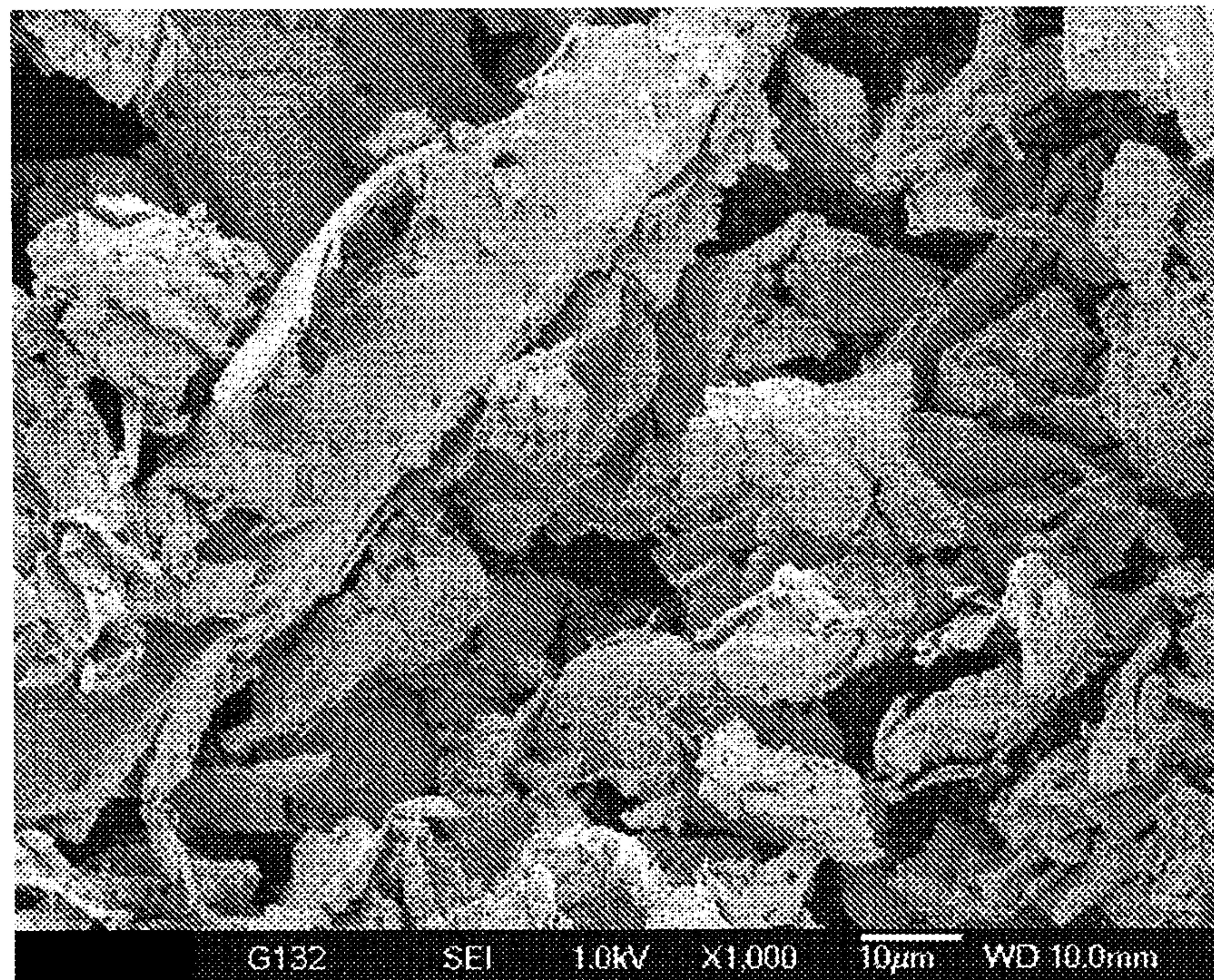


FIG. 32

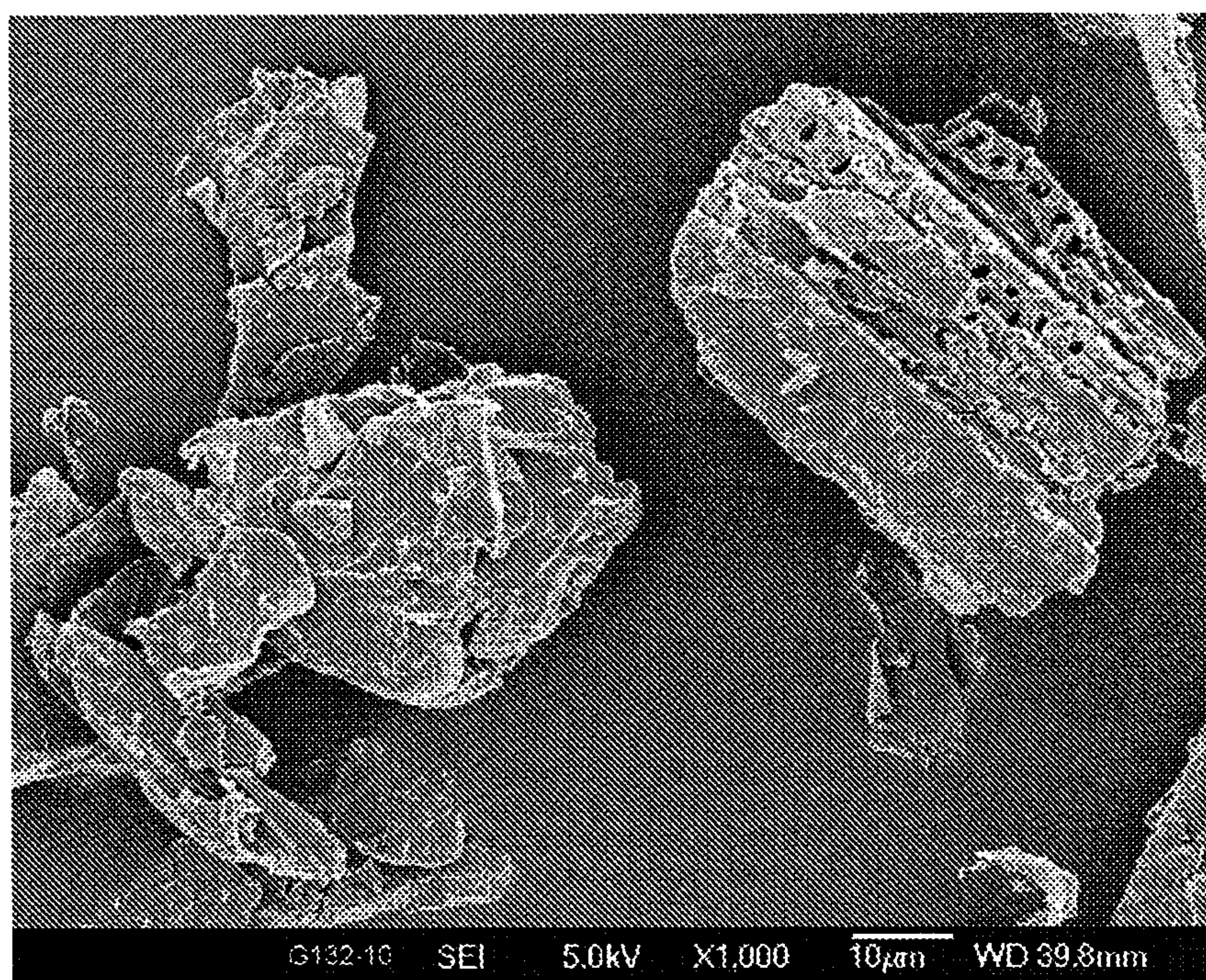


FIG. 33

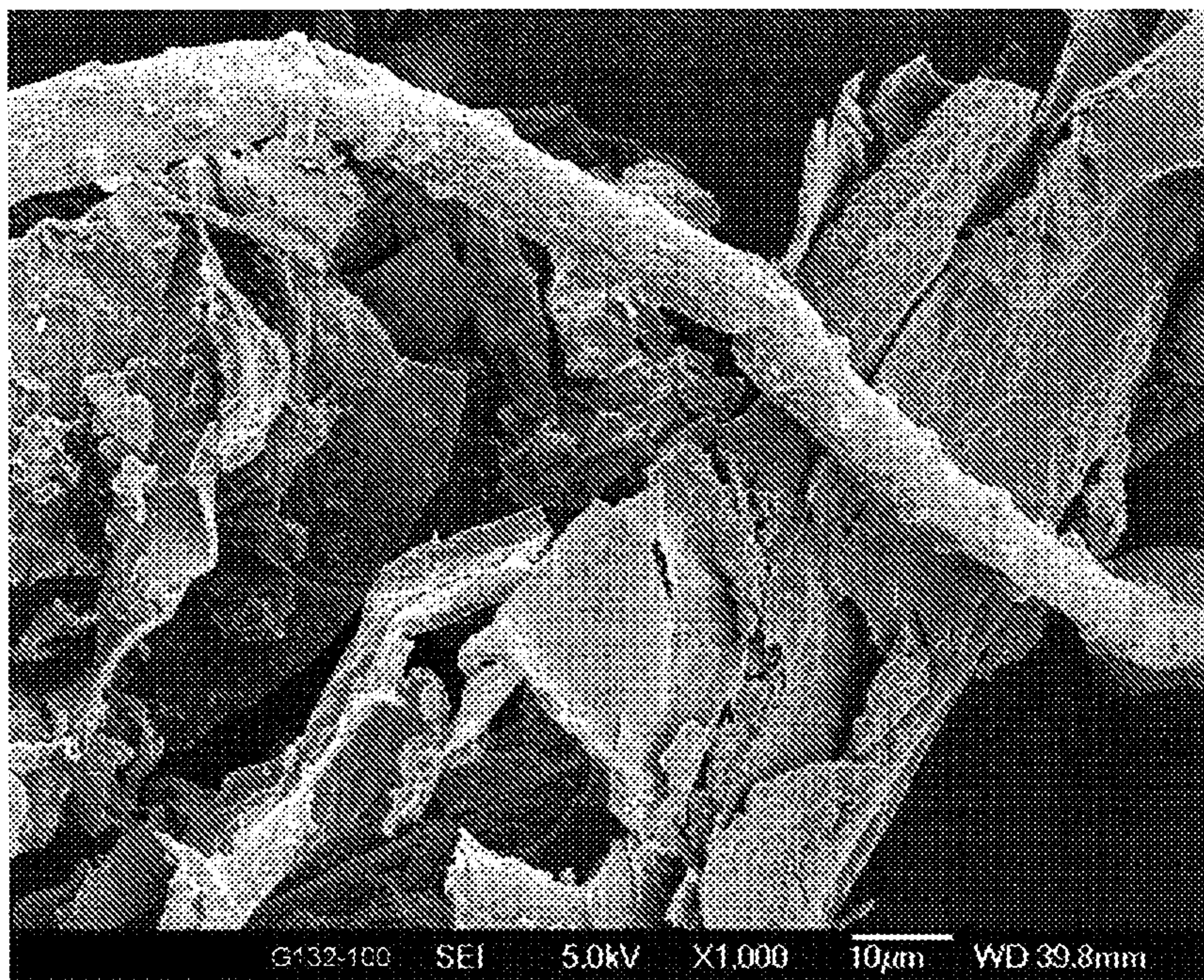


FIG. 34

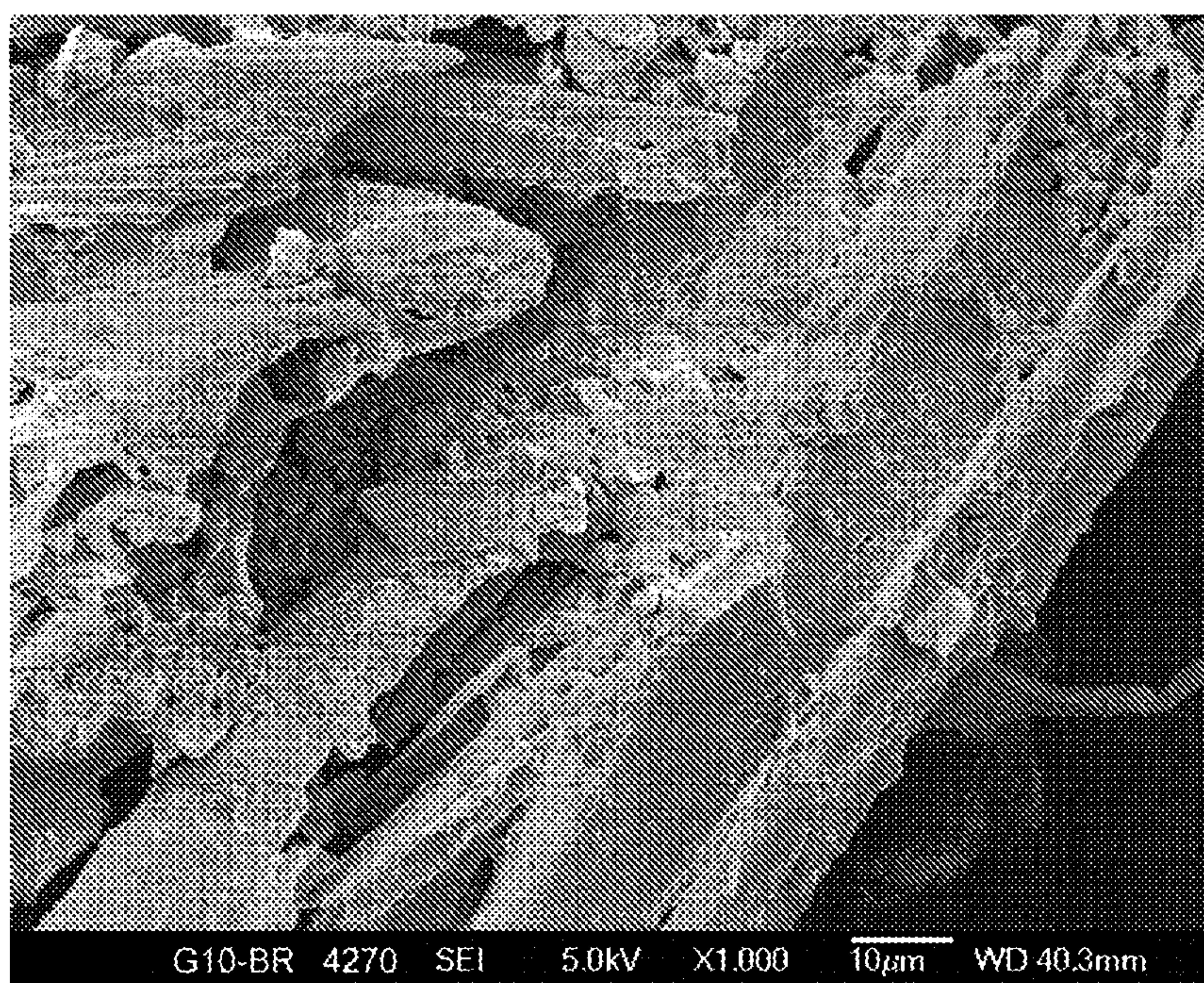


FIG. 35

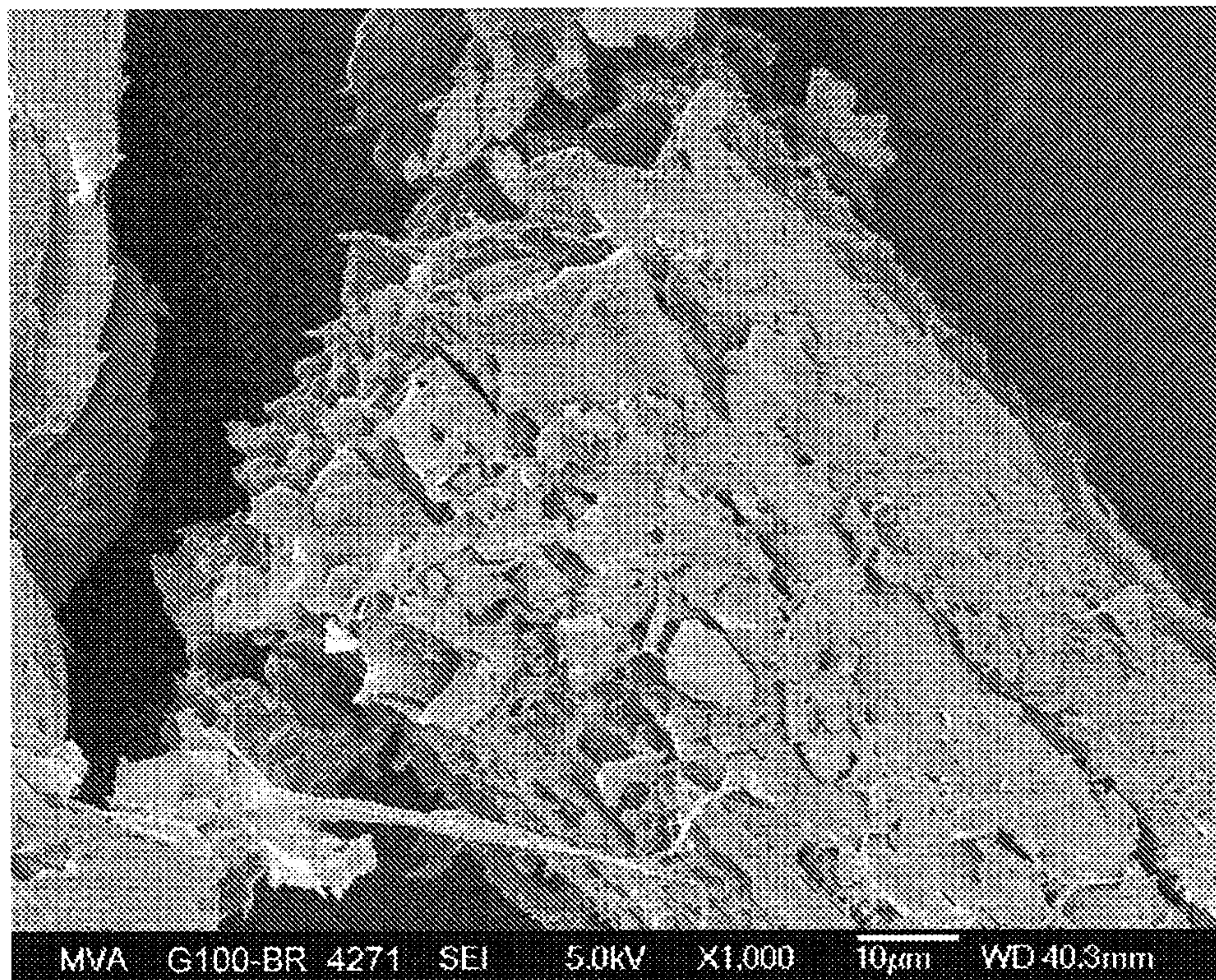


FIG. 36

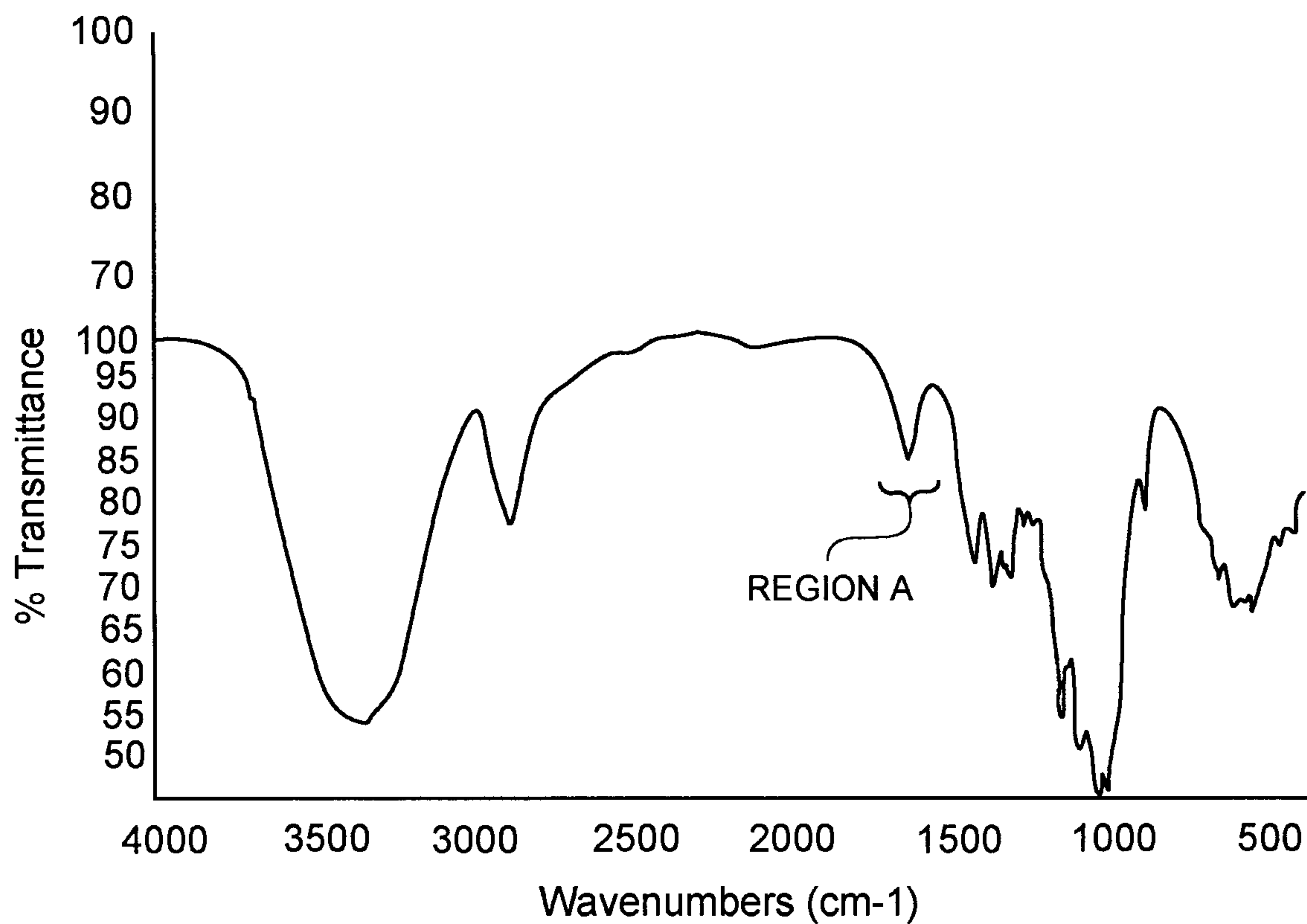


FIG. 37

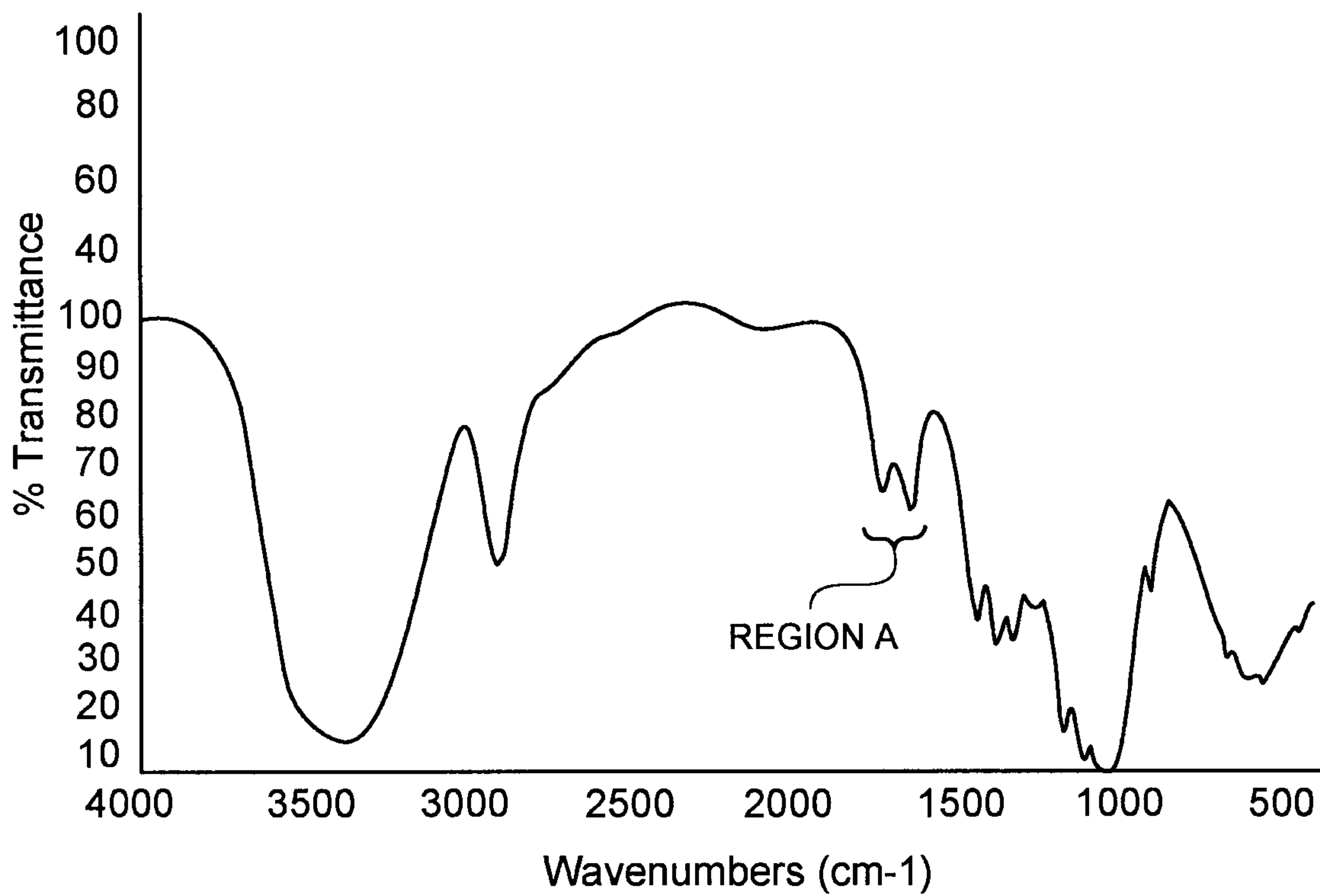


FIG. 38

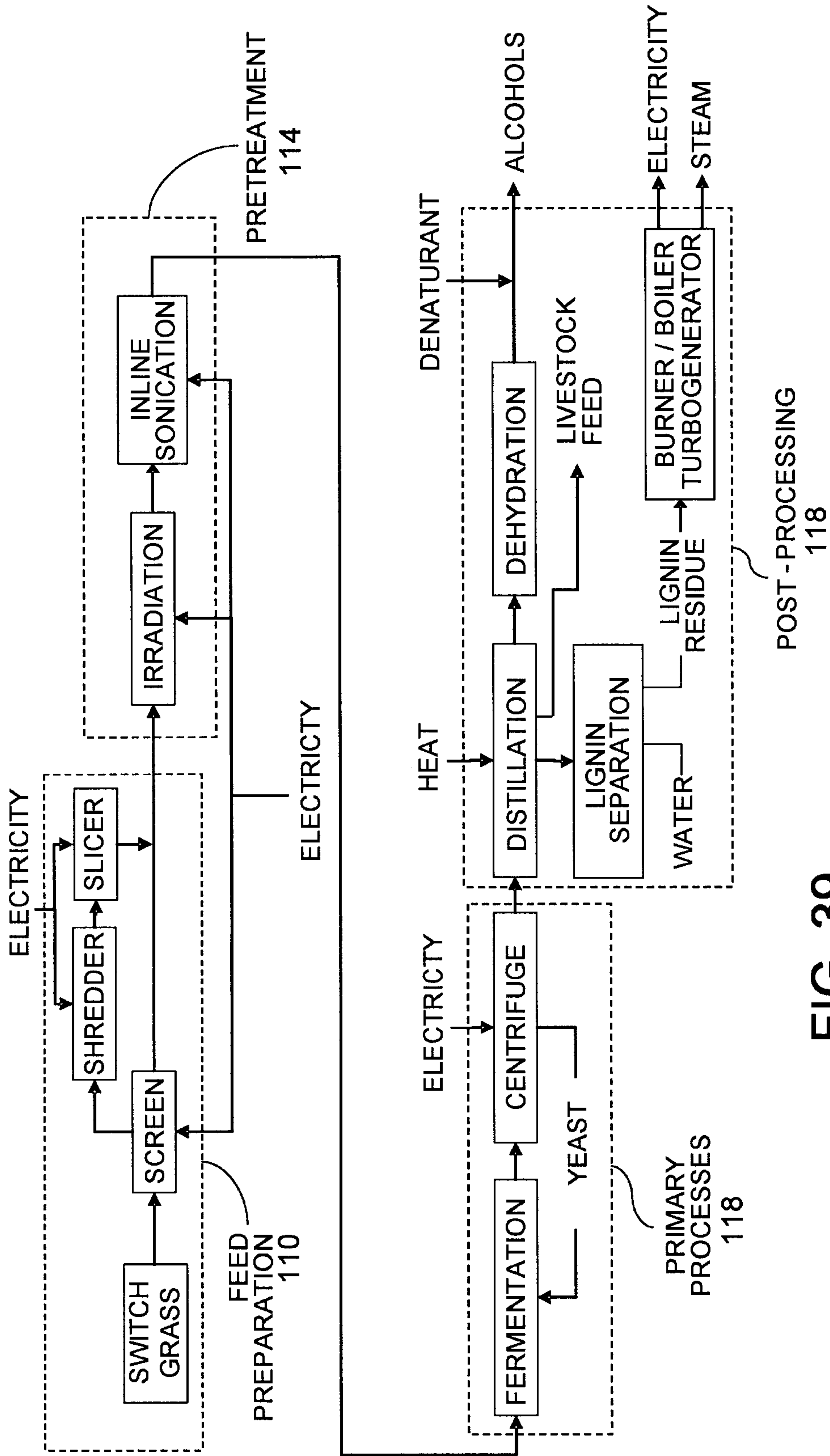
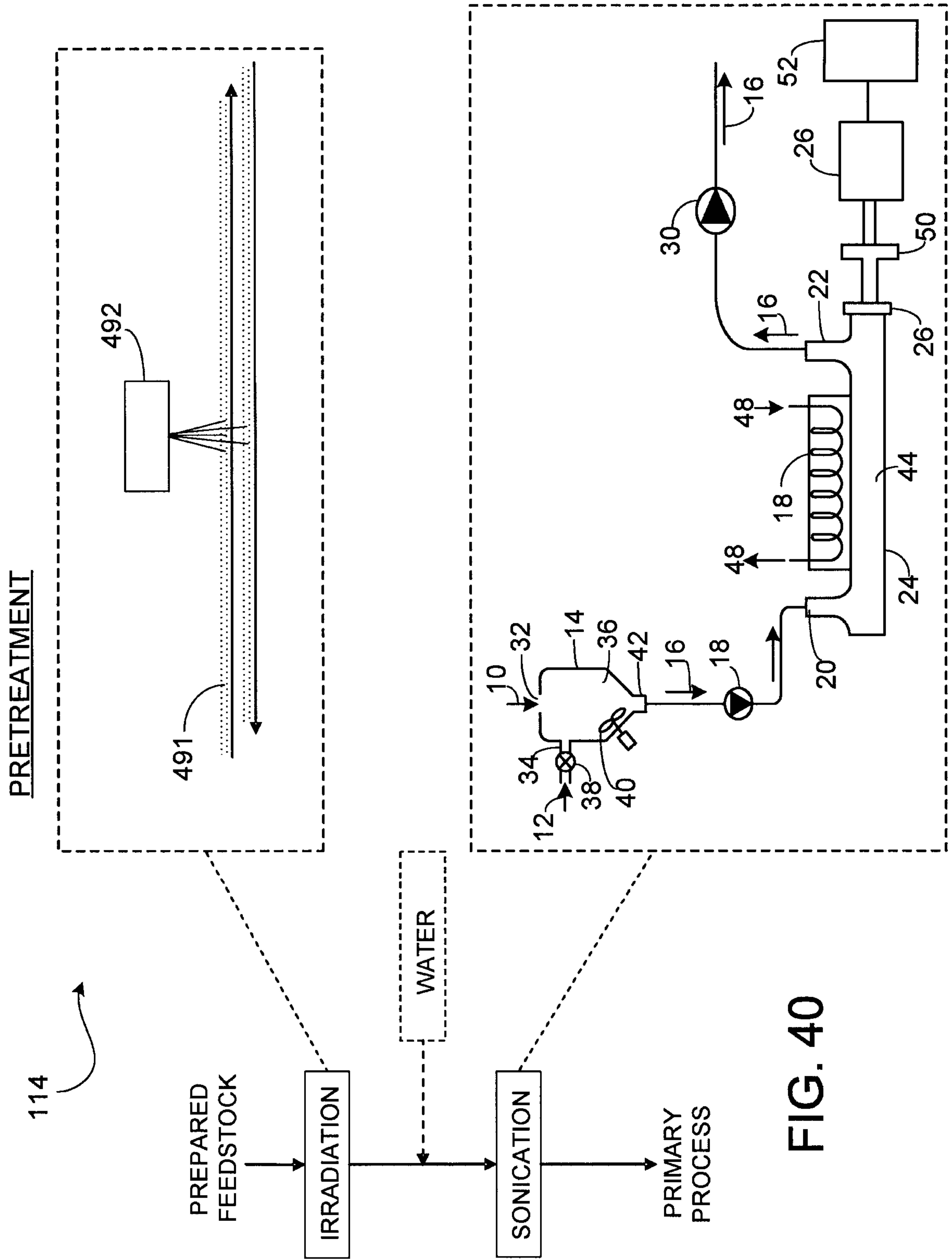


FIG. 39



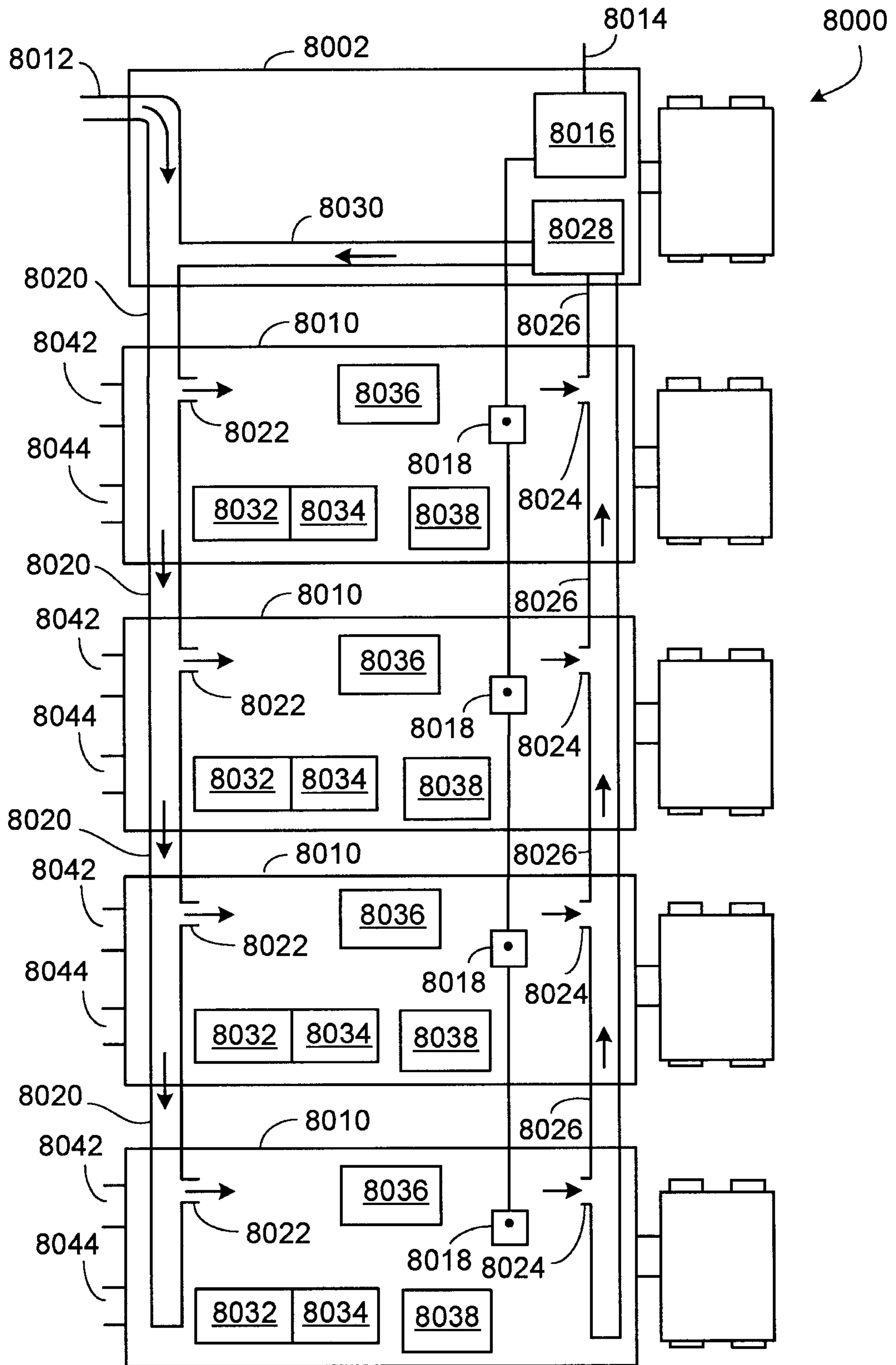
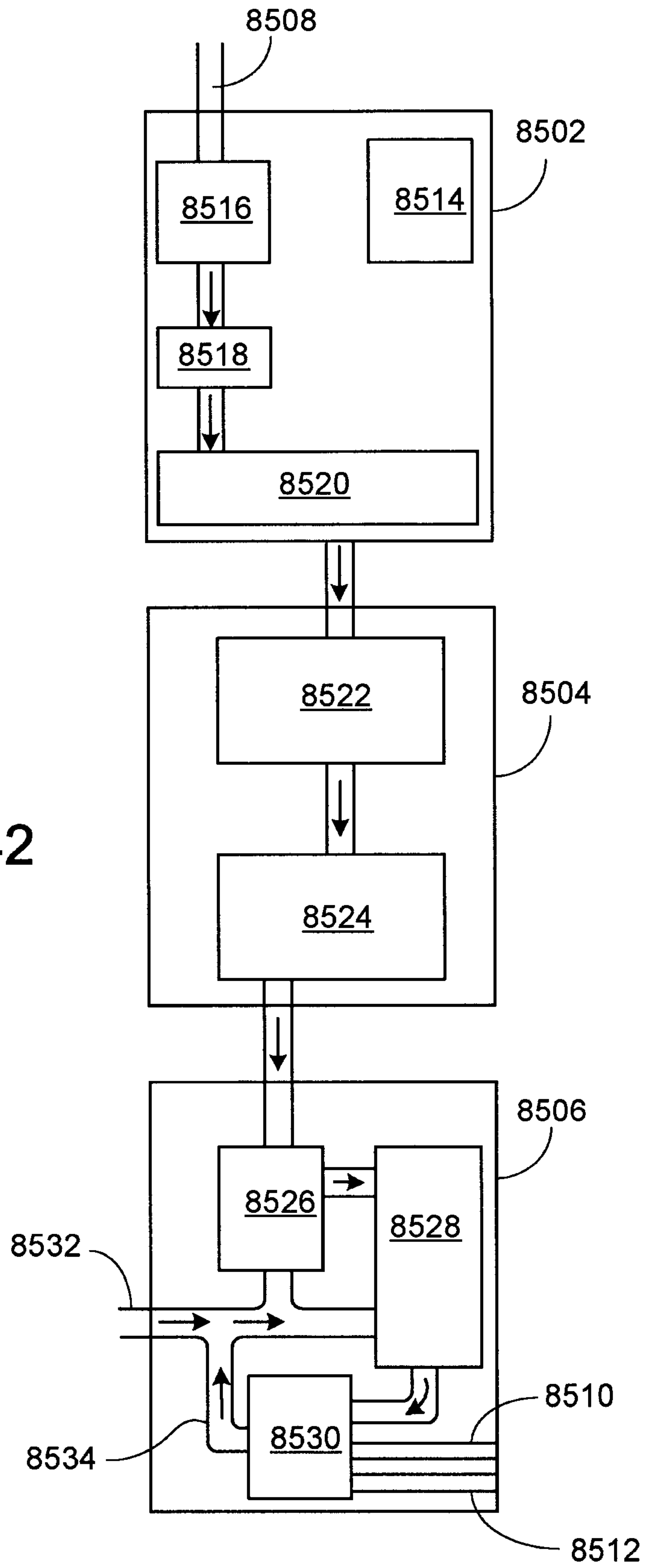


FIG. 41

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FIG. 42



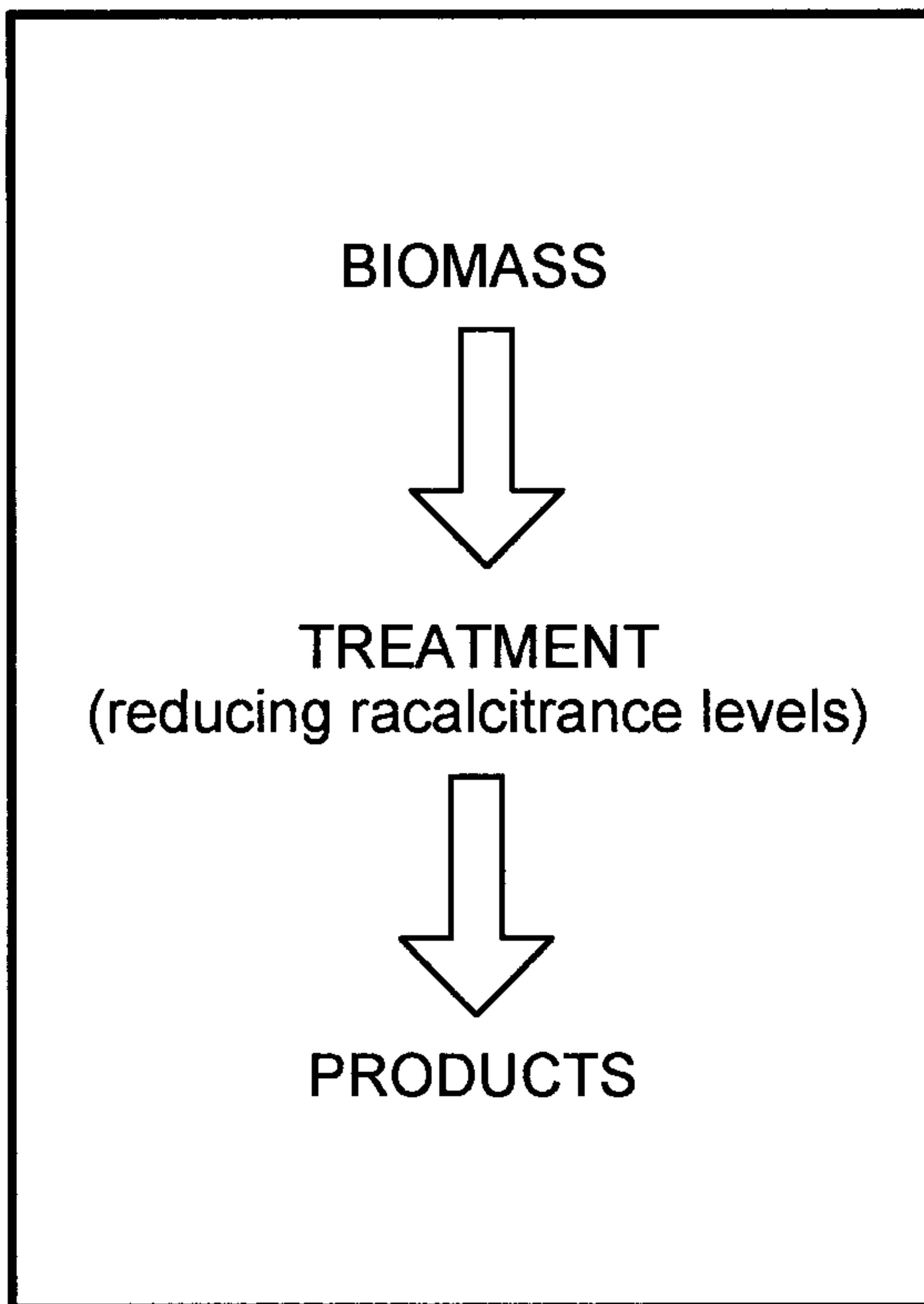


FIG. 43A

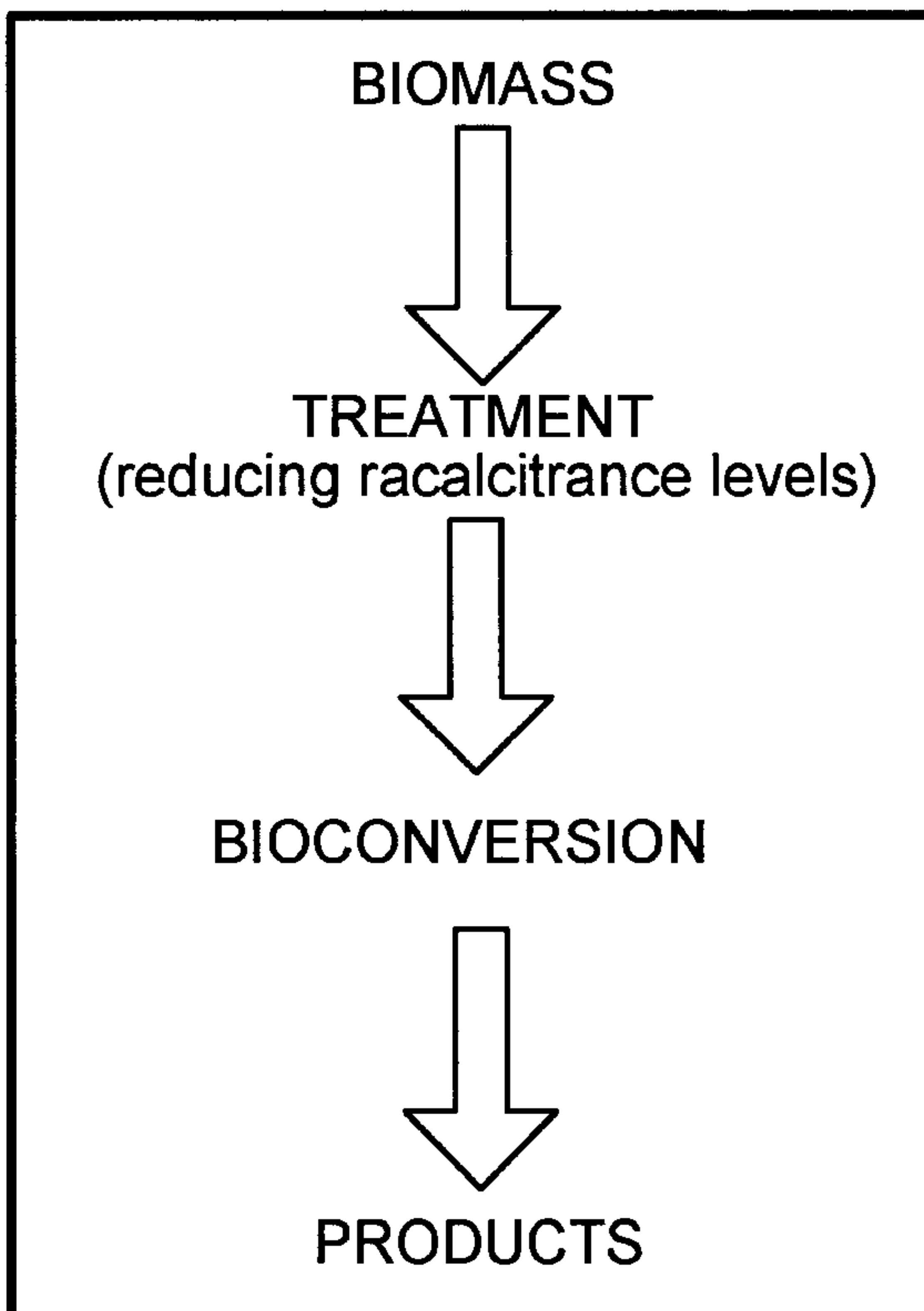


FIG. 43B

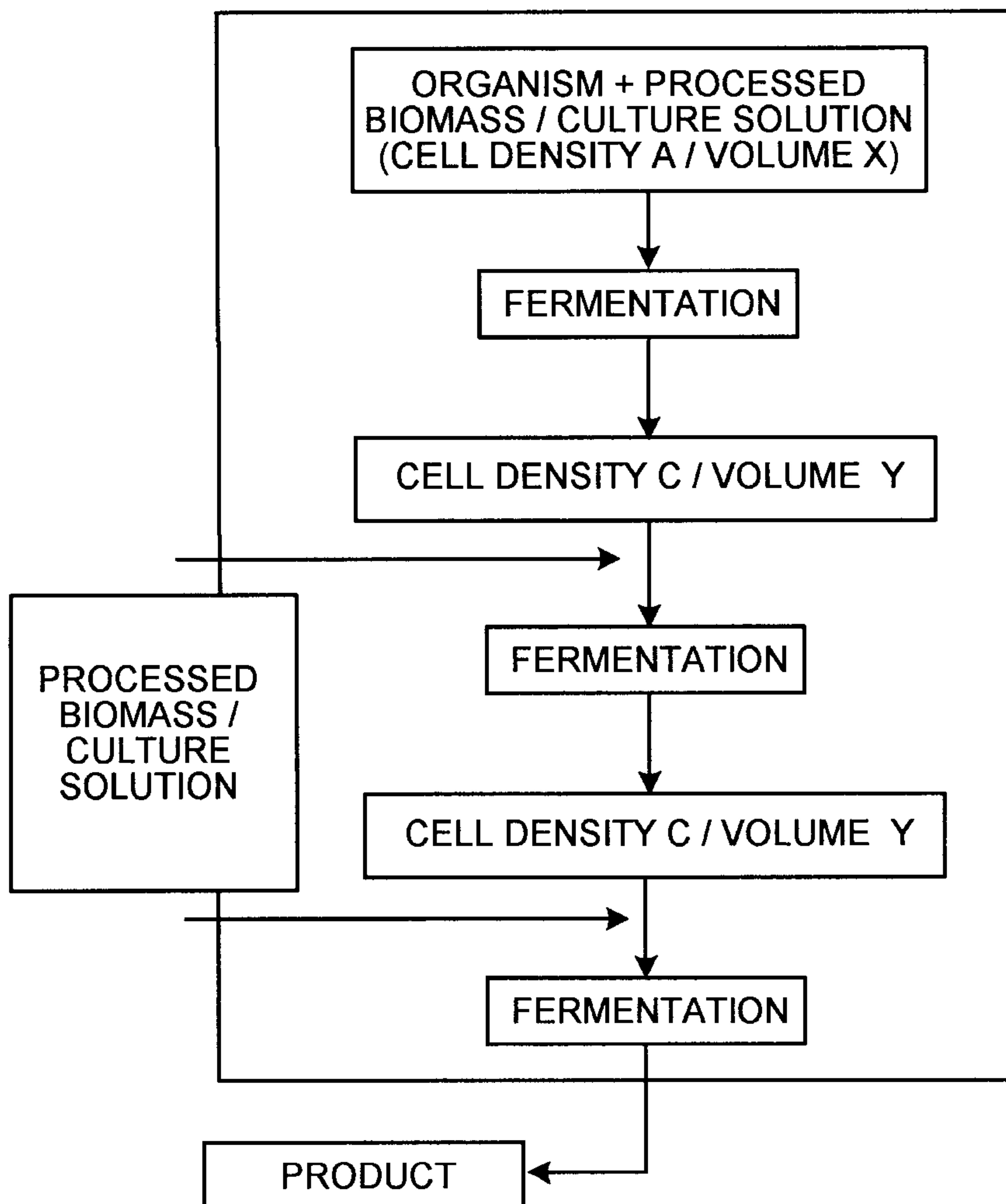


FIG. 44

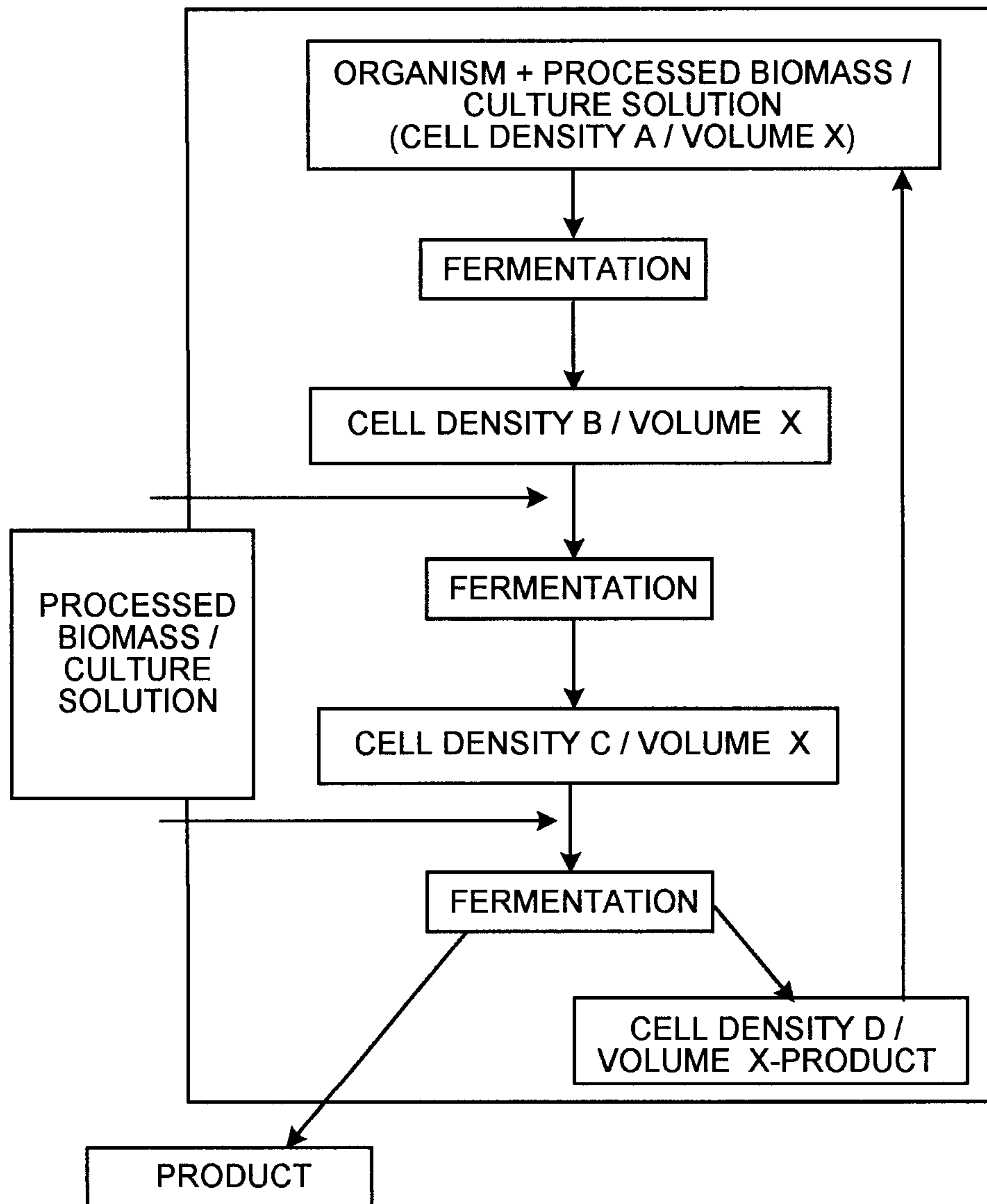


FIG. 45

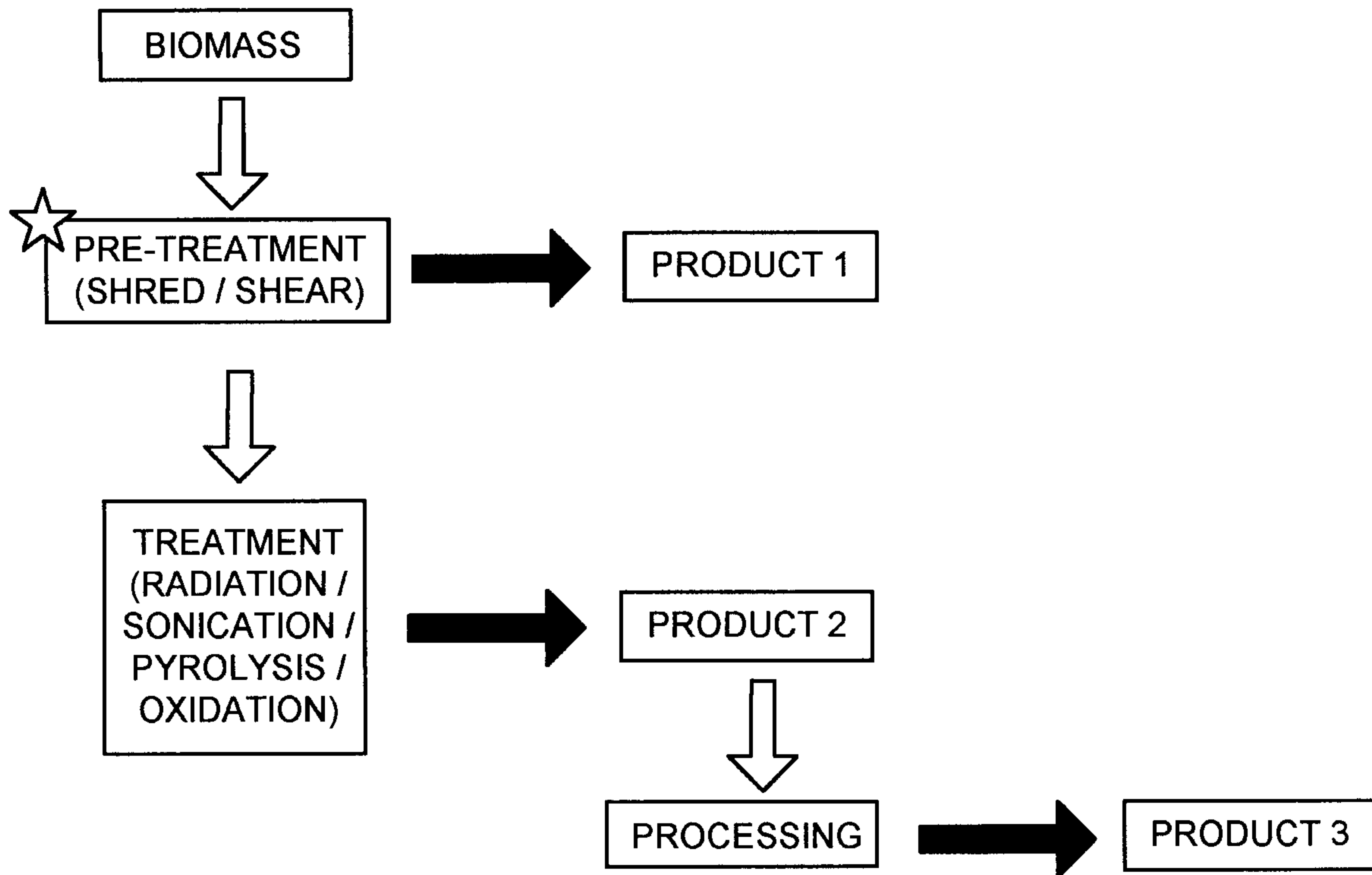


FIG. 46

