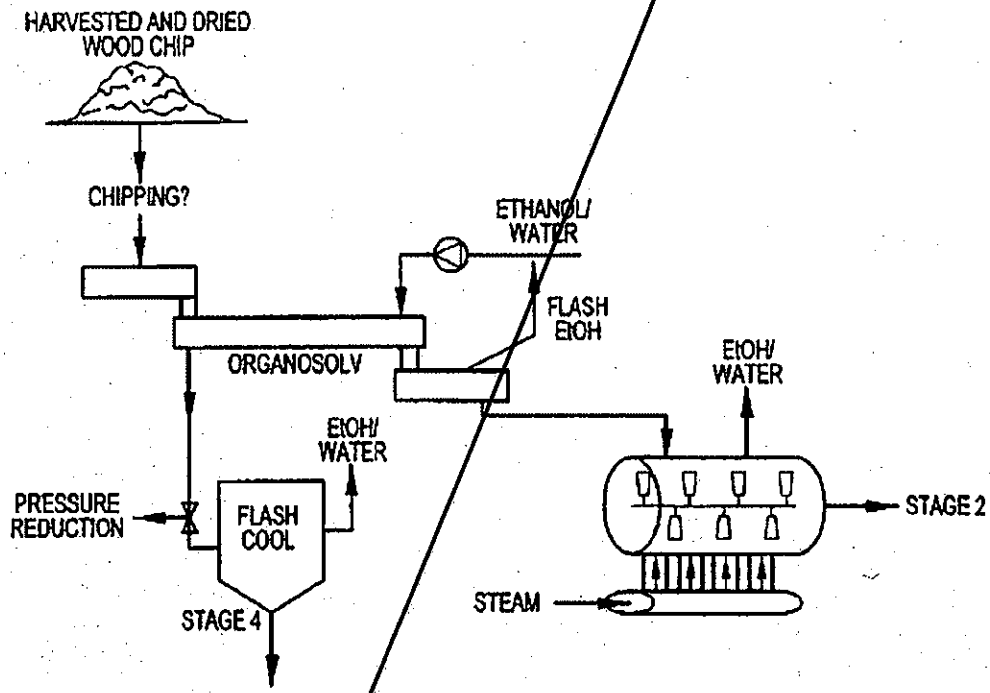

HARVESTED AND DRIED WOOD CHIP
CHIPPING?
ETHANOL/ WATER
FLASH EtOH
ORGANOSOLV
EtOH/ WATER
EtOH/ WATER
PRESSURE REDUCTION
FLASH COOL
STAGE 2
STEAM
STAGE 4

FIG. 1

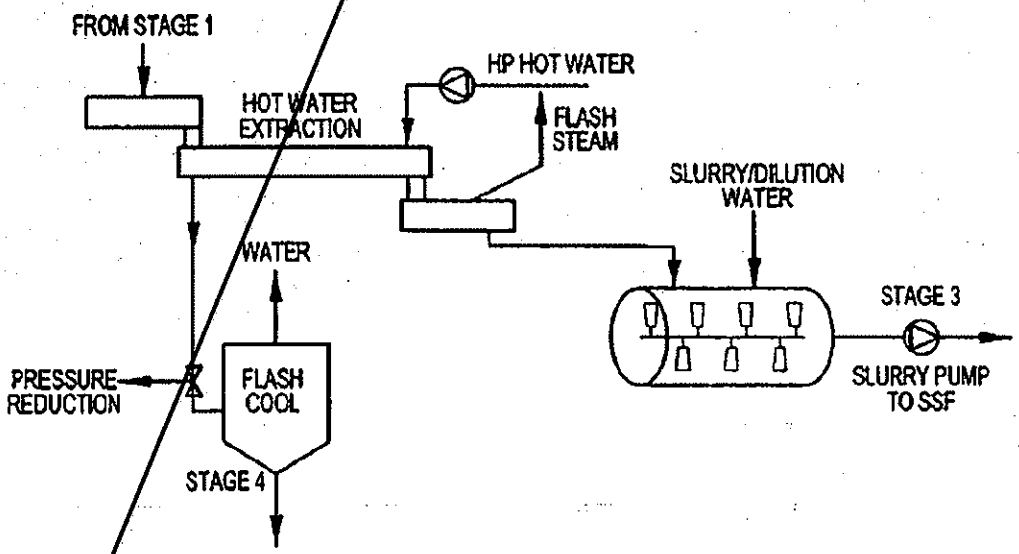

FROM STAGE 1
HP HOT WATER
HOT WATER EXTRACTION
FLASH STEAM
SLURRY/DILUTION WATER
WATER
STAGE 3
PRESSURE REDUCTION
FLASH COOL
SLURRY PUMP TO SSF
STAGE 4

FIG. 2

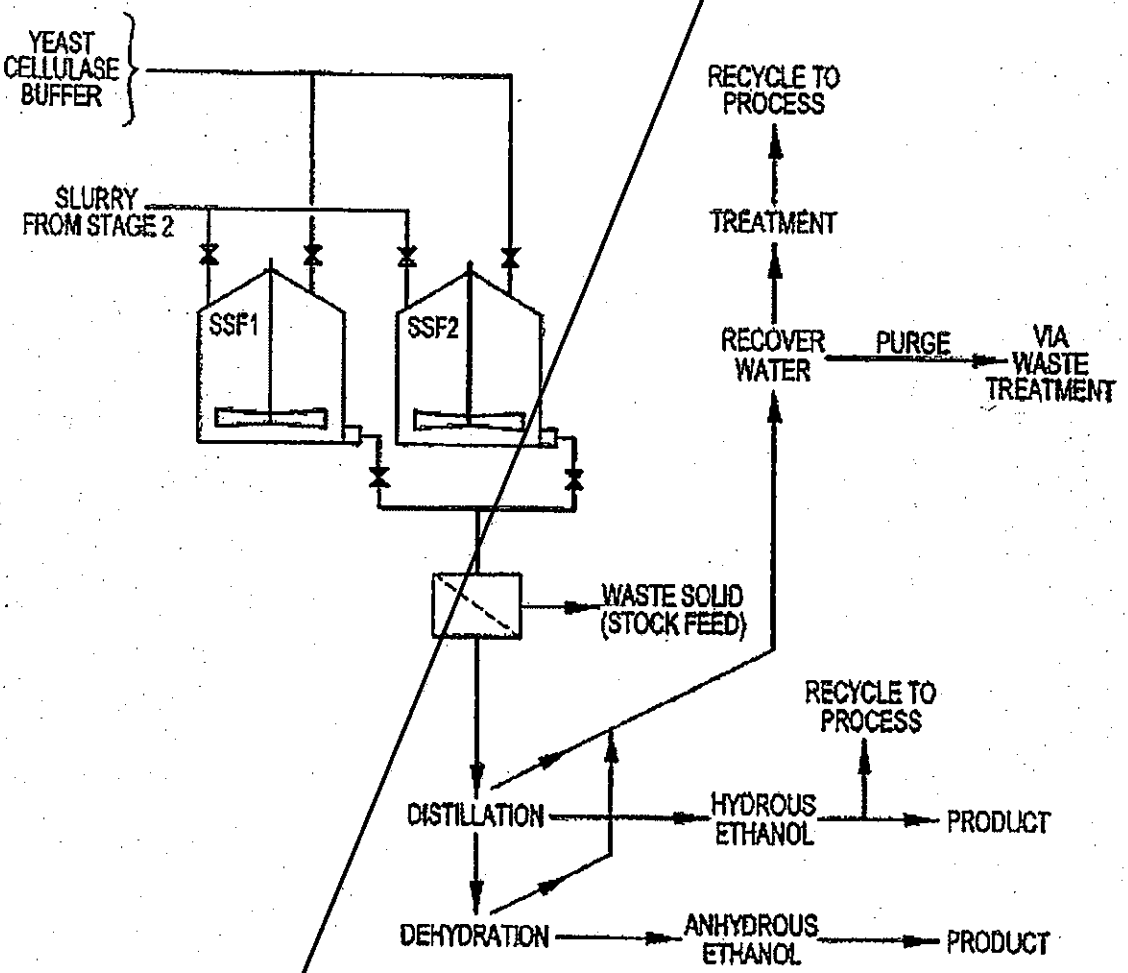

YEAST
CELLULASE
BUFFER
SLURRY
FROM STAGE 2
SSF1
SSF2
RECYCLE TO
PROCESS
TREATMENT
RECOVER
WATER
PURGE
VIA
WASTE
TREATMENT
WASTE SOLID
(STOCK FEED)
RECYCLE TO
PROCESS
DISTILLATION
HYDROUS
ETHANOL
PRODUCT
DEHYDRATION
ANHYDROUS
ETHANOL
PRODUCT

FIG. 3

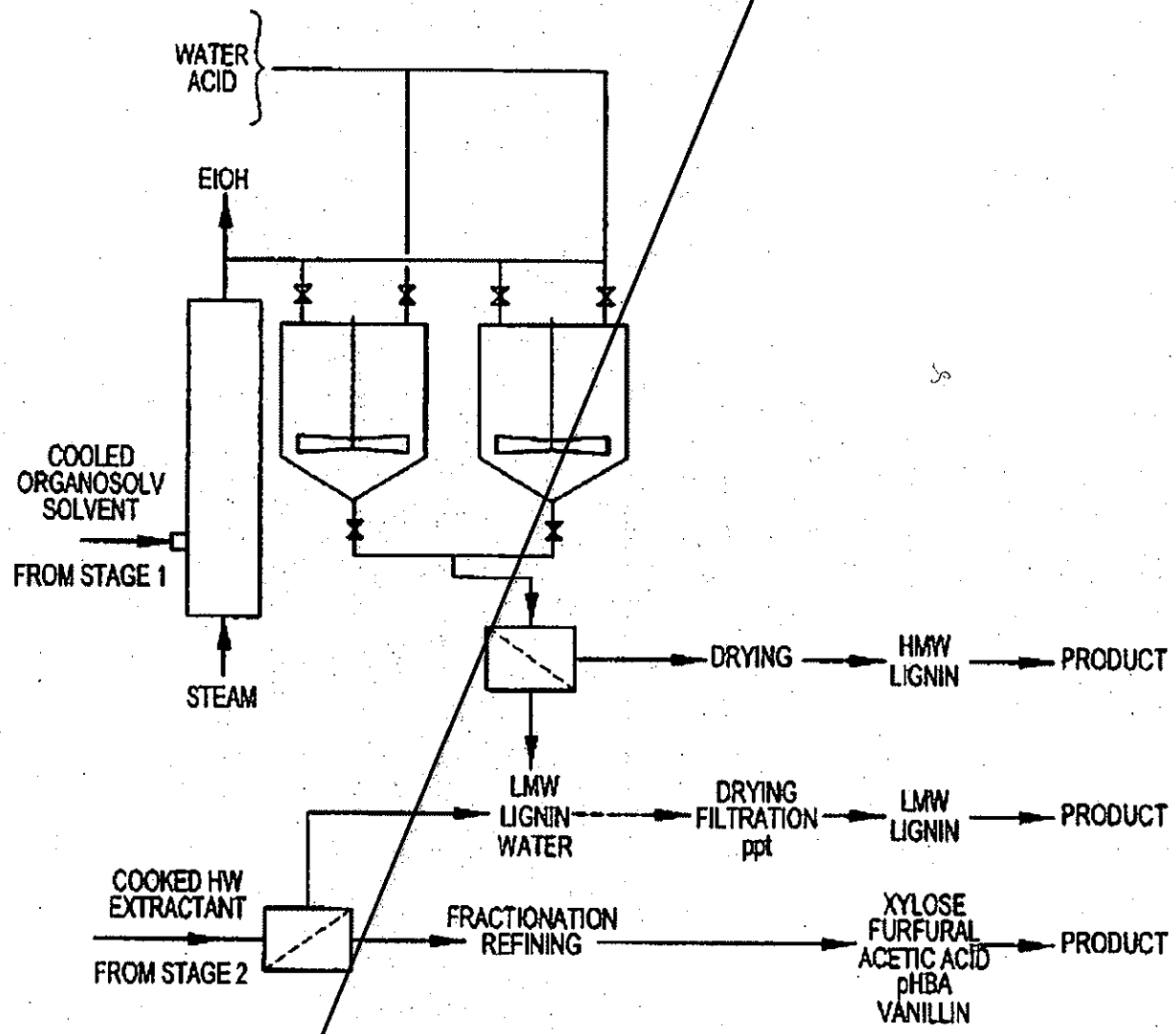

WATER
ACID
EtOH
COOLED
ORGANOSOLV
SOLVENT
FROM STAGE 1
STEAM
DRYING
HMW
LIGNIN
PRODUCT
LMW
LIGNIN
WATER
DRYING
FILTRATION
ppt
LMW
LIGNIN
PRODUCT
COOKED HW
EXTRACTANT
FROM STAGE 2
FRACTIONATION
REFINING
XYLOSE
FURFURAL
ACETIC ACID
pHBA
VANILLIN
PRODUCT

FIG. 4

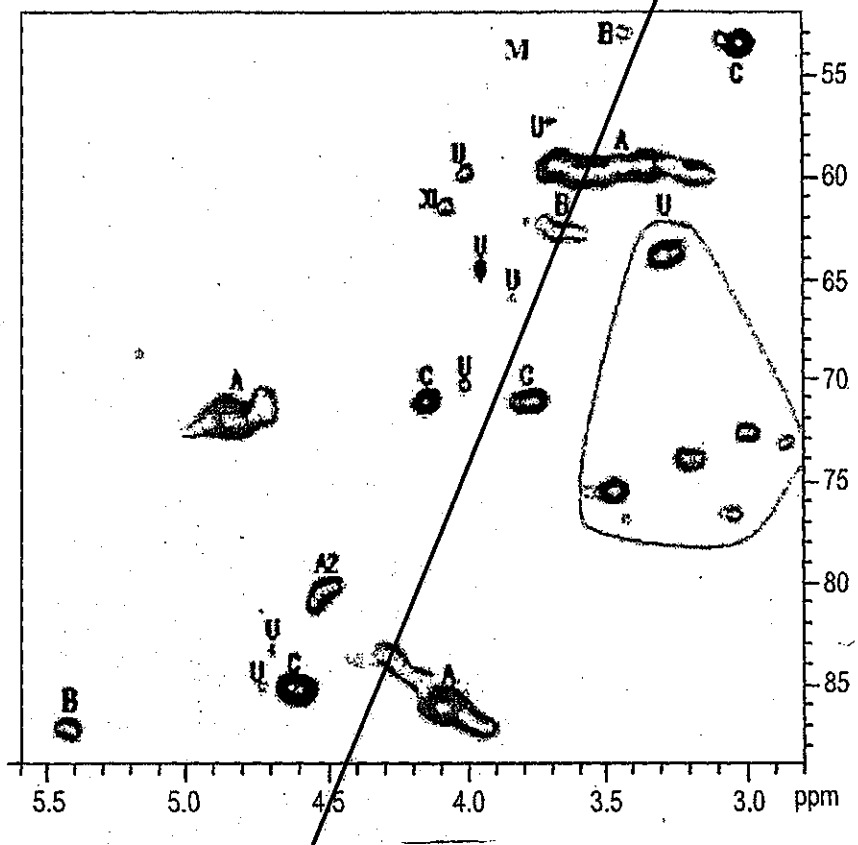


FIG. 5

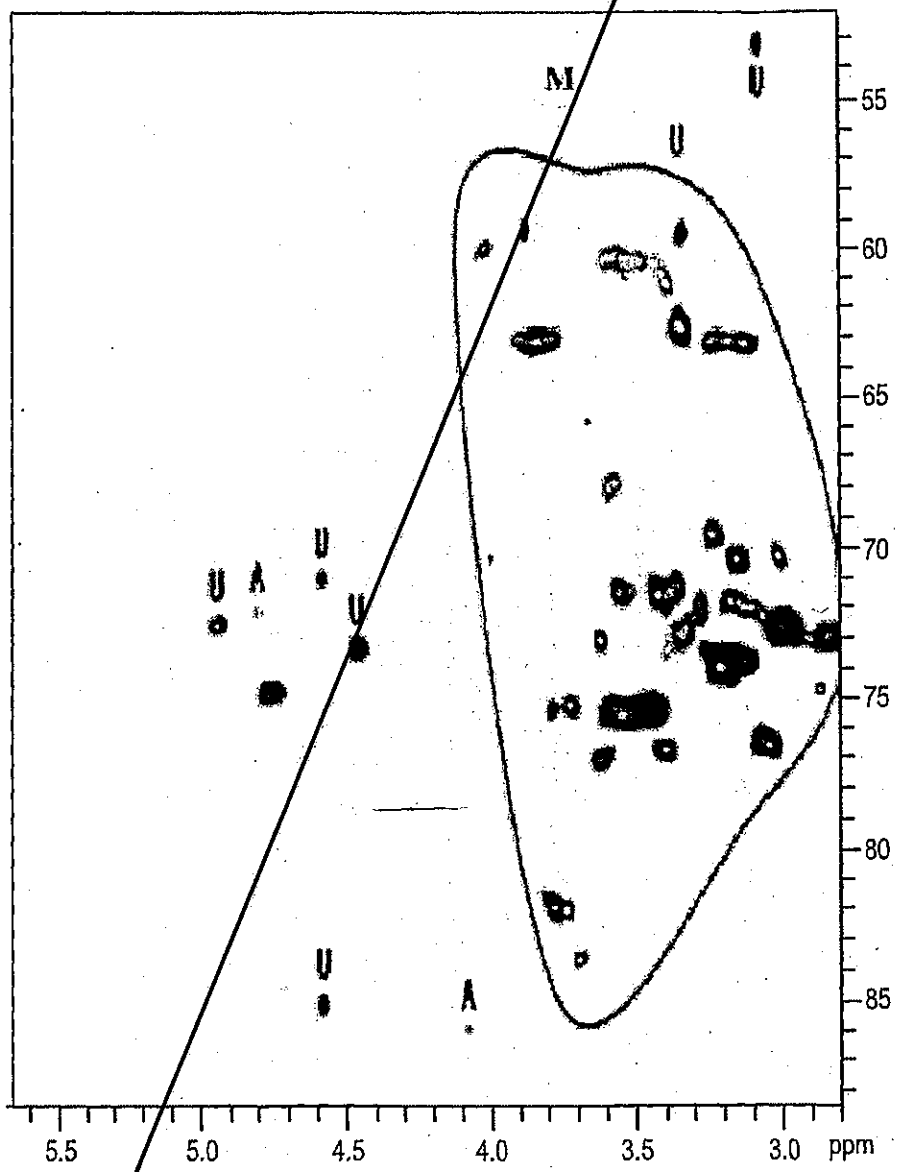


FIG. 6

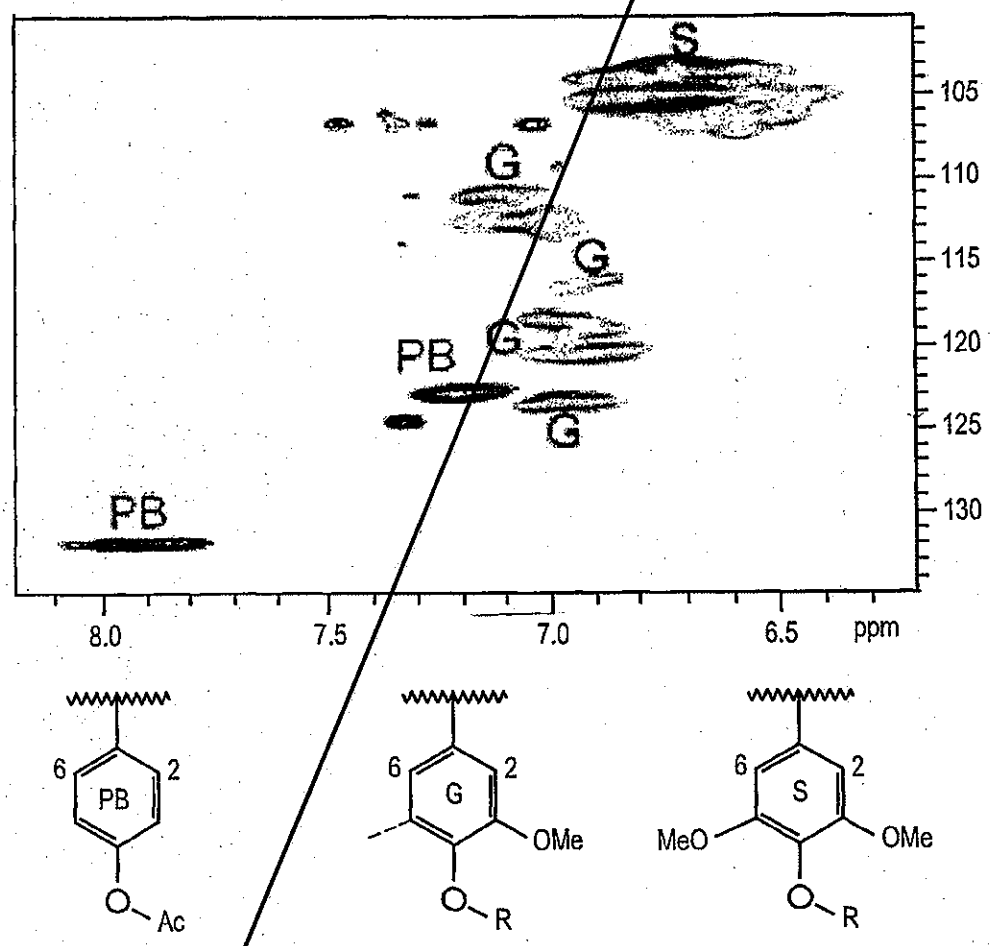

S
G
G
G
PB
G
PB
105
110
115
120
125
130
8.0
7.5
7.0
6.5
ppm
6
2
PB
O
Ac
6
2
G
OMe
O
R
6
2
S
MeO
OMe
O
R

FIG. 7

FIG. 8A

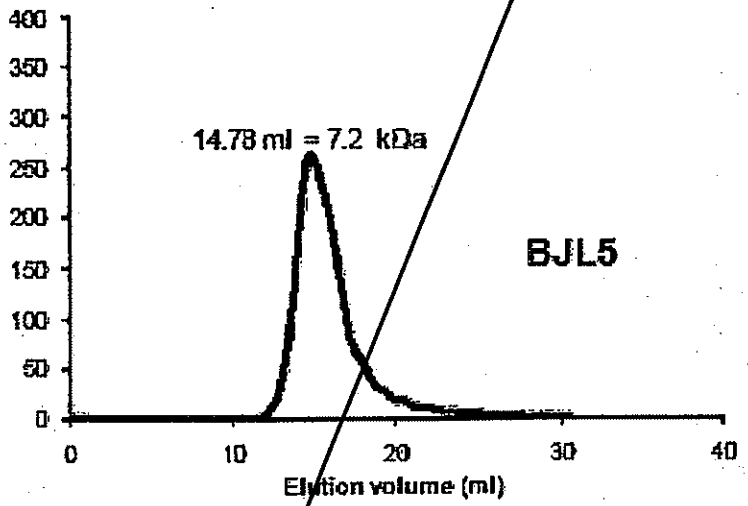


FIG. 8B

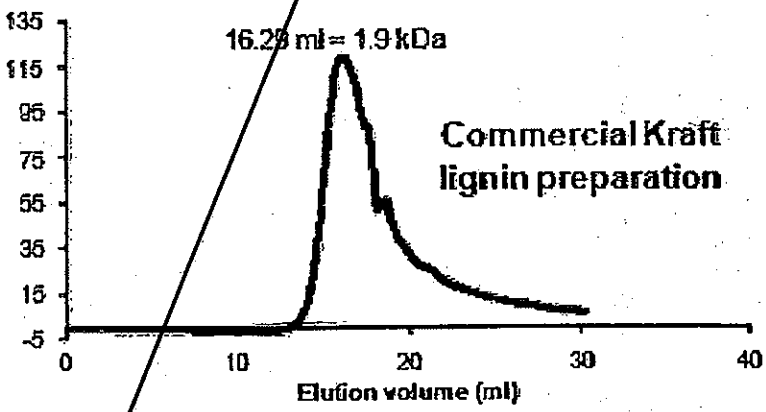
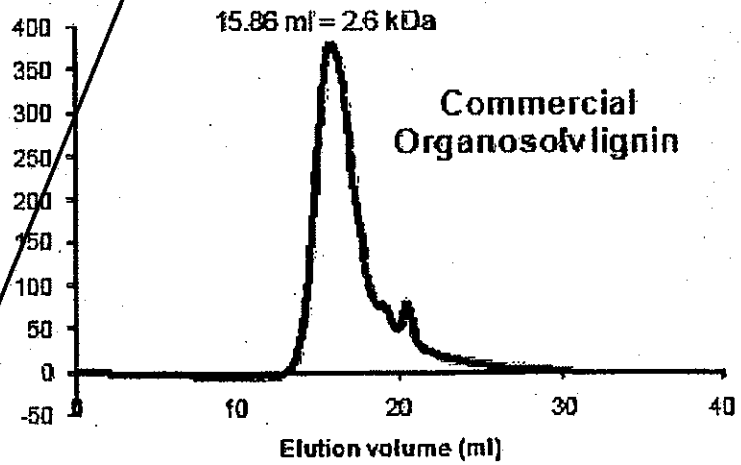


FIG. 8C



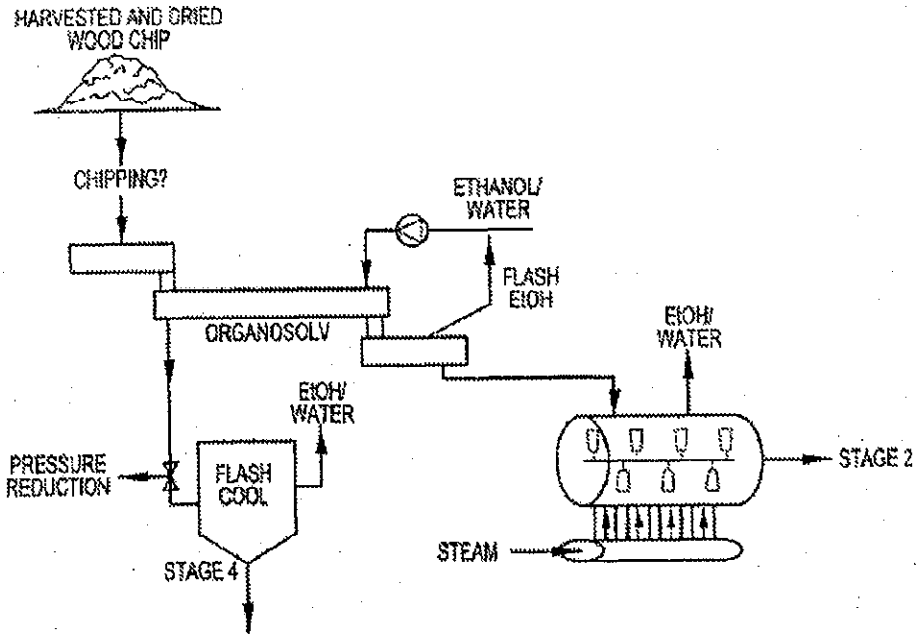

HARVESTED AND DRIED WOOD CHIP
CHIPPING?
ETHANOL/ WATER
FLASH EtOH
ORGANOSOLV
EtOH/ WATER
EtOH/ WATER
PRESSURE REDUCTION
FLASH COOL
STAGE 2
STEAM
STAGE 4

FIG. 1

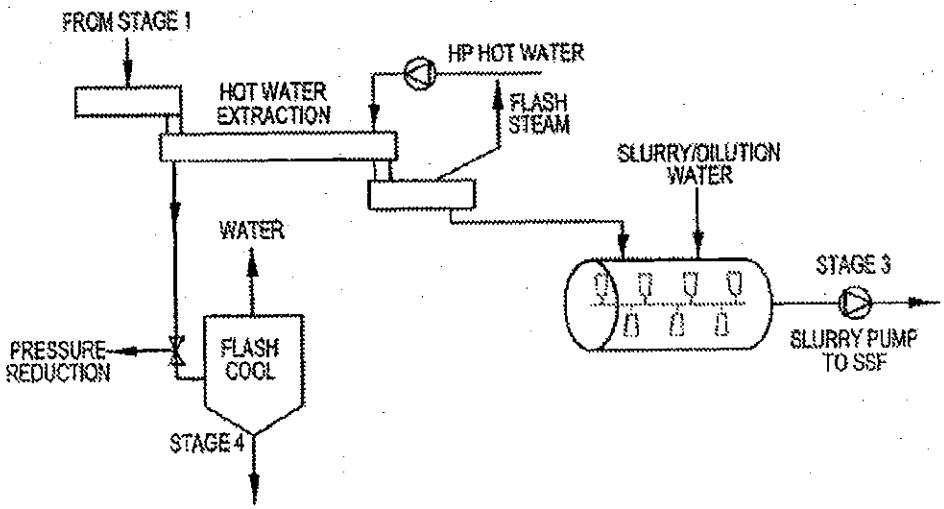

FROM STAGE 1
HP HOT WATER
HOT WATER EXTRACTION
FLASH STEAM
SLURRY/DILUTION WATER
WATER
STAGE 3
PRESSURE REDUCTION
FLASH COOL
SLURRY PUMP TO SSF
STAGE 4

FIG. 2

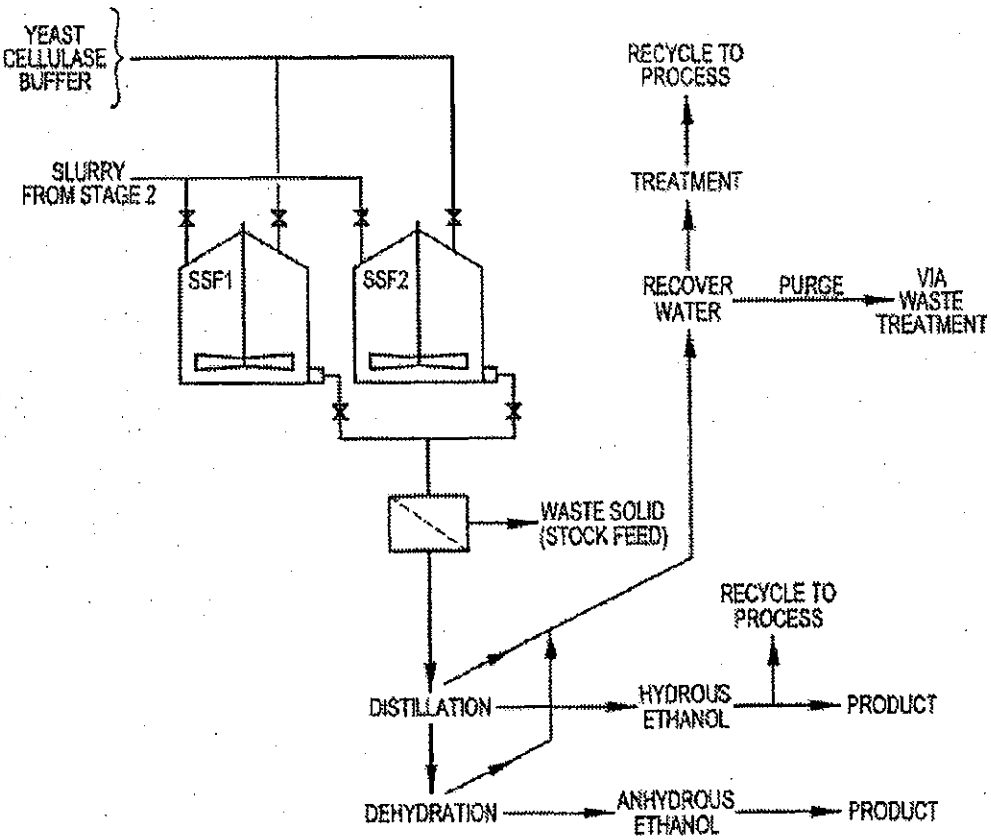

YEAST
CELLULASE
BUFFER
SLURRY
FROM STAGE 2
SSF1
SSF2
WASTE SOLID
(STOCK FEED)
RECYCLE TO
PROCESS
TREATMENT
RECOVER
WATER
PURGE
VIA
WASTE
TREATMENT
RECYCLE TO
PROCESS
DISTILLATION
HYDROUS
ETHANOL
PRODUCT
DEHYDRATION
ANHYDROUS
ETHANOL
PRODUCT

FIG. 3

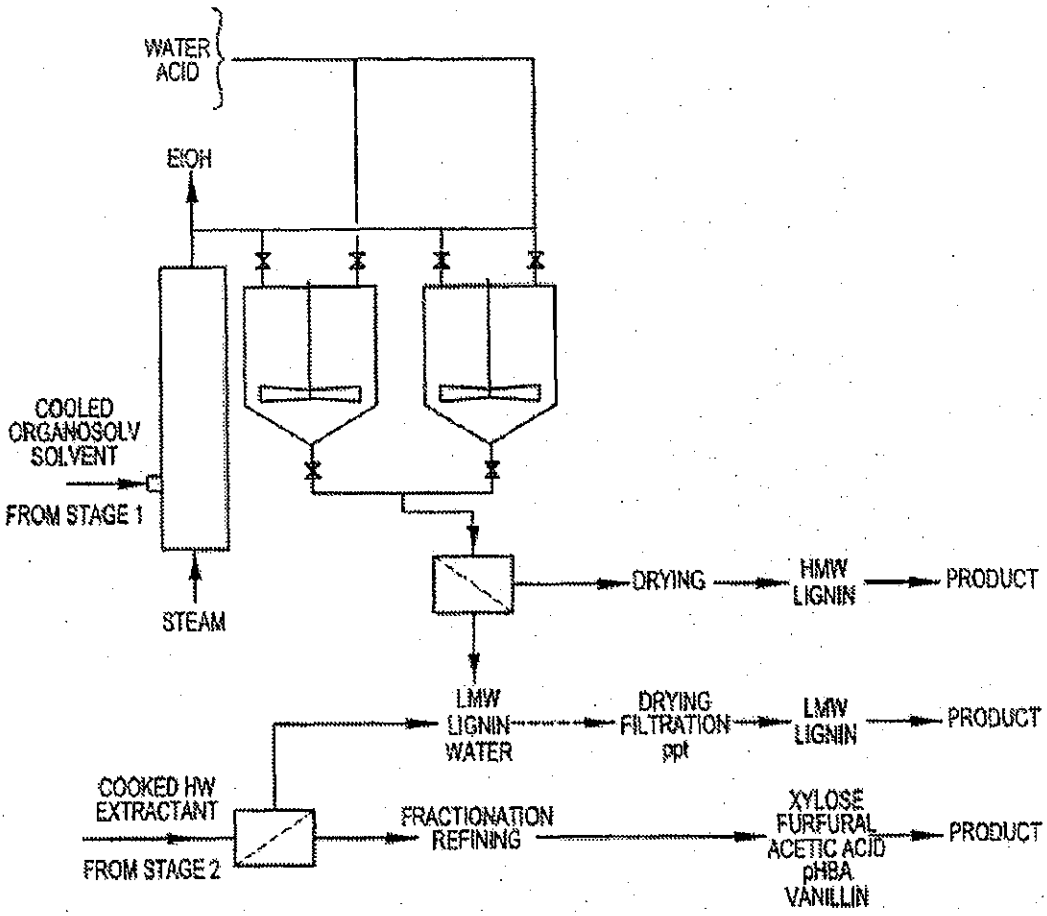

WATER
ACID
EtOH
COOLED
ORGANOSOLV
SOLVENT
FROM STAGE 1
STEAM
DRYING
HMW
LIGNIN
PRODUCT
LMW
LIGNIN
WATER
DRYING
FILTRATION
ppt
LMW
LIGNIN
PRODUCT
COOKED HW
EXTRACTANT
FROM STAGE 2
FRACTIONATION
REFINING
XYLOSE
FURFURAL
ACETIC ACID
pHBA
VANILLIN
PRODUCT

FIG. 4

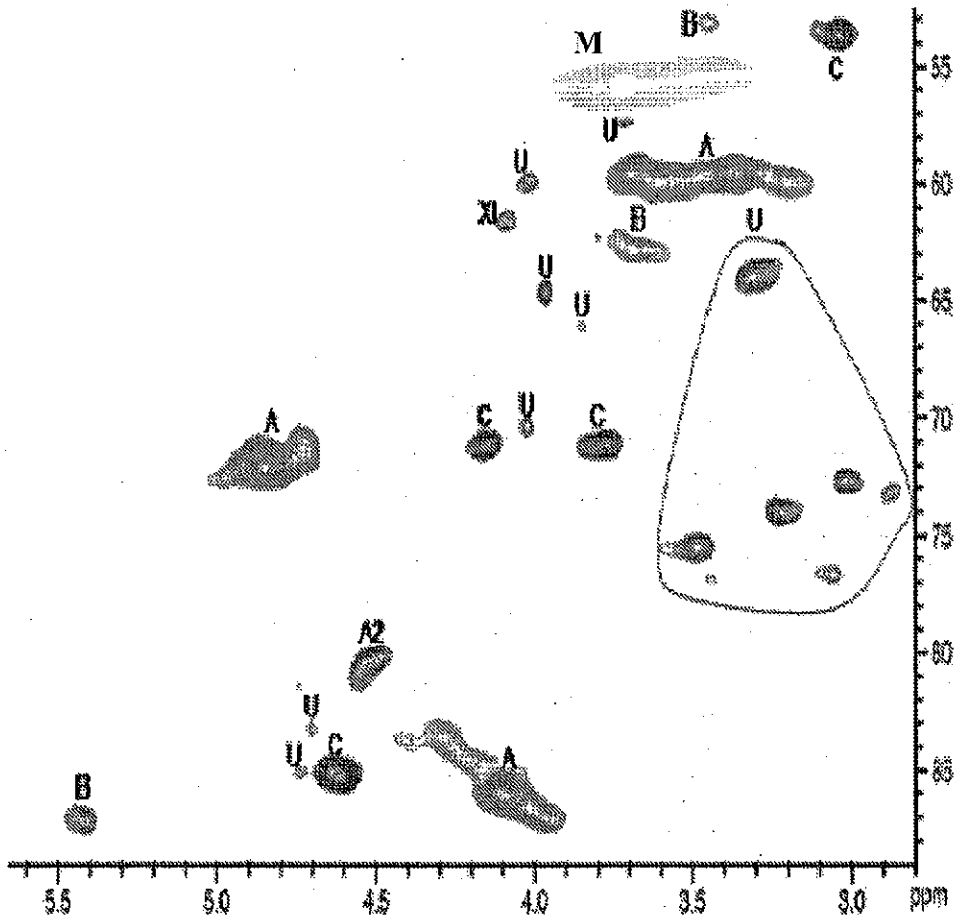

M
B
C
U
A
U
XI
B
U
U
U
A
C
U
C
A2
U
U
C
A
B
55
60
65
70
75
80
85
5.5
5.0
4.5
4.0
3.5
3.0
ppm

FIG. 5

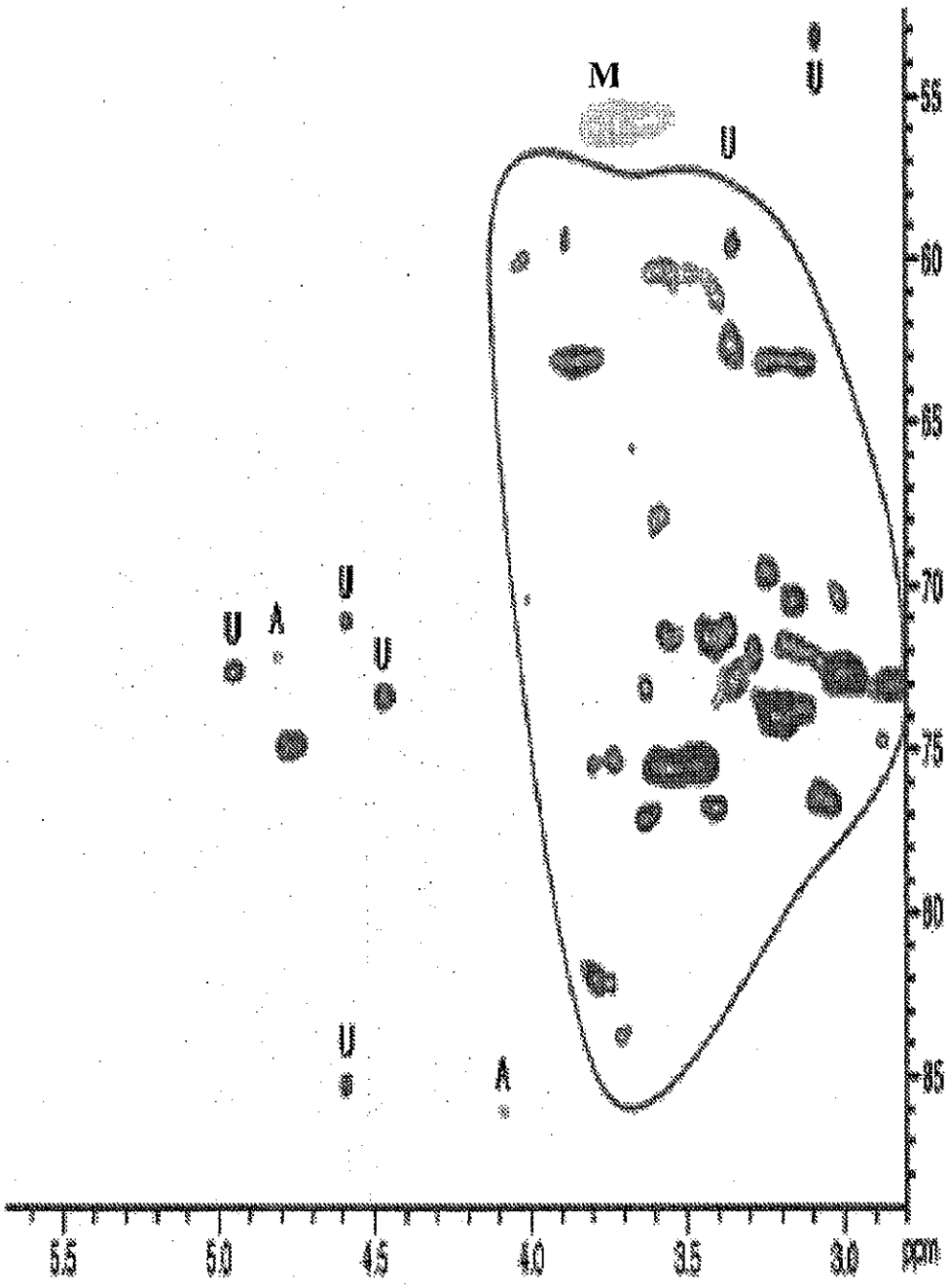


FIG. 6

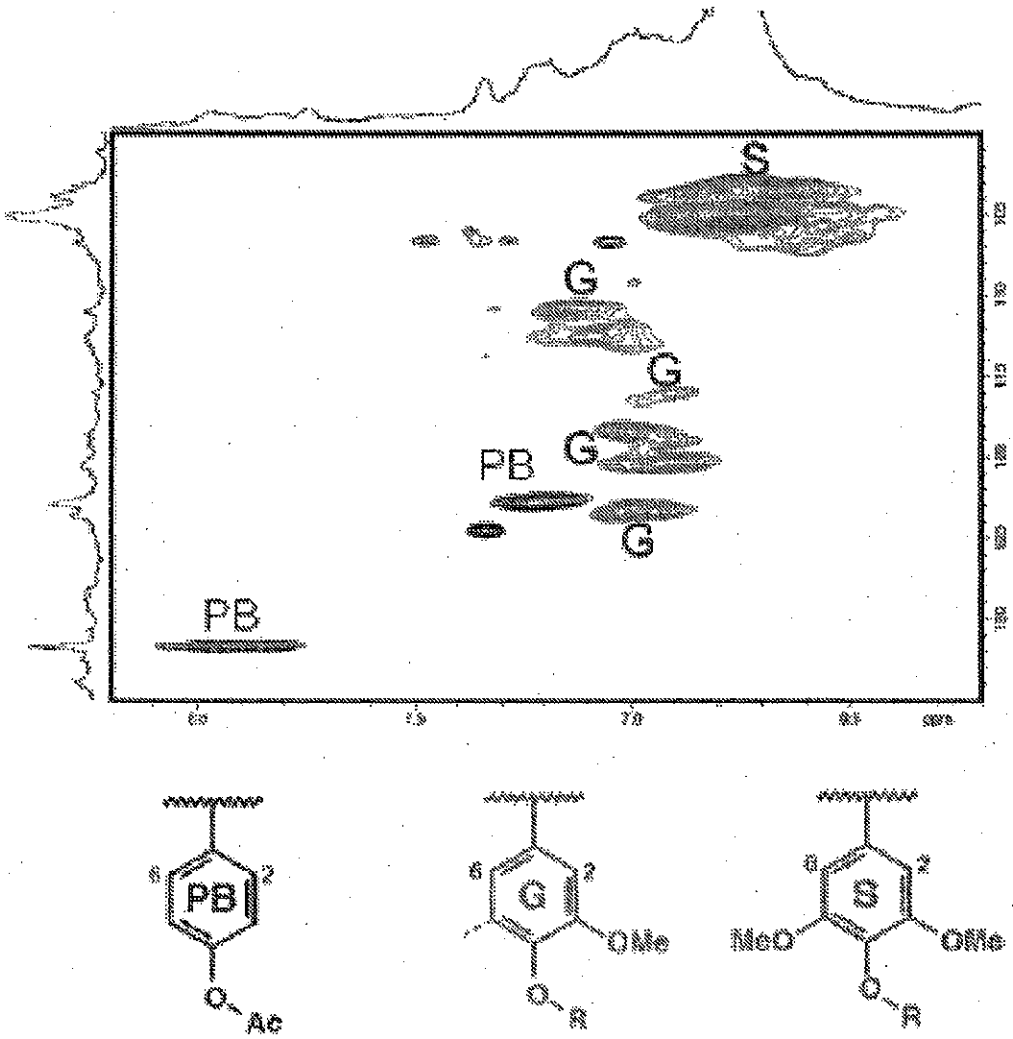


FIG. 7

FIG. 8A

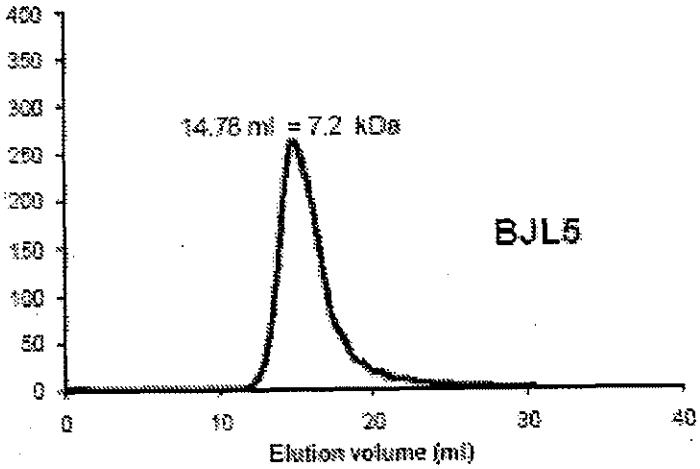


FIG. 8B

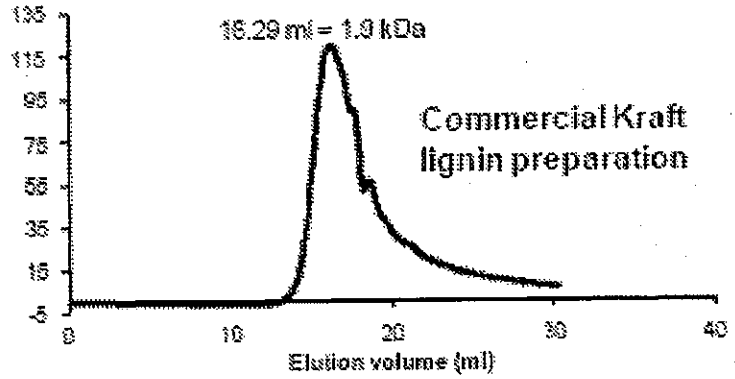


FIG. 8C

