

(19)
(12)

(KR)
(A)

(51) 。 Int. Cl. 7
H01L 21/8242

(11)

(43)

2002 - 0031283
2002 05 01

(21) 10 - 2001 - 0053697
(22) 2001 09 01

(30) JP - P - 2000 - 0032 2000 10 23 (JP)
2117

(71)	가	가	가	4	6
	가				

$$(72) \quad \begin{array}{ccccc} & 1 & 5 & 1 & \text{가} & \text{가} \end{array}$$

1 5 1 가 가

(74)

1

(54)

Ru

, DRAM

가 (Ru(C₂H₅C₅H₄)₂/O₂)가 10% (b) RuRu 가
(a) 50%

18b

, Ru ,

24 2

25a 25b ,

26 .

< >

1 ... ()

2 ...

3 ... p (p - type well)

4 ...

5 ...

6 ...

7 ...

8 ... n

9 ...

10 ...

11. 12 ...

13 ...

14 ...

15 ...

16 ...

17 ...

18 ...

19 ... (through - hole)

20 ...

21 ... (side - wall spacer)

22 ...

23 ...

24 ...

26 ...

27 ... ()

29 ...

30a ... Ru

30b ...

30c ...

30d ... Ru

30 ...

32 ...

33 ...

33a ... Ru

33b ... W

34 ...

BL ...

C ...

Qs ... MISFET

WL ...

L ...

, , , () Ru() .
)

, 300

, (10) CVD (11) (14) (15) (14) 150nm (15)

15 (15) 16 (16) 16 (16) 14 (14)
 Ti TiN , , ,
 CVD W , (15) , (15) , ,
 . (16 13) , MISFET(Qs) n (8) (,
) (BL) .

, (14) (16) (BL) . (BL) ,
 (14) TiN (10nm ,)) , TiN
 CVD W (50nm) , ()

(19) , (12) . , (19) (2)
18) CVD (20) , (20) (21)
0) (20) (20) (21)
.
(21) , (18) (17) .

9) , (19) (20) (21) , 7 (18) P , (1
 n (22) . (22) , n (19) () .
 CVD (30a, 30d) (30), (32)
 W /Ru (33) (C)

$$(C) \quad 8 \sim 17 \quad . \quad (22)$$

8 , (22) (17) , CVD (18) 50nm
, (18) (24) . (C)
(24) () .
가 , (24) (0.8μm) . 가 . (24) ,
TEOS(tetraethylorthosilicate) 가 CVD , ,

$$, \quad (24) \quad (26) \quad , \quad (26)$$

$$\begin{aligned}
 & , \quad 9 \quad , \quad (26) \quad , \quad (\quad) \quad , \\
 & \quad (26) \quad , \quad (26) \quad , \quad (26) \quad , \quad (24) \\
 & (18) \quad , \quad (27) \quad , \quad (27) \quad , \quad (27) \quad , \\
 & (19) \quad (22) \quad .
 \end{aligned}$$

10 , (24) (26) , CVD (29)(10
 nm) , (24) (27) Ta(OC₂H₅)₅ O₂ 가 400 ~450
 . (29) (下地) (24) Ru (30)(30a,30d)

$$(27) \quad , \quad 11 \quad , \quad (29) \quad , \quad (29) \quad , \quad (27) \quad , \quad (27) \quad , \quad (29) \quad , \quad (27) \quad , \quad (24)$$

, 12, (24), (27), Ru (30)(5nm)
 . CVD Ru , Ru ,
 . CVD Ru .

18a Ru CVD (Ru(C₂H₅C₅H₄)₂/O₂)

가 (a) $\text{Ru}(\text{C}_2\text{H}_5\text{C}_5\text{H}_4)_2/\text{O}_2$ (b) $\text{Ru}(\text{C}_2\text{H}_5\text{C}_5\text{H}_4)_2$ (b/a(%))
 () 250nm, 1500nm(/ =6) O_2
 O₂ 50sccm

18a	,	가 5%	,	,	Ru
	.	가 5%	,	,	
가 10%		,	50%	,	100%
,			(Ru(C ₂ H ₅ C ₅ H ₄) ₂)		
50sccm	N ₂	900sccm	,		(0.1mol/1) 5cm ³ /min, O ₂
,	,		PV=nRT(P: (atm), V: (1), n: (mol), R: (0.082), T: (K))		0.0005mol/min
1	(1.01325 × 10 ⁵ Pa), 273K	100%		11cm ³ /min	, 22%
,	18	O ₂	50sccm	,	Ru(C ₂ H ₅) ₂
C ₅ H ₄) ₂		O ₂ 가	,	,	10sccm O ₂ 가
		, Ru(C ₂ H ₅ C ₅ H ₄) ₂		290	, 300
Ru	,		, Ru(C ₂ H ₅ C ₅ H ₄) ₂ /O ₂	10%	,
가		(a) 50%			
,	13	,	, 600, 1	,	,
(22) Ru (30)			,	(27)	(30b) 가
,	(27)	(27)	,	,	
,			,	(27)	
(30b)					
,	(NH ₃)	, 700	1	,	(30b)
	(RuSiN)(30c)				,
c)			RuSiN	1nm	RuSiN(30)
(22)			Ru (30d)	(22)	Ru (30d)
.	Ru (30d)	(22)	Ru (30d)	(22)	Ru (30d)
	RuSiN	0.5~1.0nm			
,	14	,	Ru (30a) RuSiN(30c)	,	(Ru(C ₂ H ₅ C ₅ H ₄) ₂)
O ₂)		5cm ³ /min, O ₂	50sccm N ₂	900sccm	
, CVD	20nm	Ru (30a)		,	290, 665Pa
Ru (30d)		, Ru (30a)	가	, Ru(C ₂ H ₅ C ₅ H ₄) ₂ /O ₂	10%
	Ru	가		(a) 50%	
Ru	,		, Ru(C ₂ H ₅ C ₅ H ₄) ₂ /O ₂	10%	,
가		(a) 50%		,	가 Ru
(30a,30d)			, Ru	(5nm)	
,	Ru (30d)	((,	(27)
))	,	(24)
Ru (30a,30d)			,	(27) () Ru (30a,30d)
					,

(24) Ru (30a,30d) (30) . , (27)
(15).

, 16 , (30) (27) (24)
(32) CVD 15nm
550 , (32) 700 , 2 ,
, 1 ,

, 17 (32) CVD , Ru (33a)(32) 70nm (33) W (33b)(33) 100nm (33) ,
. W (33) (32) W 가 () , Ru W
, () (32) () , T
iN

, Ru (30a,30d) (30), (32)
W (33b)/Ru (33a) (33) (C) (C) DRAM
MISFET(Qs) 19 , (C) 7 , 19
A - A

, (C) (34)
, 2 Al , Al (passivation)
, , , Ru , (對)
,
(2)

1 , (27) , (22) (22) (RuS
iN)(30c) , , , , ,

20 (22) (C) (22) , , , , ,
1 ~ 7 1

(22) (23) (23) (22) , , (22) (22)
(18) , , (17) , , TiN (23) , , (22)
TiN , , P TiN (23) , , (22)
, (22) , , (17) , , n (19) n CVD
(19) n , , , , ,

$$(\quad) \quad , \quad (19) \quad n \quad (\quad) \quad ,$$

, 21, (22) (17), CVD (18)
50nm, , (18) (24) (24) . (C)
, (24) (24) (24) (0.8μm) 가 .
(24), TEOS(tetraethylorthosilicate) 가 CVD .

$$\begin{aligned}
 & (26), \quad (26), \quad (26), \quad (24) \quad (18) \\
 & (26), \quad (27), \quad (27), \quad (22) \\
 & (23), \quad . \quad . \quad . \quad (22)
 \end{aligned}$$

22 , (24) (26) , CVD (29)(10
 nm) , (24) (27) , Ta(OC₂H₅)₅O₂ 가 400 ~450
 . (29) (24) Ru (30) ,

$$(27) \quad , \quad 23 \quad , \quad (29) \quad , \quad (27) \quad , \quad (29) \quad , \quad (24)$$

$$(29) \quad , \quad (27) \quad , \quad (27) \quad , \quad (29) \quad , \quad (27)$$

, 24 , (24) (27) , Ru (30a) (20nm)
 . CVD Ru , Ru ,
 . CVD Ru .

, Ru (30a) . Ru (30a) , CVD
 (Ru(C₂H₅C₅H₄)₂) 5cm³/min, O₂ 50sccm N₂ 900sccm , 290 ,
 665Pa , 18 , (27)
 Ru (a) (27) Ru (b) (b/a) 50%

, 16, 17 1

가 가

3

,

Ru

5.

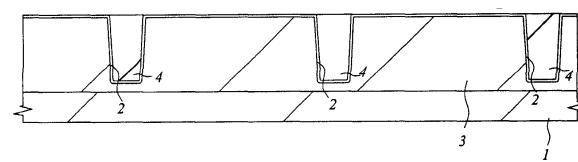
3

,

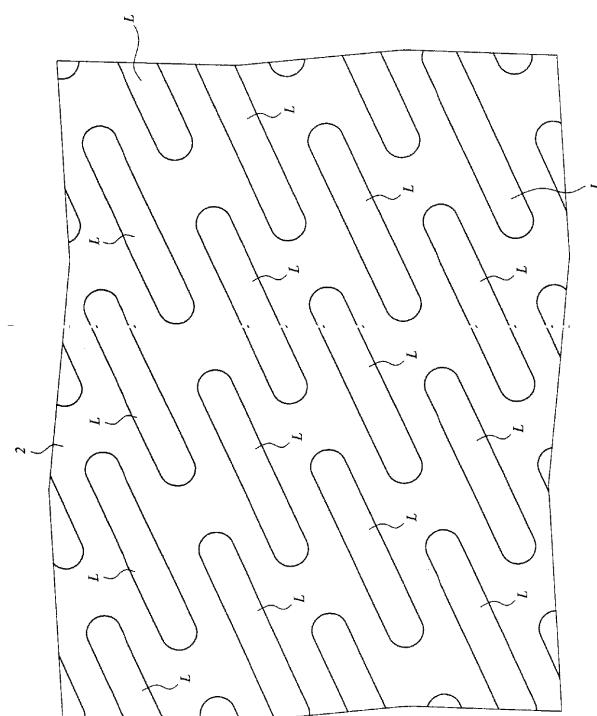
Ru

5nm

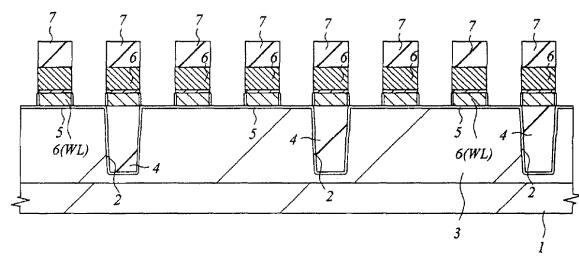
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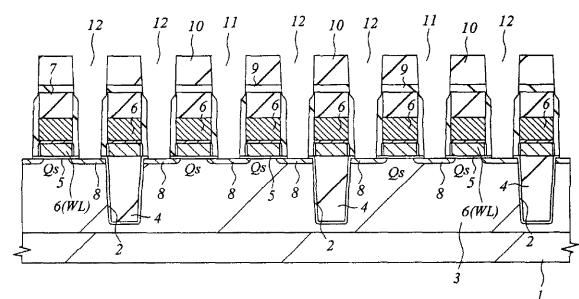
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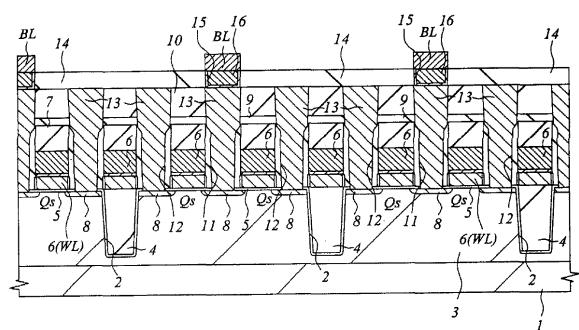
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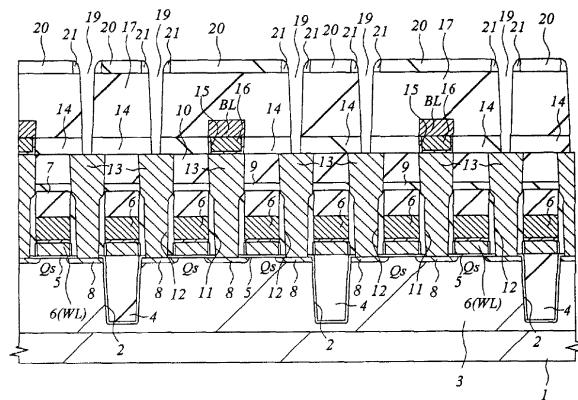
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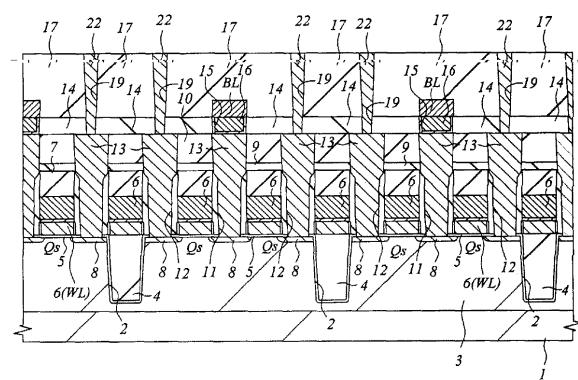
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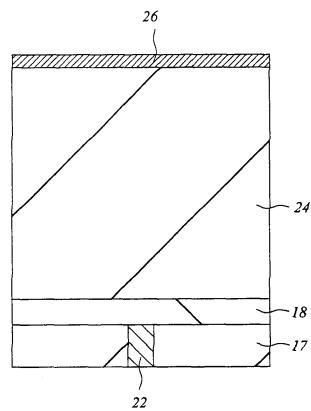
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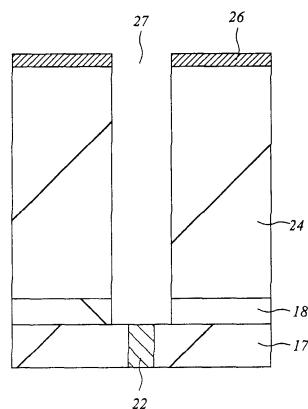
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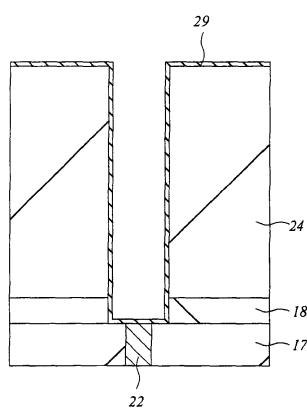
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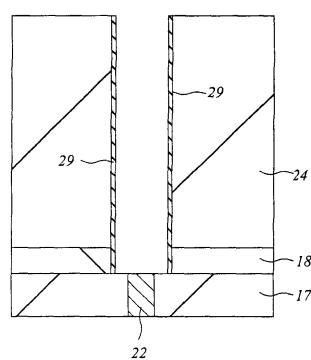
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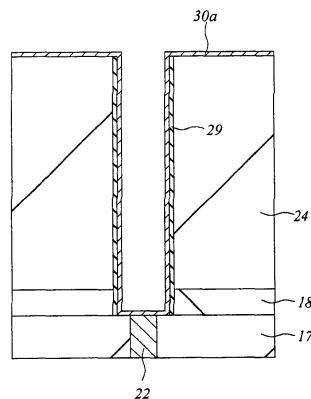
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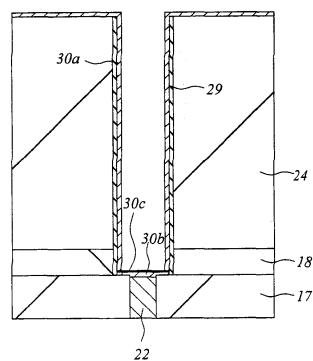
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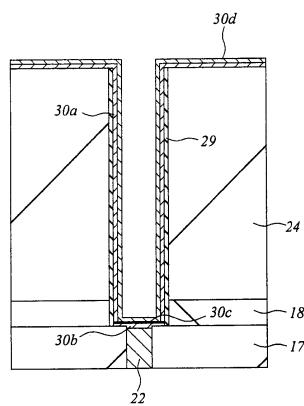
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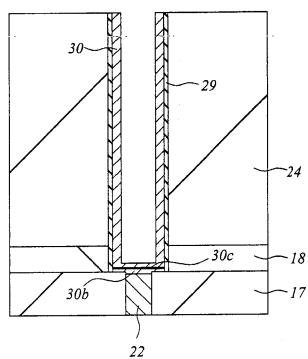
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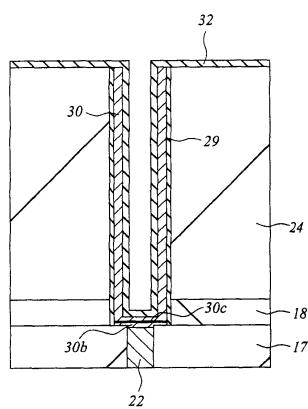
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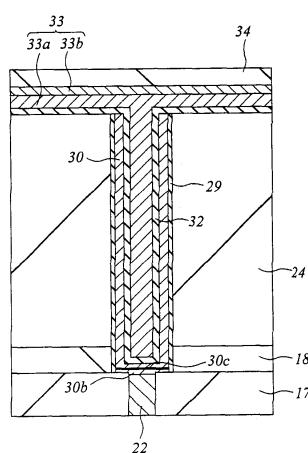
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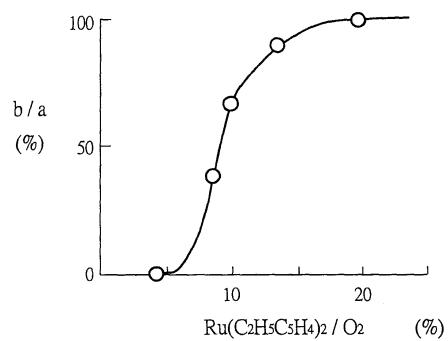
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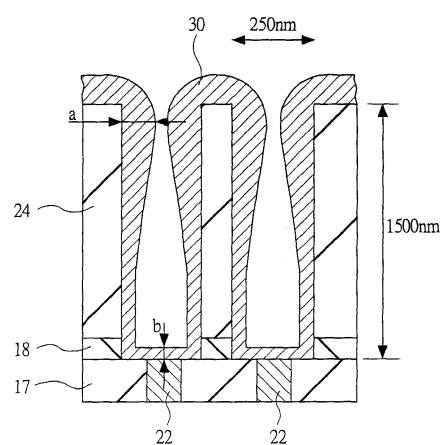
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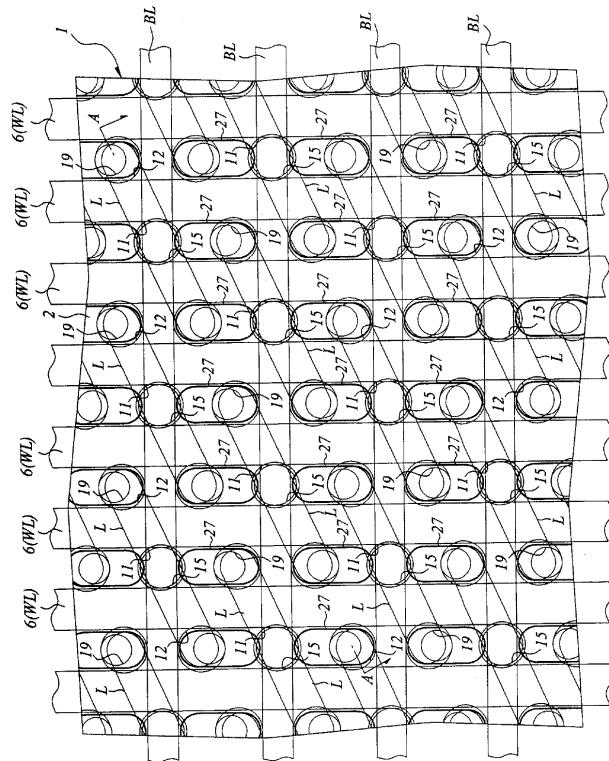
18a



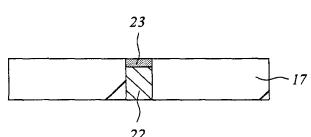
18b



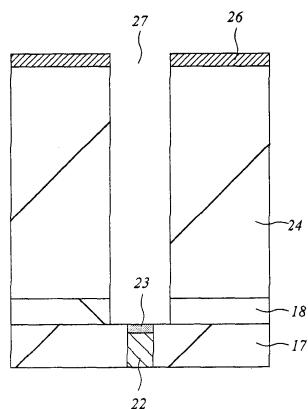
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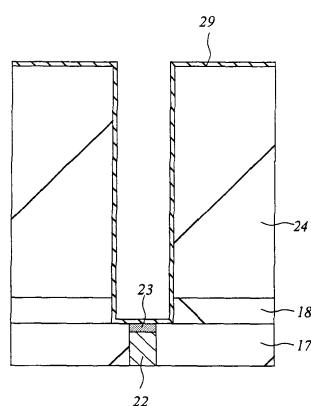
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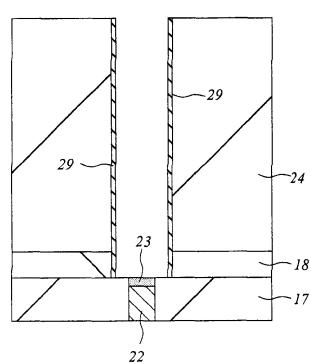
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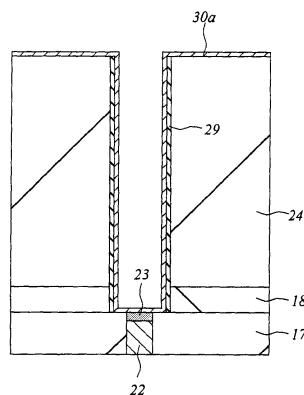
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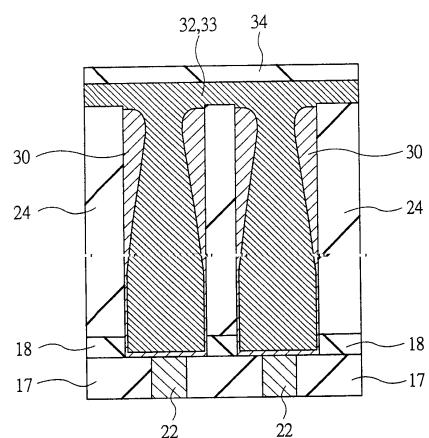
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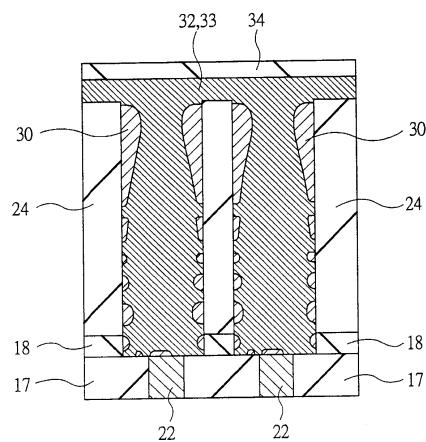
24



25a



25b



26

