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(22) 1997 12 24(65) 1998 - 0064586
(43) 1998 10 07

(30) 96 - 356493 1996 12 26 (JP)

(73) 가 가

가 가 가

가 72

(72) 가
가 가 가

1가 가

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1가 가

가 가 가

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(74)

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(54)

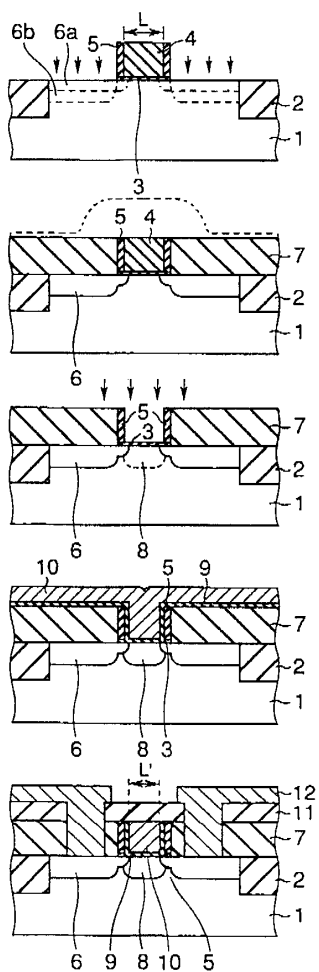
(4) . (1) (4) ,
(4) (1) / (6) ,
(4) (7) , (4) ,

(4)

(9)

(9)

(10)



| | |
|---|---|
| 1 | 1 |
| 2 | 1 |
| 3 | 2 |
| 4 | 2 |
| 5 | 3 |
| 6 | 4 |
| 7 | 5 |

| | | |
|---------|-------|---|
| 8 | 6 | . |
| 9 | 6 | . |
| 10 | 6 | . |
| 11 | 7 | . |
| 12 | | . |
| 13 | 2 | 1 |
| < | | > |
| 1 : | | |
| 4 : | | |
| 6 : | / | |
| 7 : | | |
| 9, 9a | 9e : | |
| 10, 10a | 10d : | |

.

(SiO₂) MOS ,

(, 3nm) , 가

, Ta₂O₅ 「 」

/ (.)

.

,

) Si 800 1000 (/ , ,

가 .

12a 12b (31)
 , (32) STI(Shallow Trench Isolation) , (33) ,
 (34) , (35) / .
 , / (35) , / (35) (34)
 , 12a / (35) (34) . ,
 (34)
 , , (34) / (35) , / (35)
 , 12b
 SiO₂ (33) . ,
 가 가 .
 , (34) / (35) , (34)
 가 (900 , 30)
 , (33) 가 가 .
 , ,
 ,
 ,
 가
 .
 ,
 ,
 MIS ,
 .
 ,
 / ,
 ,
 ,
 , STI 「 」 2
 .
 , CVD .

/

.

/가

, RIE CMP
가 CMP RIE
/가
/

가

1 1 2
1a 1b 1 A - A'
 $5 \times 10^{15} \text{ cm}^{-3}$ p (1) STI (2)
(2) $0.10 \mu\text{m}$ n $5 \times 10^{16} \text{ cm}^{-3}$ P $5 \times 10^{19} \text{ cm}^{-3}$ / (6) $5 \times 10^{20} \text{ cm}^{-3}$ LDD (V_{th})
(8)
1nm Si_3N_4 (Ta_2O_5)
(9) (9) (10) (10)
, TiN, Ru, W)
(6) (10)
(7, 11) / (6) (12) 0.1 0.15 μm
(13) 가

2a 2e 13a 13e 1
2a 2e 13a 13e A - A'
2a 13a $5 \times 10^{15} \text{ cm}^{-3}$ p (1; n
p Si 가) (100) , n Si 1 μm p () , p
n ()
RIE Si (1)
(2; 0.2 μm STI)

5nm SiO₂ (3) SiO₂ (3) (4) Si₃N₄ 가
 300nm RIE
 (4) Si₃N₄ (7;
 SiO₂) Si²
 Si RIE SiO₂ (3) Si (1) R
 IE 가
 (4) (2)
 , LDD (4) Si₃N₄ , (P⁺)
 70KeV, $4 \times 10^{13} \text{ cm}^{-2}$, n⁻ (6a) SiO₂
 RIE (4) 20nm SiO₂ (5)
 (A_S⁺) 30KeV, $5 \times 10^{15} \text{ cm}^{-2}$, n⁺ (6b) LDD
 , LDD (6a) (6b) / L L
 , 2b 13b , CVD - SiO₂ (2b) , 30
 0nm , 800 N₂ 30 (densify)
 / (6) (Xj) 750
 , 950 10 RTA
 CMP (4) Si₃N₄
 , 2c 13c (4) (2)
 SiO₂ (3) () , (7) (5)
 . n , 0.7V (Vth)
 (B⁺) 10KeV, $5 \times 10^{12} \text{ cm}^{-2}$ p
 SiO₂ (8) SiO₂ (3) SiO₂ (3)
 , RTA 800 , 10 (8)
 , 2d 13d , SiO₂ (3) ,
 (9) Ta₂O₅ 20nm , Si
 Si (1nm) SiO₂ () RTP
 NH₃ 가 Si () Si₃N₄ ()
 (Ta₂O₅ , (Ba, Sr) TiO₃) , CVD - SiO₂ CVD - SiON ,
 CVD - Si₃N₄ , 1000 , 10 가
 RTP 가
 , [10; Ru , TiN , W , (WN x)
] , CVD - SiO₂ CVD - SiON , CVD - Si₃N₄
 Si

, 2e 13e , CMP (10) (9)
 (4) , 2e L'
 2a L (9) 2
 가 L(0.15 μ m 가), 가 0.02 μ m (9)
 2 , 0.02 μ m \times 2 = "0.04 μ m "
 L 0.11 μ m 가 0.15 μ m
 .
 , (11) SiO₂ 200nm / (6)
 (10) Al (12) .
 1 가 .
 /
 , 가 .
 , RIE CMP 가 (, 가
 RIE 가 가) .
 .
 , / , /
 . , 가 .
 , (Vth) /
 . , /
 .
 , 가 2
 .
 , CVD STI Si 가
 (가)
 .
 , 2 3 4 .
 3a 3b 1 2b 2c . , 2
 .
 2 1 Si₃N₄ ,
 (7) SiO₂ Si
 i Si (4) RIE SiO₂ (3) (4) Si Si (1) S
 .

, 3 LDD / (4') Si / (6)

, LDD Si 4a 4b 1 2b 2c (5') Si₃N₄ (5')

N₄ 가 (5) Si₃N₄ (L') , SiO₂ (3)

, 3 5

5 1 2a 2c , 2

2 1

SiO₂ (3) () (6)

(8) / (6) (8)

, 4 6 , 2

2 1 / (6) (14) / (14)

(14) (600 , 30) (14)

, (14)

, 5 , 7 , 2

2 1 / Si Si / Si (15)

, 50nm Si / Si

Si (15) (, 1000 Si

, 700 Si Si) Si (15)

, Si (15)

6

8a 6 8b

1

(21) 8a

1

m

9a 10d 2

9a CMP (8a, 8b) (4) (Vth)가 3 (5) 2b (8a, 8b)[

1 / (6) / RTA , 800 , 10

9b (4; Si₃N₄) (hot) (4; Si₃N₄)

SiO₂ (3) Si (1) (9a) Si (1) (9b) 1nm

Si₃N₄ 2nm Ta₂O₅ (9b) (9b)

, Bi₄Ti₃O₁₂, PZT, PLZT, BiSr₂TaO₉, BaMgF₄ 1nm (Ba, Sr) TiO₃

(CeO₂) 20nm

(10a) , Pt, Ru, Au, TiN, W, TiW , (Pd, Ir, Rh, Os)

10c (10a) (9a, 9b) CMP (4; Si₃N₄)

SiO₂ (3) Si (1) (9c)

Ta₂O₅ 20nm , Si (1) , 1nm) SiO₂ Si₃N₄

[Ta₂O₅ (Ba, Sr) TiO₃] (10

b; Pt , Ru , TiW , WN_x , TiN , W)

, 10d , (10b) (9c) CMP
 . , () SiO_2 200nm ,
 , () Al 가 () .
 , , 1
 () .
 , 가
 .
 , 7 11 .
 , 6 (8) 6 .
 , 9 .
 , 11a . , 11a 9a 9b
 .
 , (4) (8d)
 , 6 (8d) CMP . , (10c) (8c) (9d) 9
 / (6) .
 , 11b .
 , (8e)
 (9e) CVD - SiO_2 CVD - Si_3N_4 , (10c)
 n^+ Si , 800 가 /
 (8e)
 , 가
 .
 , /
 가 . ,
 2
 가 .
 ,
 / , 가
 RIE CMP , RIE 가 . , 가

· , / .

, , 가 .

(57)

1.

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1 ;
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1 1 ;
1 ,
1 , 1 ,
.

2.

1 , 1 가
.

3.

1 , 1 SiO_2 .

4.

1 , 1
.

5.

4 , SiO_2 .

6.

1 , 1 Ba, Sr, Ti
.

7.

6 , 1
.

8.

7 , SiO_2

9.

1 , 1 .

10.

1 , 2 ;

2 , 2 SiO_2 , 1 2 .

11.

1 , 2 ;

2 2 , 2 1 .

12.

11 , 2 .

13.

1 , 1 2 ;

2 2 .

14.

1 , .

15.

14 , Si_3N_4 , SiO_2 .

16.

1 , 1 , 1 .

17.

1 , / LDD (Lightly Doped Drain)

18.

,
1 ;
;

1 1 - 1 Ta₂O₅ -
;

1 ,

1 , , 1 ,
.

19.

18 , 1 가

20.

18 , 1
.

21.

20 , SiO₂
.

22.

18 , 1 Ba, Sr, Ti
.

23.

18 , 1 .

24.

18 , 2 ;

2 , 2 SiO₂ , 1 2
 , 2 .

25.

18 , 2 ;
2 2 , 2 1
.

26.

25 , 2 .

27.

18 , 1 2 ;
2 2 .

28.

18 , .

29.

28 , Si_3N_4 , SiO_2
.

30.

18 , 1 , ,
.

31.

18 , / LDD .

32.

,

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33.

32 ,
가
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35.

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36.

32 , /

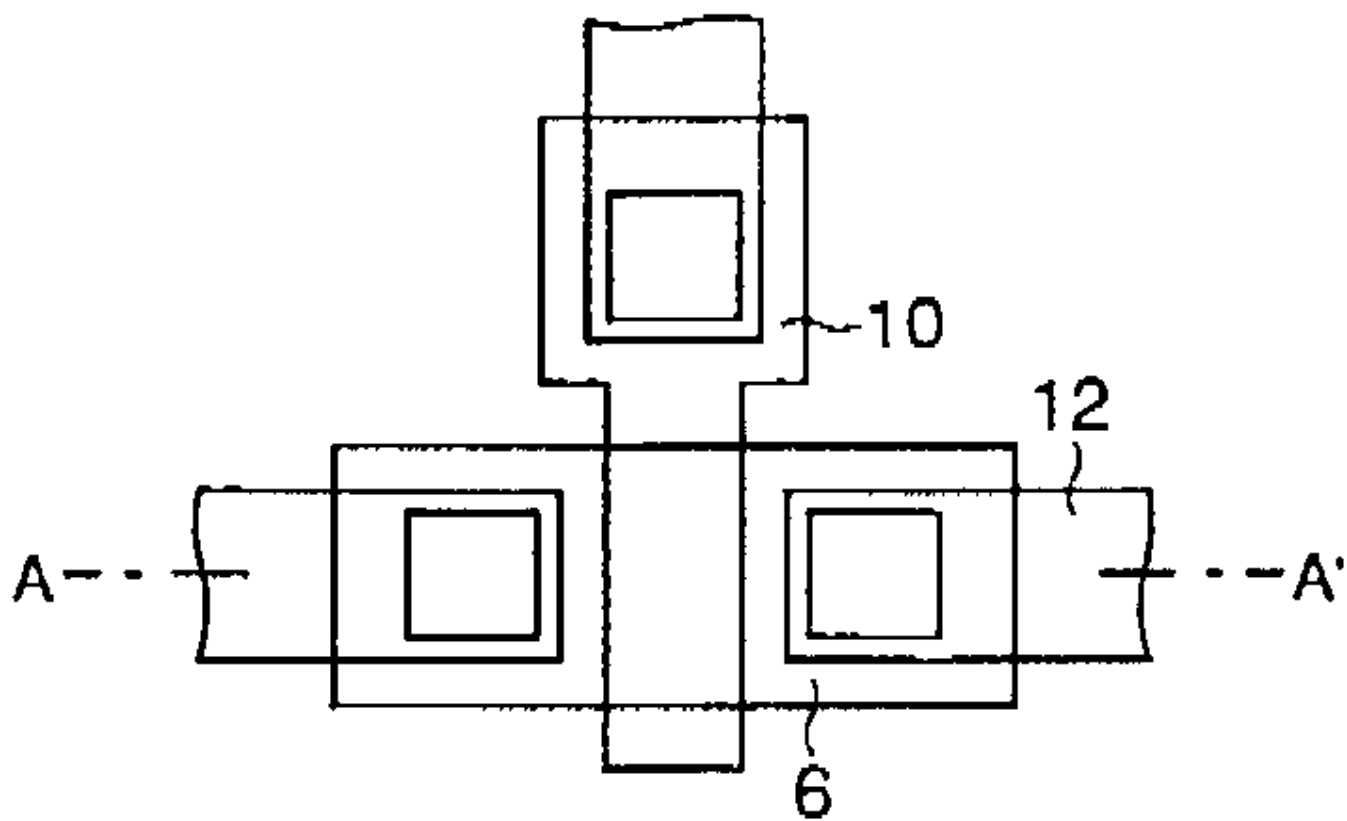
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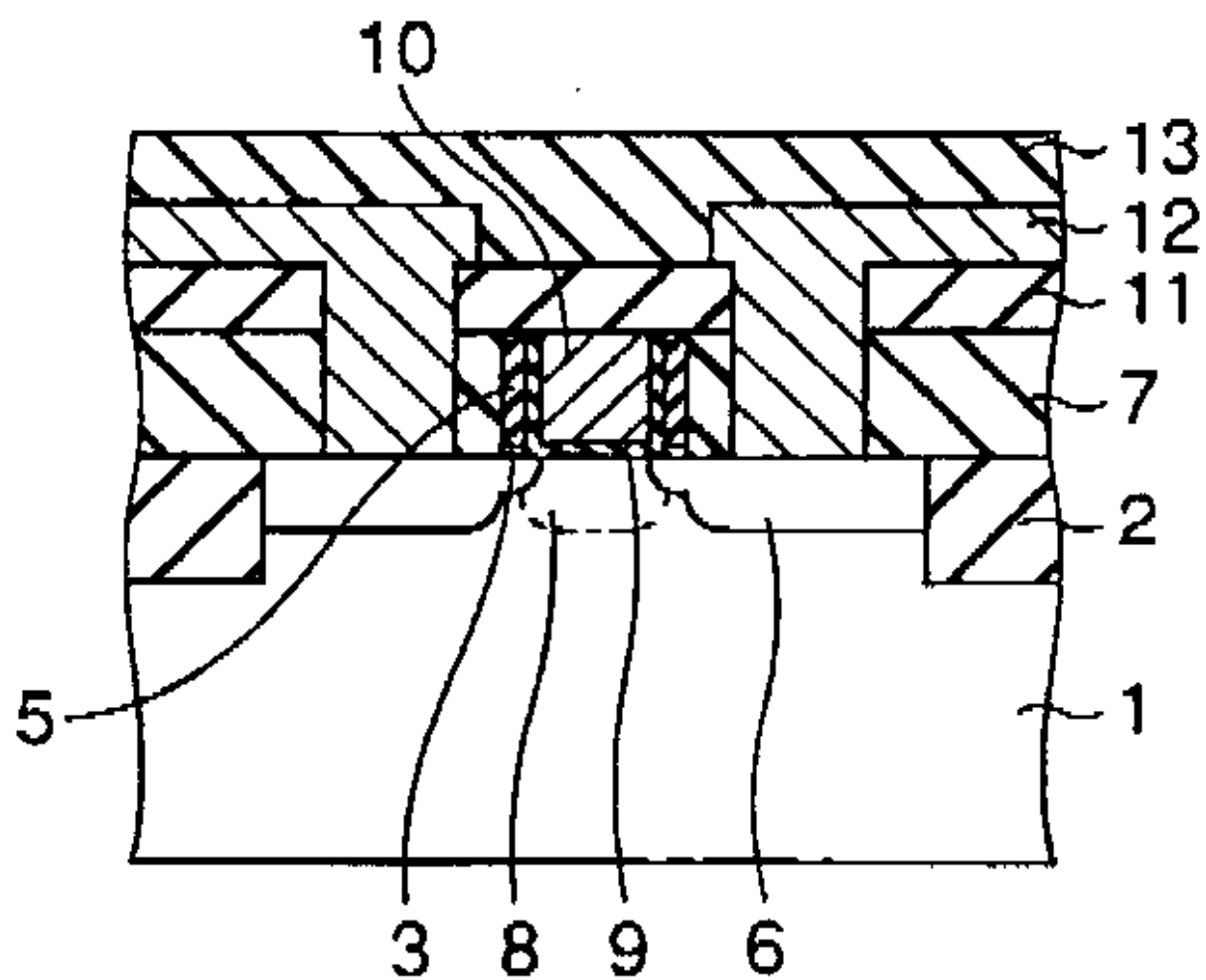
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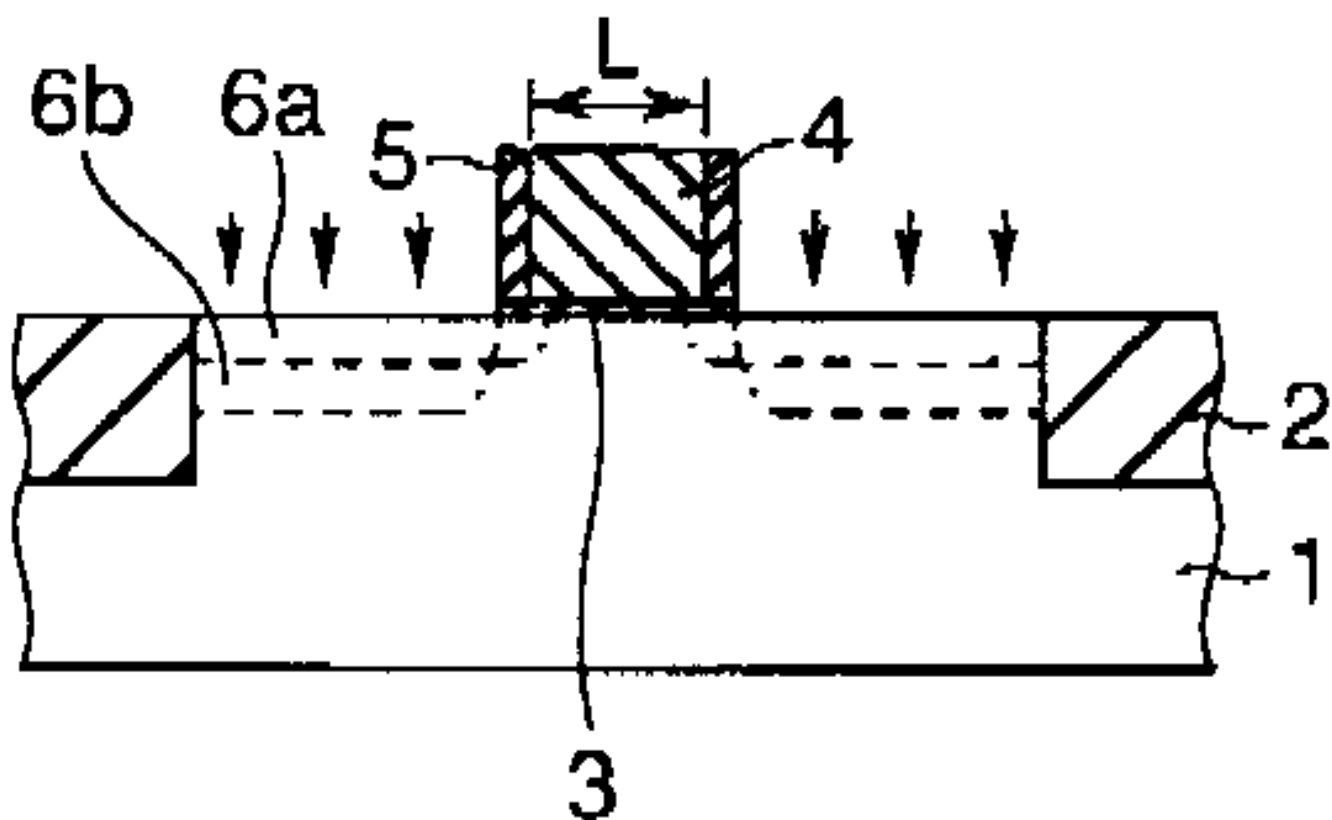
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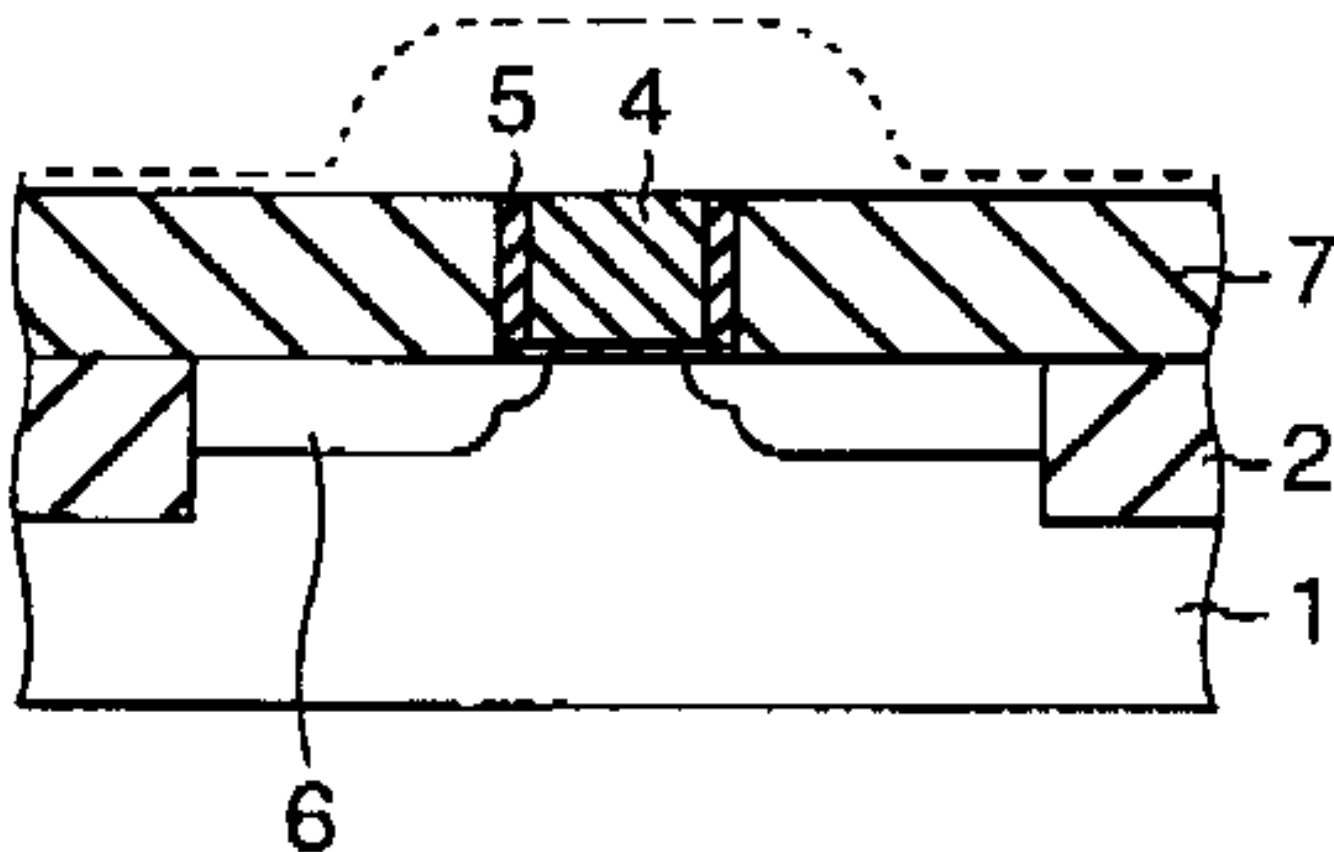
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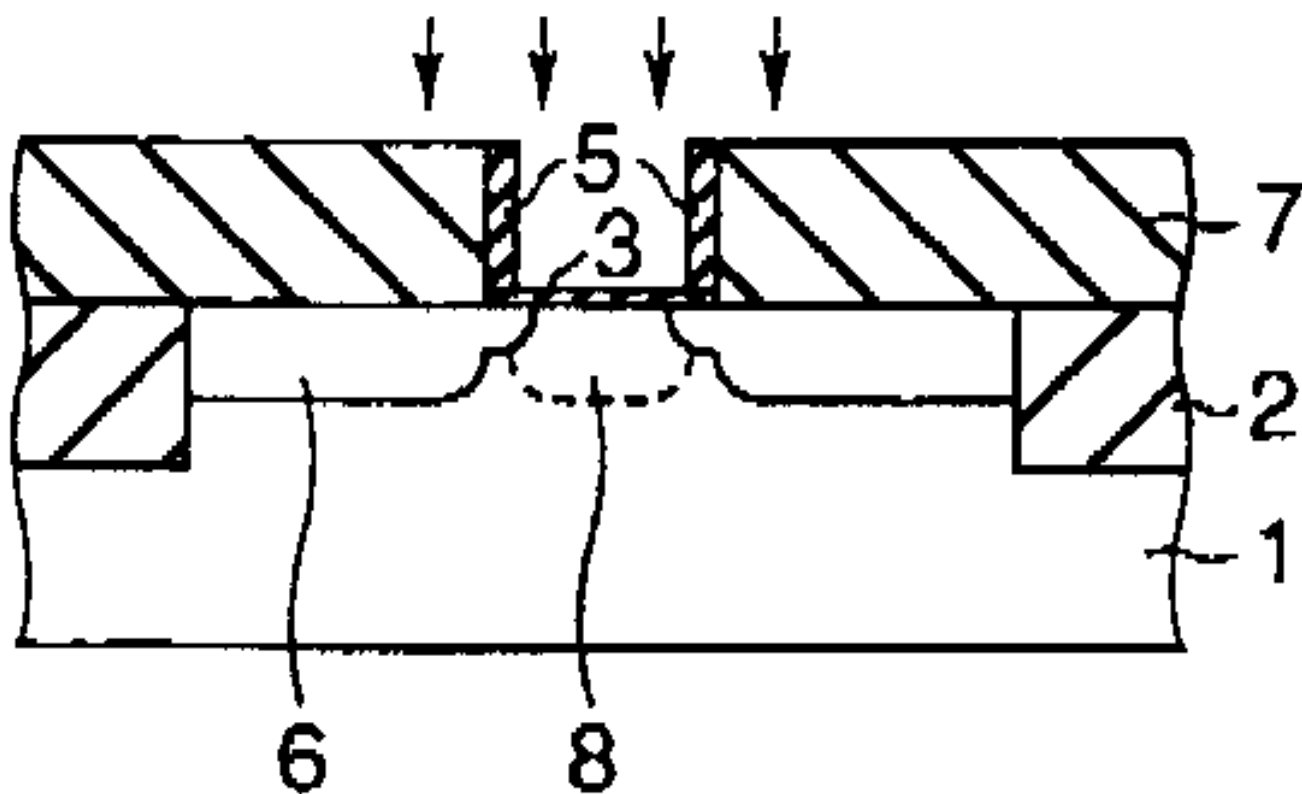
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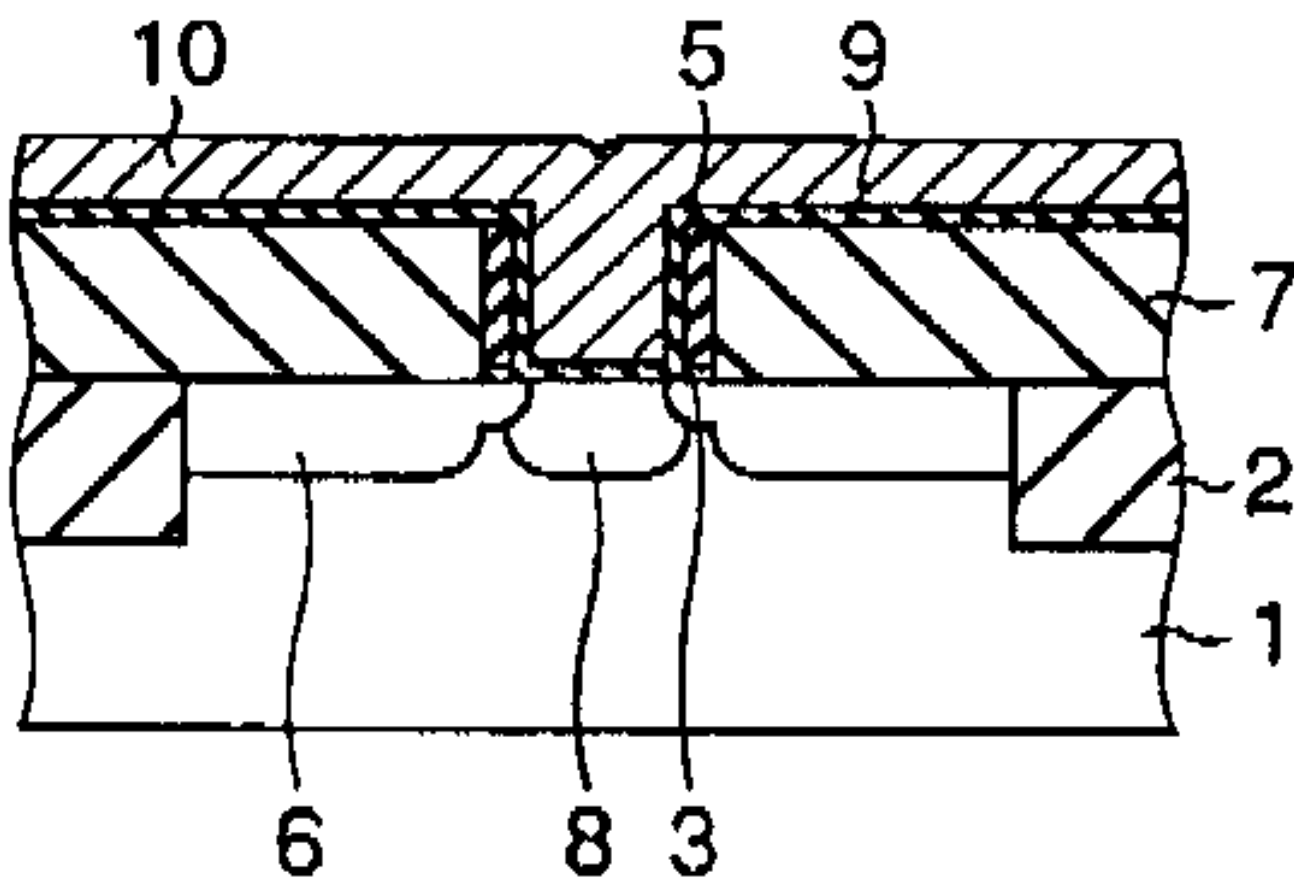
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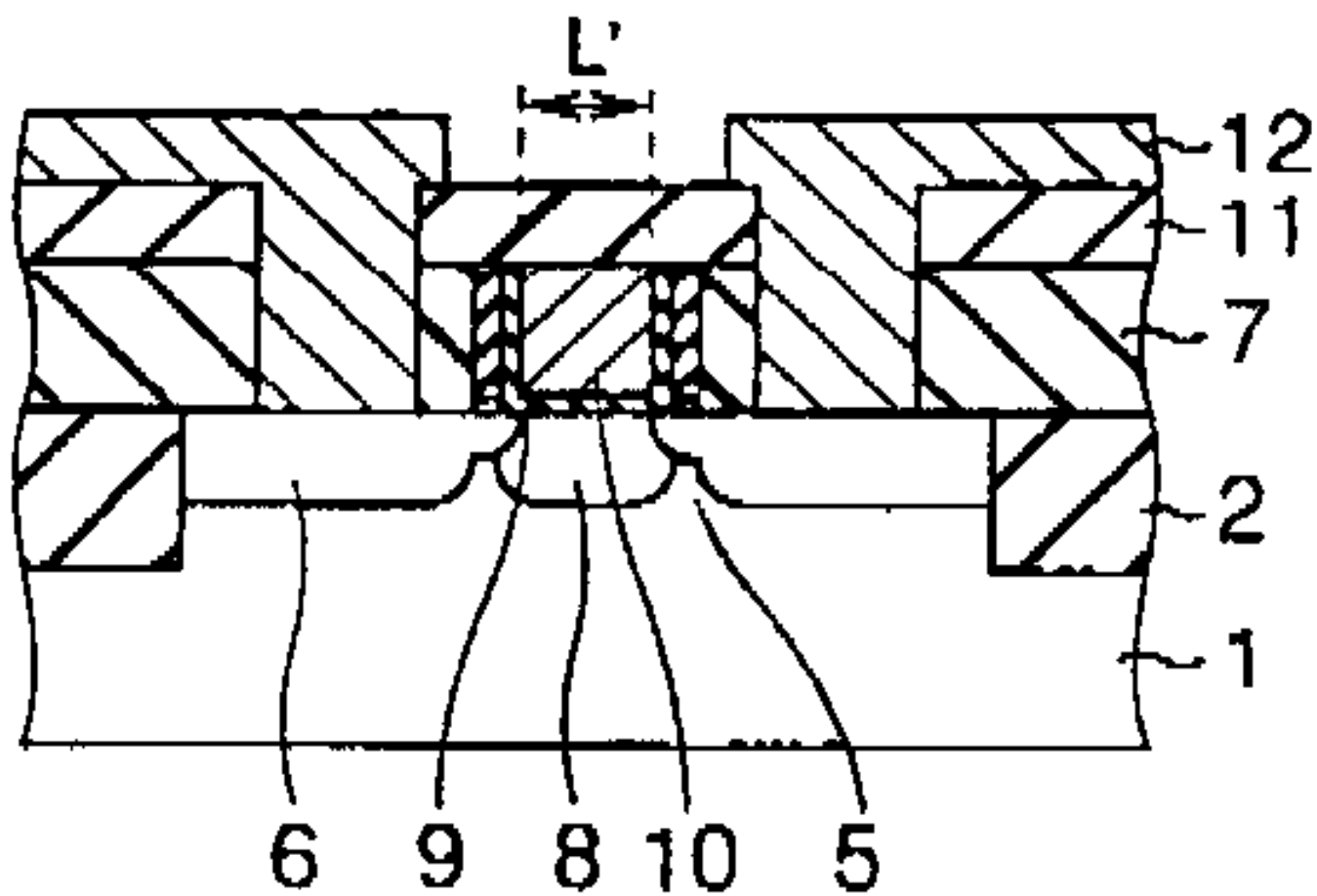
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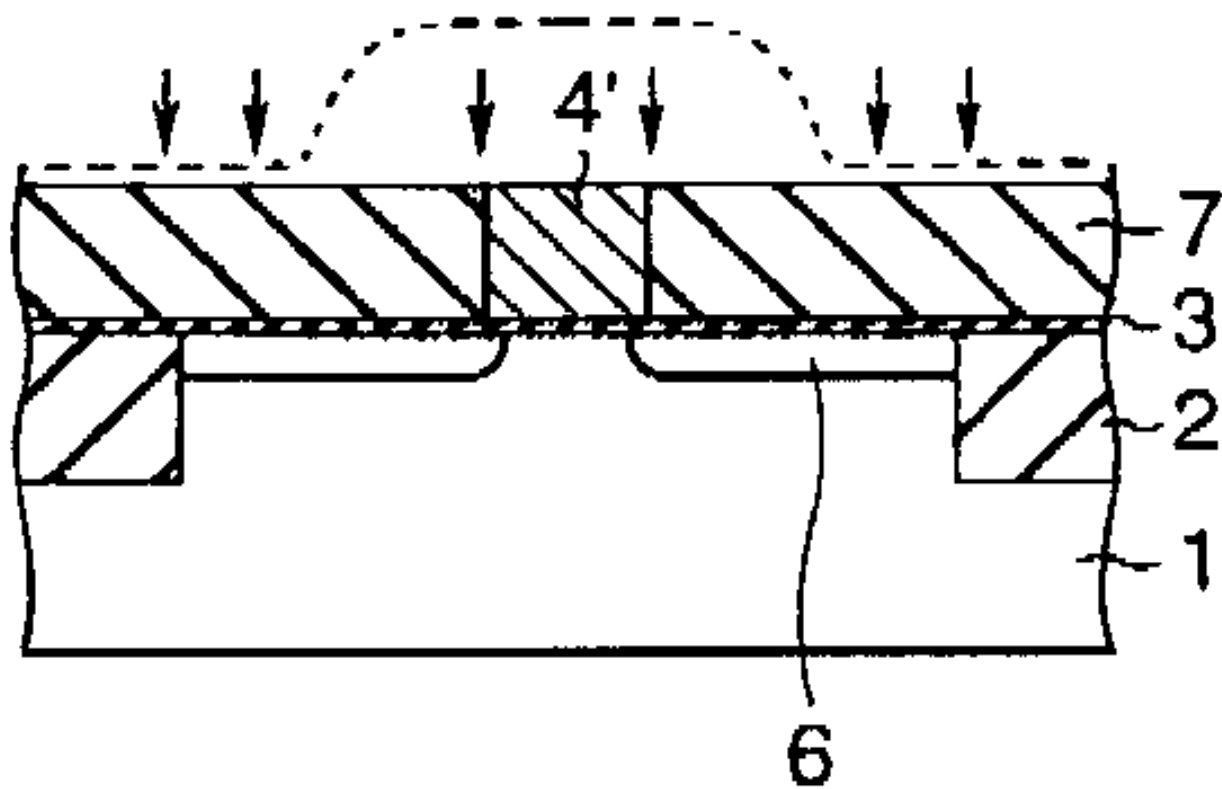
2d



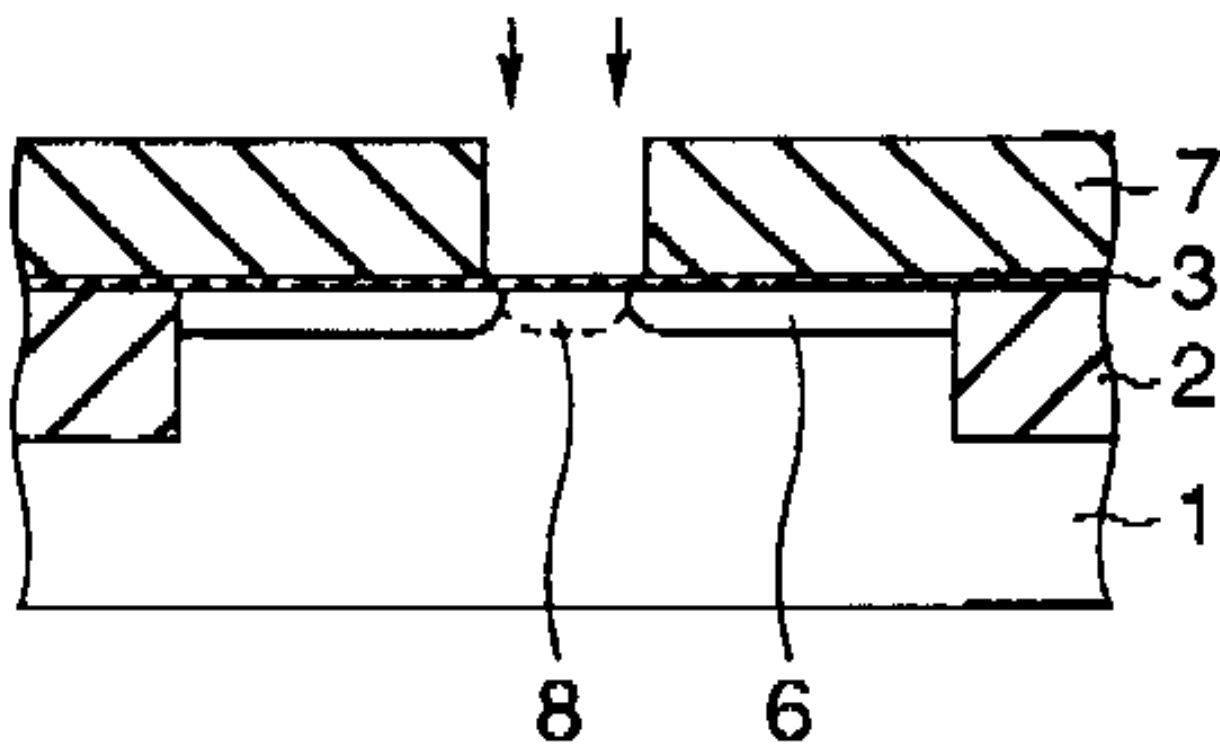
2e



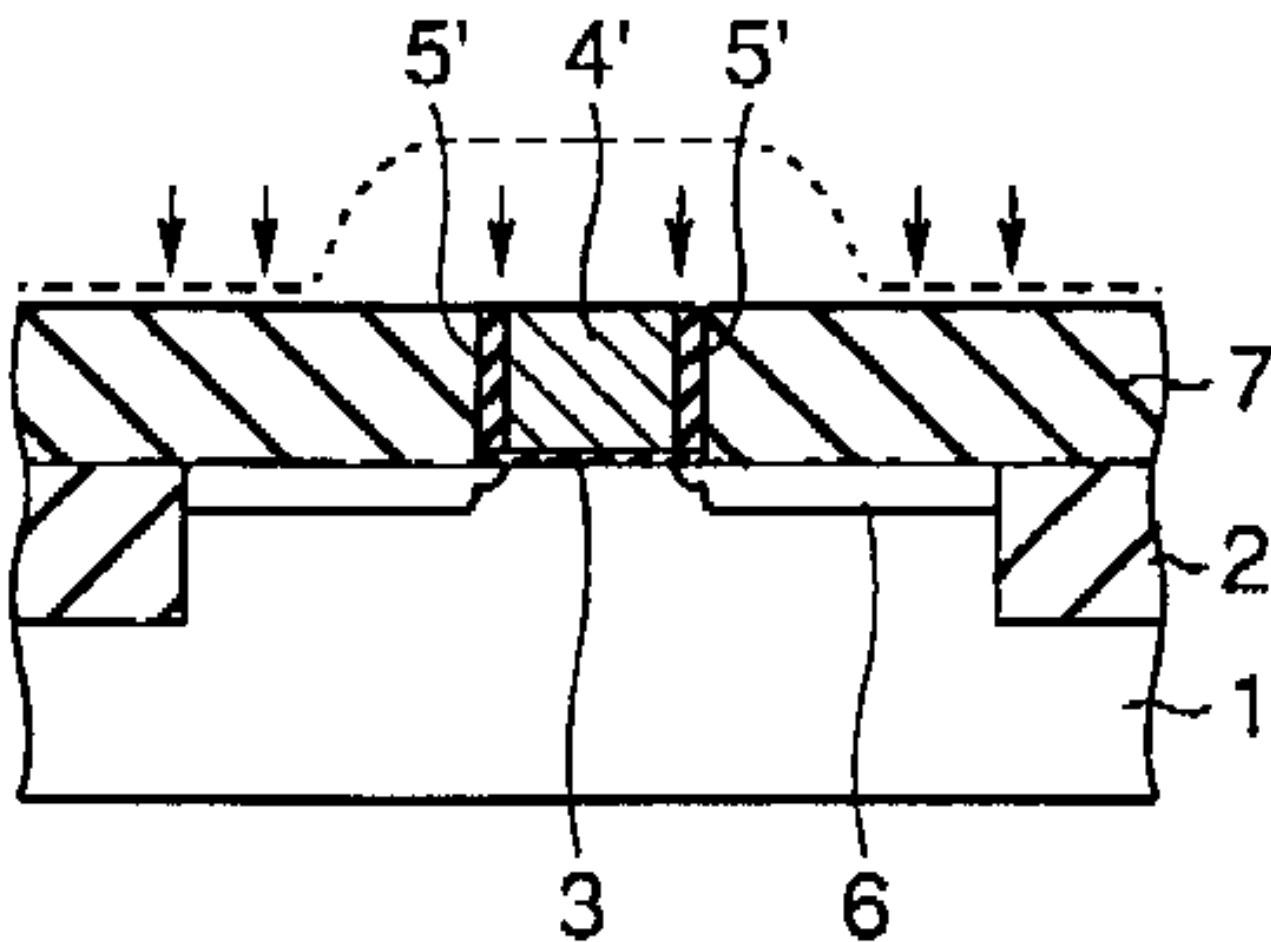
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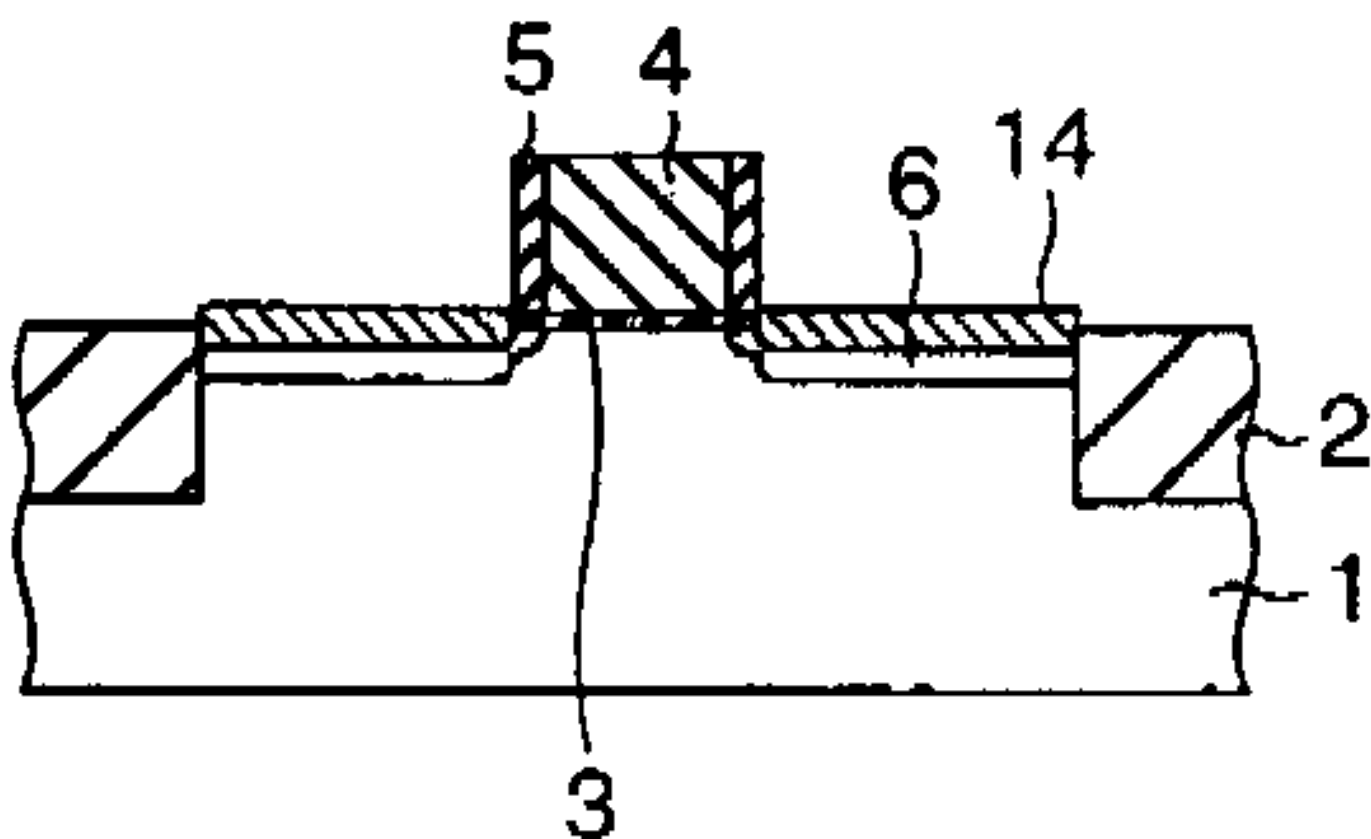
3b



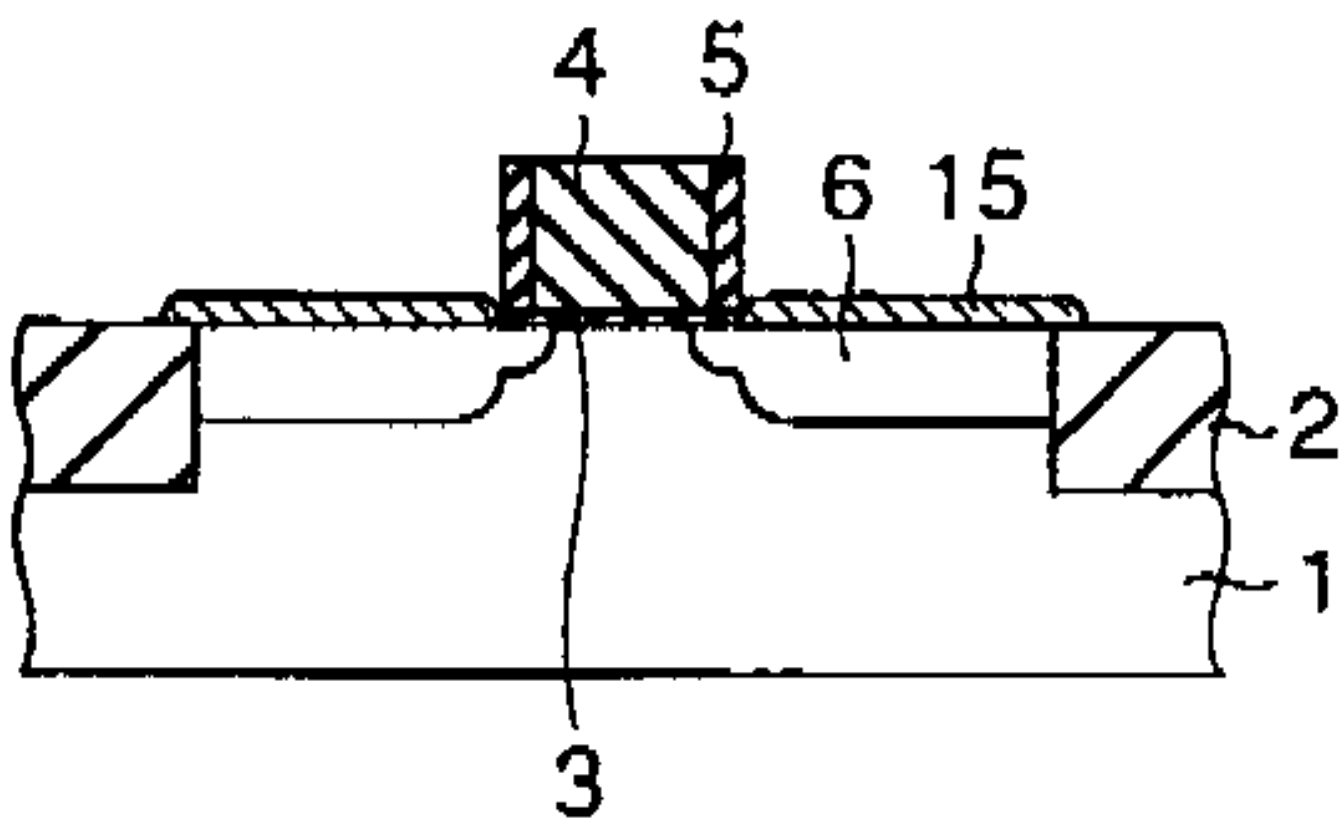
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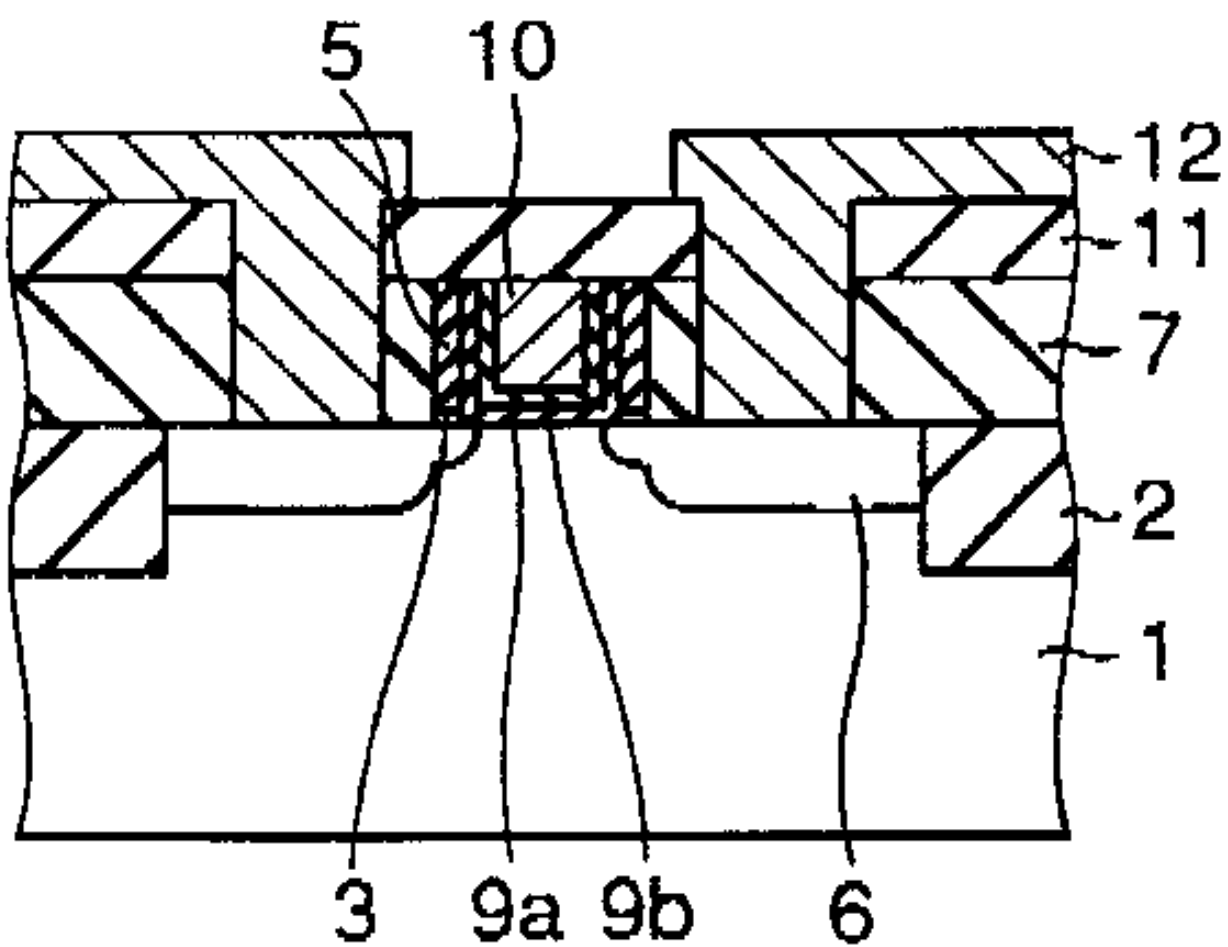
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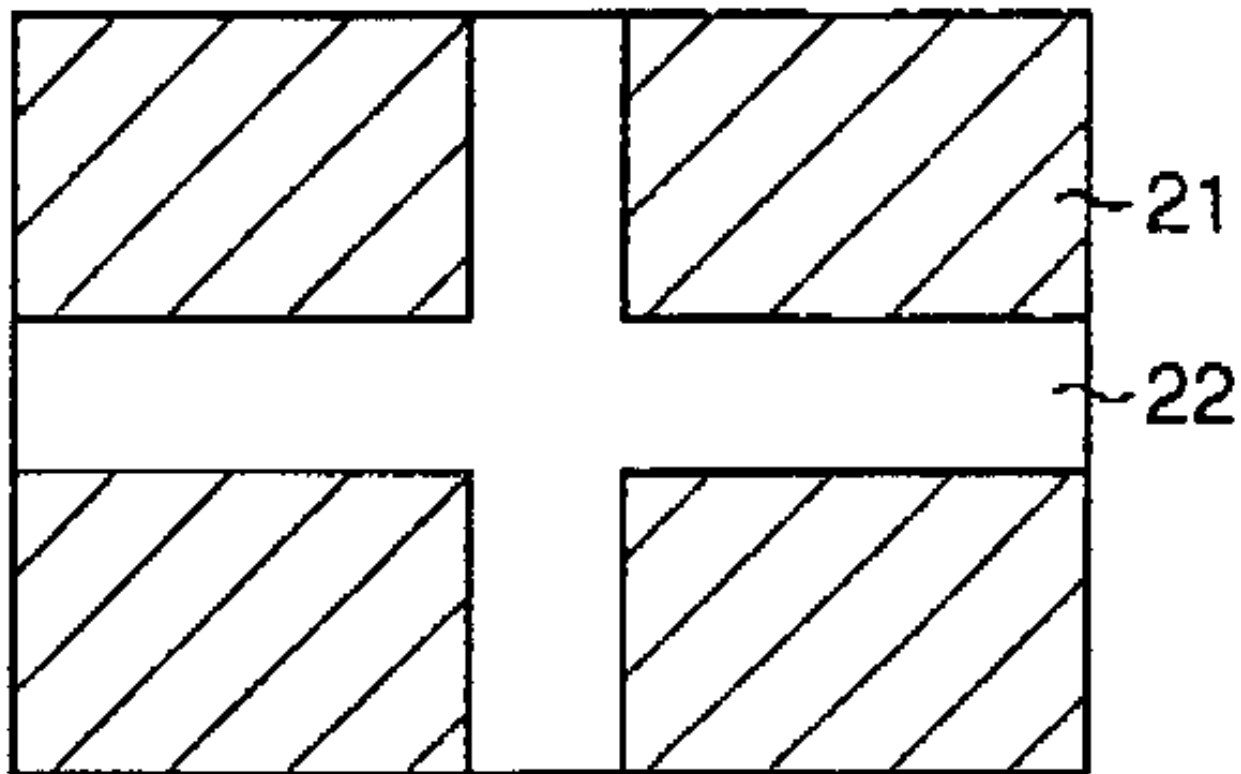
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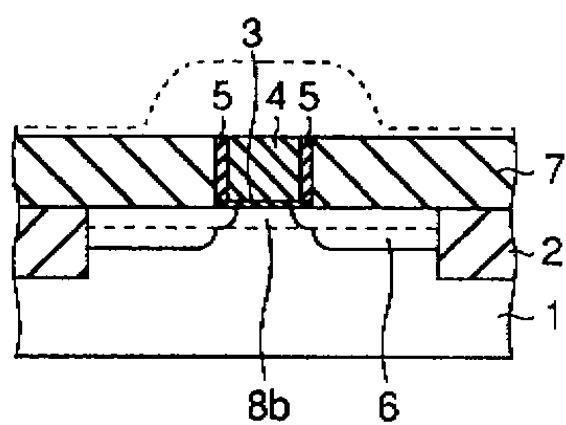
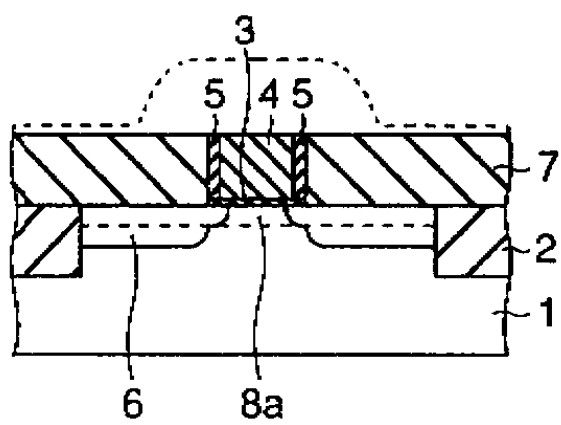
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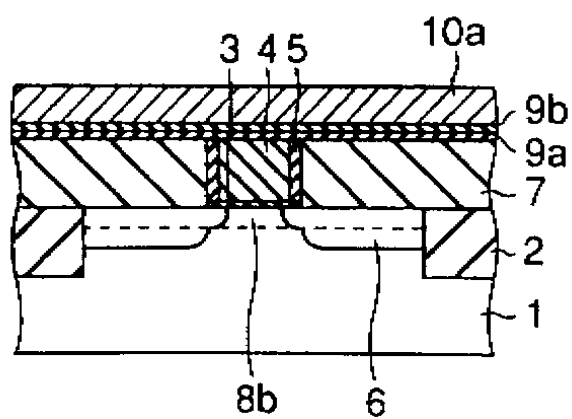
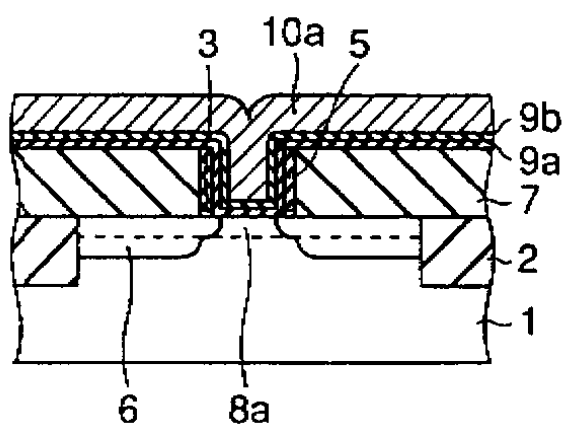
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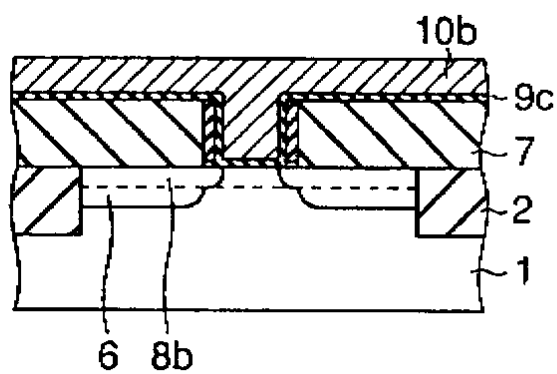
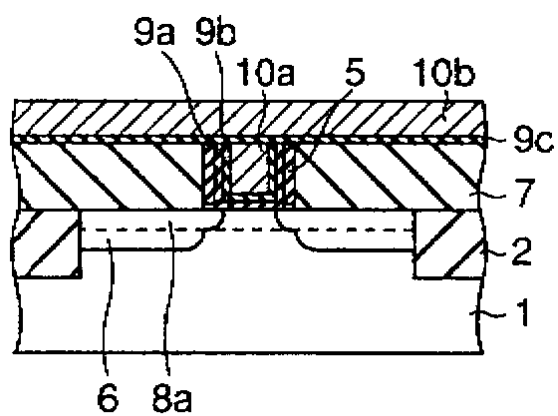
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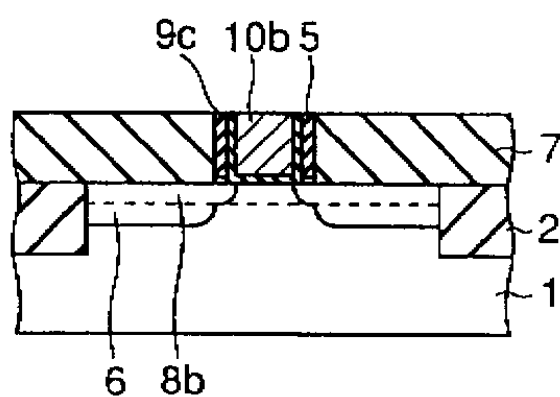
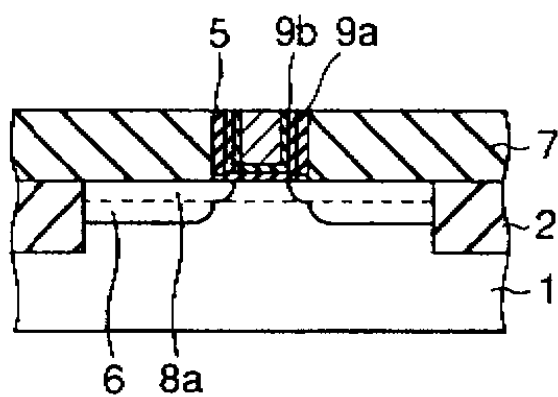
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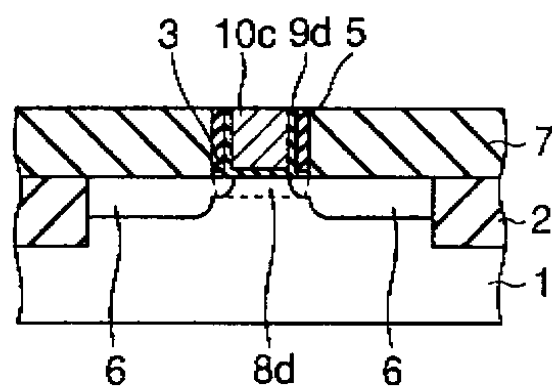
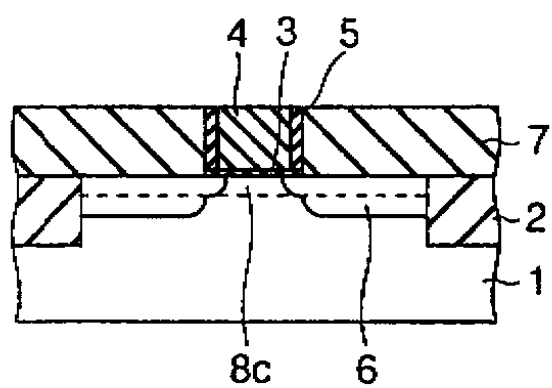
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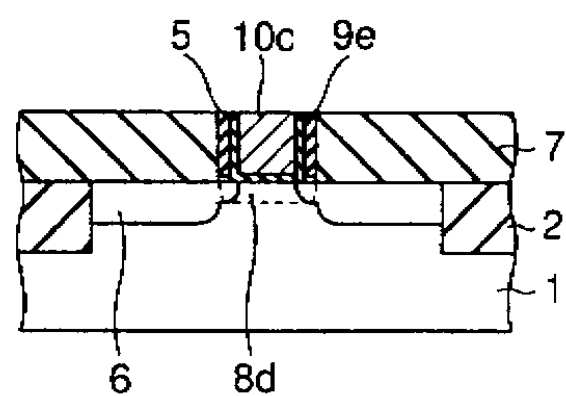
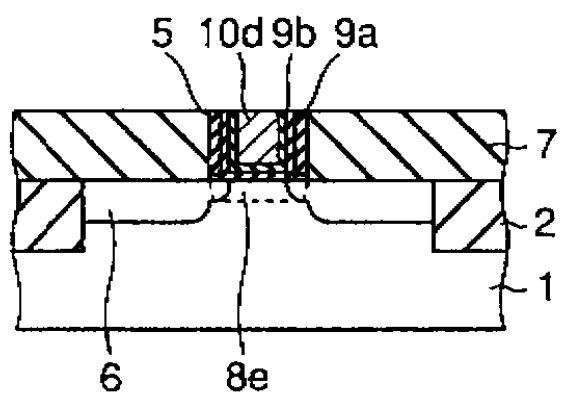
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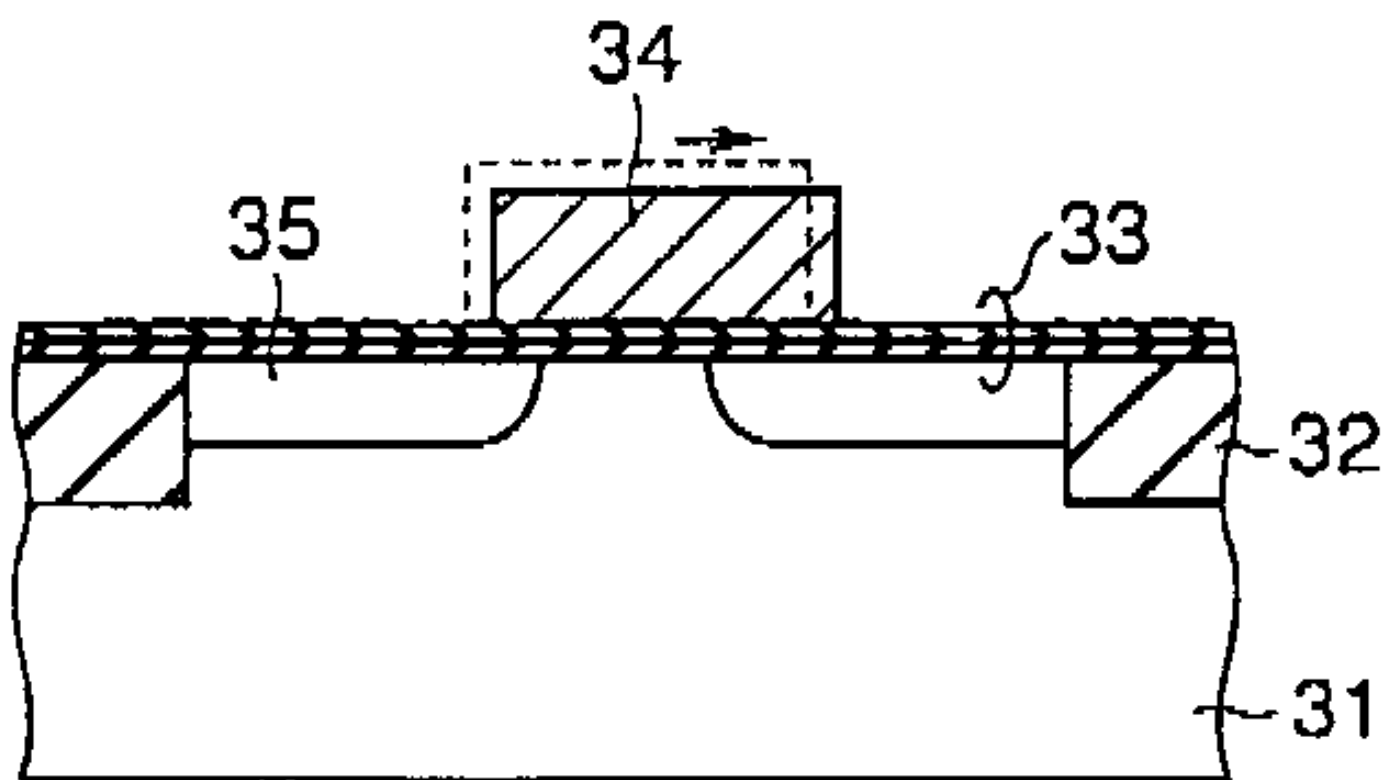
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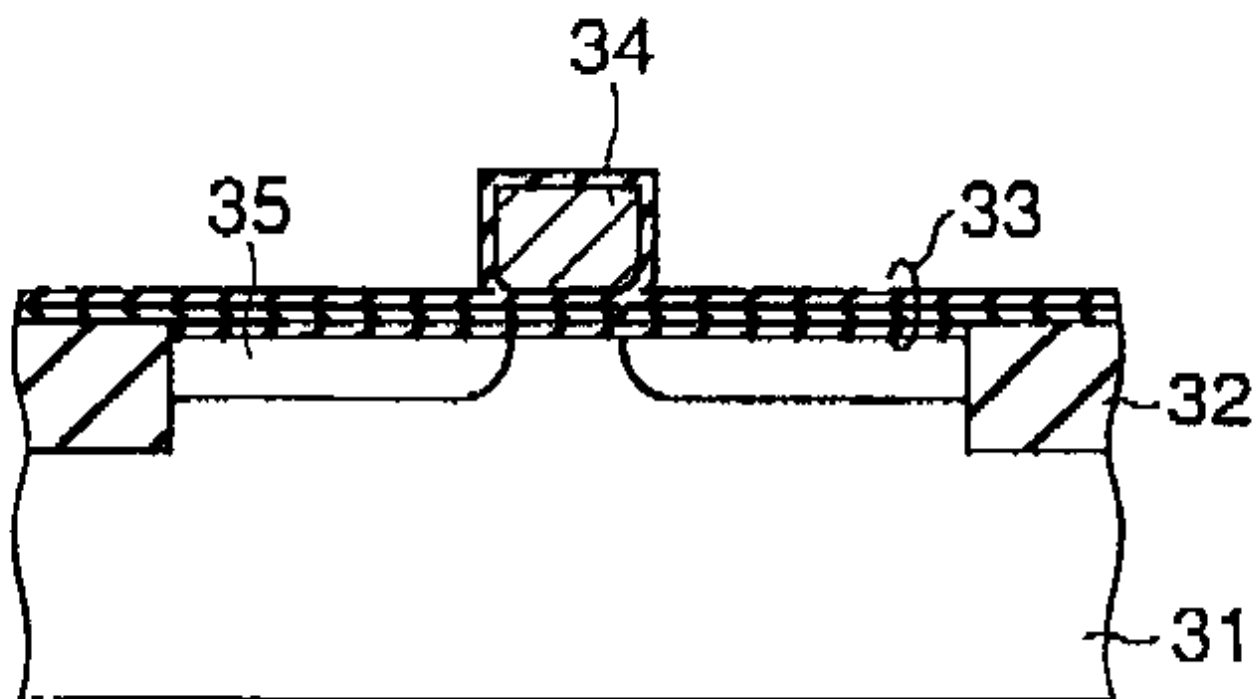
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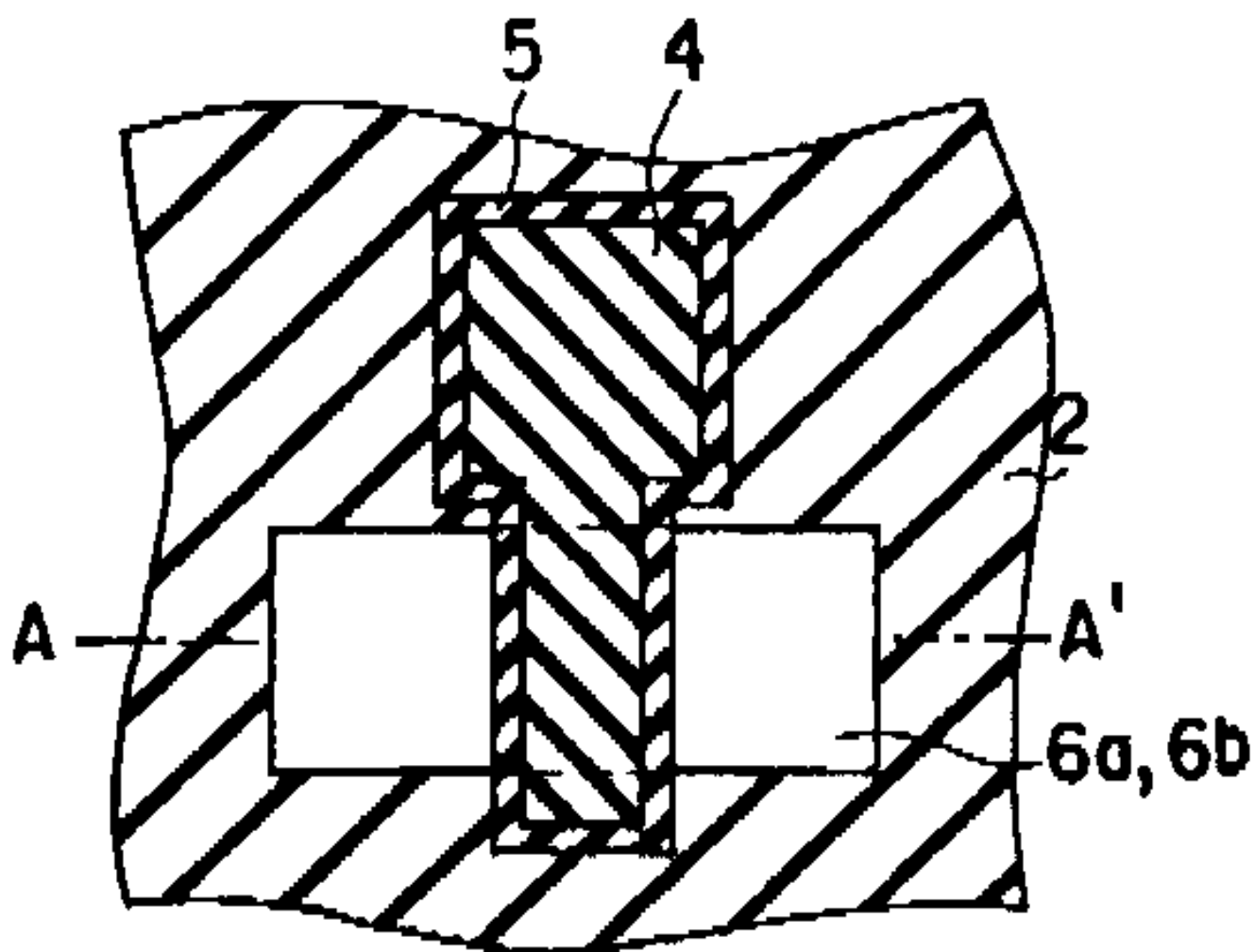
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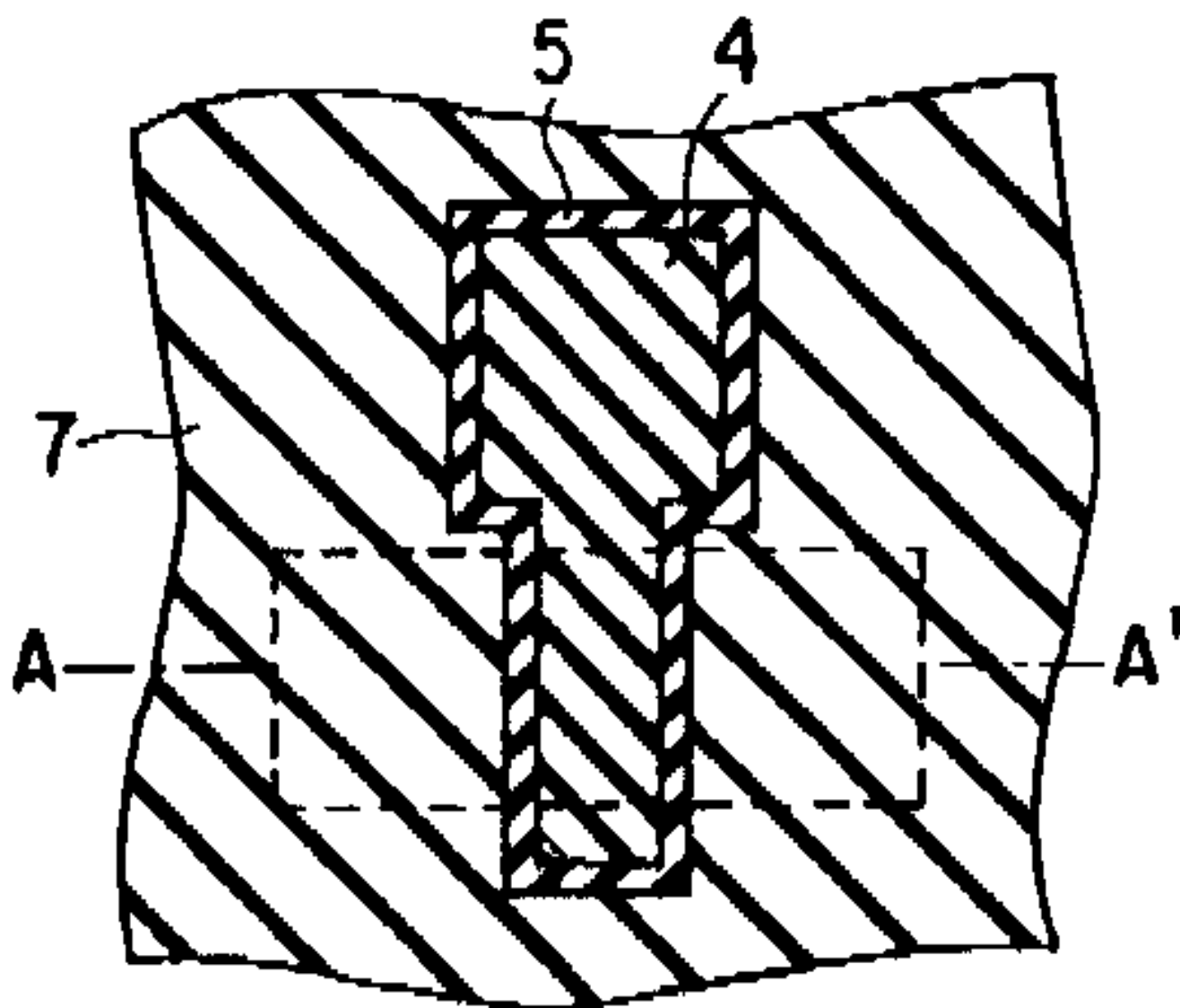
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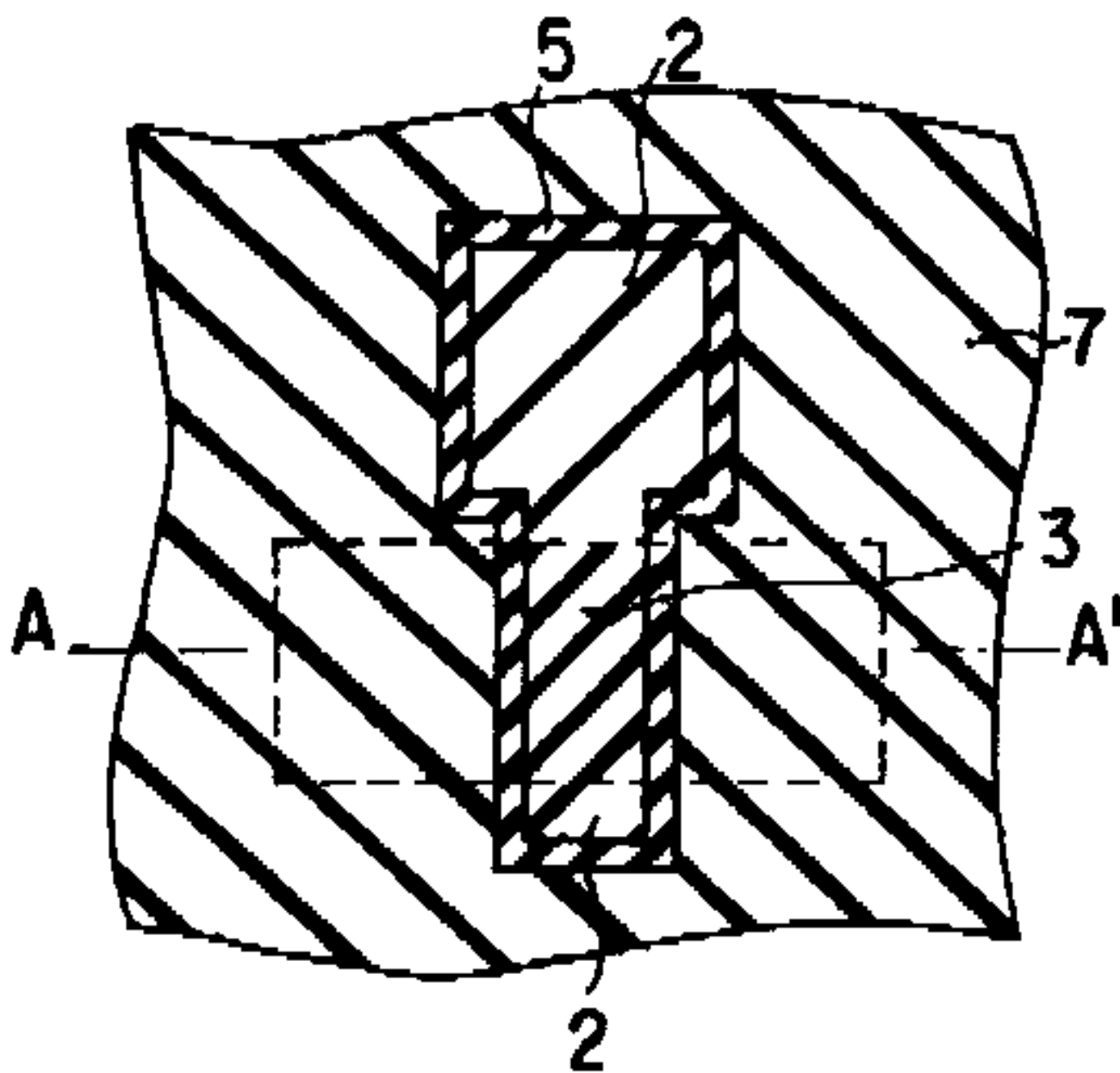
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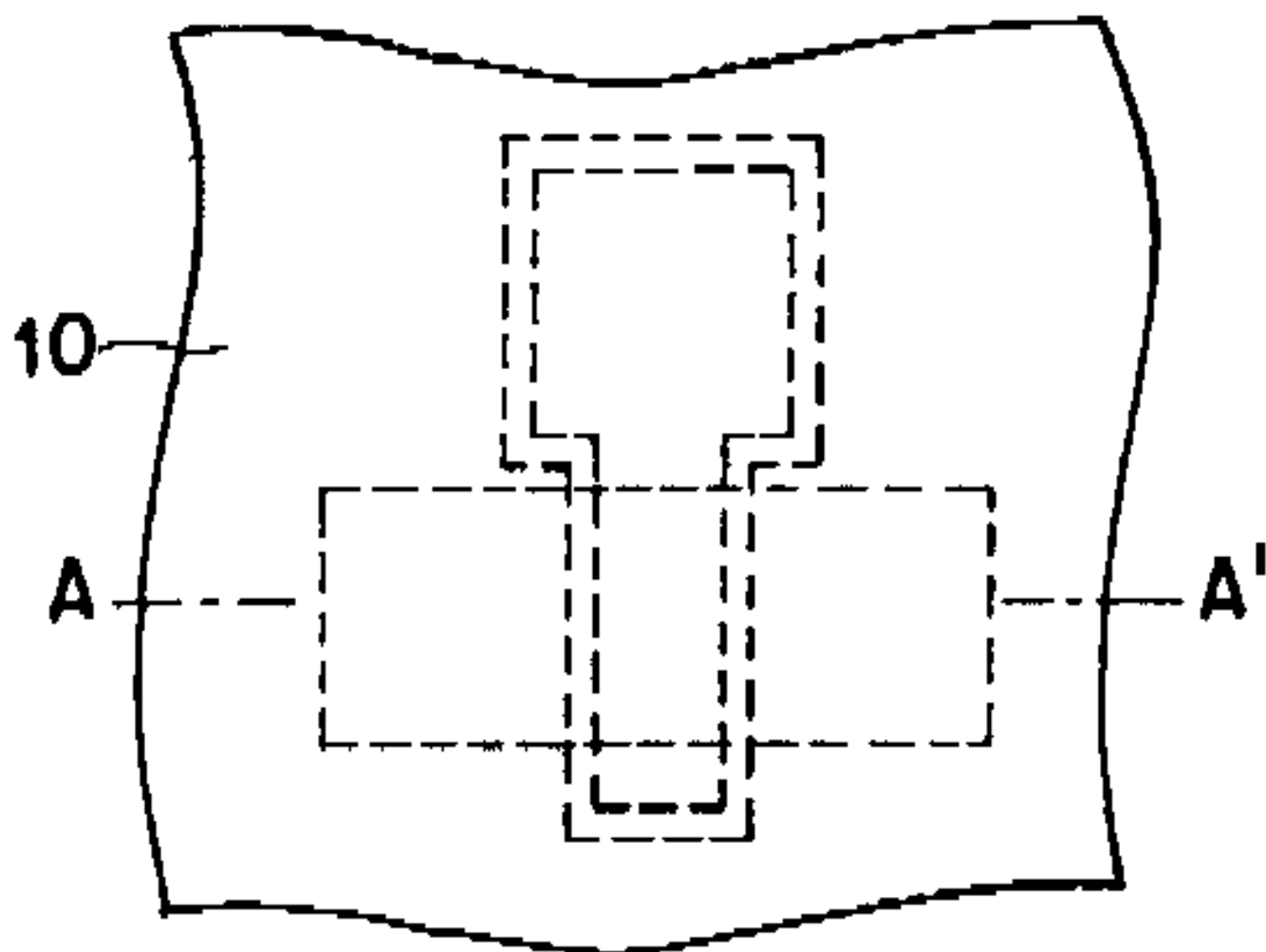
13b



13c



13d



13e

