

(19)  
(12)

(KR)  
(B1)

(51) 。 Int. Cl. <sup>7</sup>  
H01L 27/04

(45)  
(11)  
(24)

2001 12 12  
10 - 0316175  
2001 11 17

(21) 10 - 2001 - 0046733  
(22) 2001 08 02  
(62) 1998 - 0006077  
: 1998 02 26

(65) 0000 - 0000000  
(43) 0000 00 00  
1998 02 26

(30) JP - P - 1997 - 0004 1997 02 27 (JP)  
4244

(73) 가 가

1 1 1

(72) 가 가 가 1가 가  
가 가 8가 가  
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(74)  
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(54)

가 2 가 1 DRAM , 가

(22a, 22b)	(11b)	(11) (21A)	(11a) MOSFET (20B)	(22a)	MOSFET (20A) (22A)
1		1			
1	1			DRAM	
2	DRAM				
3	DRAM				
4	DRAM				
5	DRAM				
6	DRAM				
7	2		DRAM		
8	3		DRAM		
9	4		DRAM		
10	5		DRAM		
11	6		DRAM		
12	7		DRAM		
13	8		DRAM		
14	DRAM		MOSFET		
15	DRAM		MOSFET		
16	DRAM				
17	DRAM		MOSFET		
18	DRAM				

<

11 :

11a :

11b :

12 : ( )

20A : 1 (MOSFET)

20B : 2 (MOSFET)

21A, 21B, 21B' :

21A' :

22A, 22B :

22a, 22b :

22a' :

23A, 23B :

24A, 24B :

25A, 25B :

26A, 26B :

31 :

31a : 1

31b : 2

32A, 32B, 32B' :

33 :

33A :

33B :

33B' :

34 :

35 : 1

36 :

37 :

38 :

39 :

41 : TEOS

42 :

51 :

52 :

61 :

62, 63 :

71 :

1, 2 MIS DRAM(Dynamic Random Access Memory)

, LSI

가 0.1 $\mu$ m CMOS (試作)

가 가

가 ( )

가 .

가

(extension) 가

( )

LSI

1

가 .

가

SAC(Self Aligned Contact)

( )

, SAC

가

가 .

가

가

가

가 .

가

가

가 1  
 가 2  
 가가

MIS  
 가 2 1  
 1, 2

1 2 1 2 1 1

1 2 1 2 1 1

1 2 1 2 1 1

1 2 3 1 2 1 2 1 1

가 2(d+x)  
 가 2(d+x)

1

1 2 , 1 , 1 2 , 2 2 . , 1 1 2 , 1 1 2 1 2 , 1 1 2 , 1 2 , 2 2 , 2 2 , 2 2 . , 1 2 가 가 , 1 2 가 가 < , 1 2 DRAM DRAM (11) , 1 2 (MOSFET; 20A, 20B) MIS 가 . MOSFET(20A) (21A) ( 1 : 2 2A) , MOSFET(20B) (21B) ( 2 ; 22B) , 가 . , (11) ( : 12) , ( : 11a) ( : 11b) . (11) (11a) MOSFET(20A)가 MOSFET(20A) , (11) (23A) (21A) .

(21A) , (11) .  
 ( : 24A) .

, MOSFET(20A) ( , ) (24A) (25A)

, (21A) , SAC (Self - Aligned Contact) (26A) .  
 가

, MOSFET(20A) (21A) , ( 1 )  
 (22a) , (22A)

, MOSFET(20A) ,

, MOSFET(20A) , (11a) MOSFET(20A) (21A') ,

가 , SAC , MOSFET(20A)

, (11b) , 1 MOSFET(20B)가 MOSFET(20B)  
 (11) (23B) (21B)

(21B) (12) (11) , .  
 (24B)

(24B) , (25B) , 가

MOSFET(20B) (25B) MOSFET(20A) (2  
 5A) 가

, (21B) , SAC .  
 가 (26B)

, MOSFET(20B) (21B) , MOSFET(20A) (22A)  
 가 , (22B)

MOSFET(20B) (22B) , , ,  
 (22a) , ( 2 ) (22b)

, MOSFET(20A, 20B)가 (11) , (21A;  
 (21A') ), (21B) , (31)

(31) CMP(Chemical Mechanical Polishing) , .

(11a) (31) , (32A, 32B) (32A, 32B) ,  
 (32A) SAC MOSFET(20A) (21A)



(11) (32A) (25A) .

(11b) (32B) , MOSFET(20B) .

(32A, 32B) , MOSFET(20A, 20B) .  
 ( ; 33)가 , DRAM 가

DRAM , MOSFET(20A) , (22A)

MOSFET(20B) , (22B) 가 .

(21A) (32A)

가 .

가 , 가 .

2 6 , DRAM .

2 (11) , STI (Shallow Trench Isolation) ( ,  
 LOCOS ) (12) .

(11) (23A, 23B)  
 (26A, 26B) , (21A; (21A')

), (21B) .

(11a) , MOSFET(20A) (21A) (21A') , ,  
 0.1 $\mu$ m .

(11b) , MOSFET(20B) (21B) , , 0.1 $\mu$ m  
 10 $\mu$ m 20 $\mu$ m .

3 , (24A, 24B) .

n MOSFET , As 15 keV 5 x 10<sup>14</sup> cm<sup>-2</sup> , p MOSFET BF<sub>2</sub> 10keV 5 x 10<sup>14</sup> cm<sup>-2</sup>  
 -2 , Si Ge

가

(24A, 24B) , RIE(Reactive Ion Ething)

, MOSFET(20A) (21A, 21A') , , 50nm  
 (22a) (22A) .

, MOSFET(20B) (21B) , 50nm ,  
 (22a) .

, 4 , (22a)  
 , , TEOS (Tetra Ethoxy Silane) (41) .

, 5 , RIE TEOS (41) .

, MOSFET(20B) , (22a) (22b) ,  
 (21B) (22a, 22b) (22B) .

, MOSFET(20A) , (21A, 21A') , TEOS (41)  
 (22b) .

, , (21A') (22b) , (21A, 21A')  
 TEOS (41) , TEOS (41) 가 .

, (25B) ( ) , .

n MOSFET , As 50keV  $3 \times 10^{15} \text{ cm}^{-2}$  , p MOSFET  $\text{BF}_2$  35keV  $3 \times 10^{15} \text{ cm}^{-2}$   
 -2 , .

, MOSFET(20B) (24B) , , (21B) (22B)  
 ( , (22A) , (22b) )  
 (25B) , 가 .

, 6 , (31) , ,  
 , CMP .

(31) , (22a) .

, RIE , (42) (31) , MOSFET(20A) .  
 (32A) , MOSFET(20B) (32B)

, MOSFET(20A) (21A, 21A') , TEOS (41) (31)  
 , (22a) .

, MOSFET(20A) SAC 가 , (21A) ,  
 (32A) .

, MOSFET(20A) (21A') SAC , (12) (32A) ,  
 (21A') 가 .

, (12) , 가 .

, MOSFET(20B) SAC 가 , 가 (32B) (21B) ( ,  
 12) 가 가 .

(42) (25A) ( RTA ) (32A)

(Rapid Thermal Annealing)

(24A) (21A, 21A') (22A) (22a) (25A)

가

(25B) (25A) 가, MOSFET(20B)

STI (11a)

가

MOSFET(20B) 가 MOSFET(20A) (25A)

(32A, 32B) (31)

(33) MOSFET(20A, 20B) 1 DRAM 가

1 MOSFET(20B)

가

7 2 DRAM

1 DRAM 가 MOSFET(20B) (24B) (25B) ( 5 ), ( Ti ; 51)

RTA MOSFET(20B) (52) ( 7 (a) )

Ti (11a) (21A, 21A') (11b) (21B)

(52) 가

(52) (21B) (22B)

(12)

MOSFET(20B) (22a, 22b) (21B)

(52)

(31) CMP

RIE (42) (31) MOSFET(20A) (32A) MOSFET(20B) (52) (32B)

(42) (32A) (25A) (

(52) (相轉移) RTA .

(24A) (21A, 21A') (22A)

, MOSFET(20B) (25B) 가 ( 7 (b) ). (24A)

(25A)

(32A, 32B) (31)

(33)

DRAM 가 ( 7 (c) ).

1 DRAM 가

MOSFET(20B) (22B)

, MOSFET(20B) (52)

(25B) 가 (22B)

(52) 가 가

(22b) (25B) (52)

가

, MOSFET(20A) (33)

, 가 (P) (W)

8 3 DRAM

1 DRAM 가 , MOSFET(20B) (21B)

(22b) TEOS (41) ( 4 ), SAC

MOSFET(20A) (61)

(61) (25A) ( )

(62) (61) P W

( 8 (a) ).

, RIE TEOS (41)

, MOSFET(20B) (21B) (22a) (22b)

, (21B) (22a, 22b) (22B)

, MOSFET(20A) (21A') (61)

(62) (22b) , (21A, 21A') T

EOS (41)

, (25B) ( ) .

, MOSFET (20B) (24B) (21B) (22B) 가 .

, MOSFET (20B) (24B) (25B) ( ) .

, RTA MOSFET (20B) (61) (62) , (52) ( 8 (b) ) .

, , (31) CMP , ,

, RIE MOSFET (20A) (62) (52) (52) (32A) , MOSFET (20B) (52) (32B)

, (32A, 32B) (31) .

, (33) MOSFET (20A) DRAM 가 ( 8 (c) ) .

, 2 DRAM 가 MOSFET (20A) (33) 가 가

, MOSFET (20A) (24A) (25A)

MOSFET (20B)

, MOSFET (20A, 20B) , (32A, 32B) (52)

, MOSFET (20A) 가 ,

, MOSFET (20A) (21A, 21A') (32A) 가 .

9 4 DRAM .

, 1 DRAM 가 , MOSFET (20A, 20B) (22a) ( 3 ) , ( 3 ; 71) .

(71) (31) SAC , (22a)

(a) (71) , (22b) TEOS (41) ( 9 ) .

, RIE TEOS (41) ( 9 (b) ).

(71) MOSFET(20B) (22a)  
 (71) (22b) (21B) (22)

B) , MOSFET(20A) (21A') (22b) ,  
 (21A, 21A') TEOS (41) .  
 (25B) ( ) (71)

, MOSFET(20B) (24B) (21B) (22B)  
 (25B) 가 .  
 (31) , CMP

, RIE MOSFET(20A) (32A) MOSFET(20B)  
 (32B) .

, MOSFET(20A) (31) TEOS (41) , ,  
 (21A, 21A') (12) (32A)  
 (32A, 32B) (71) ,

(71) ,  
 (12) (32A) , ( )  
 12) 가 .

, (32A, 32B) (31) .  
 (33) MOSFET(20A, 20B) (32A)  
 (21A, 21A') (12) 가 ( 9 (c) ).  
 DRAM

, 1 DRAM 가 (12) (32)  
 (21A, 21A')

A) , 4 DRAM (21A') (12)  
 (32A) (21A) 가 .

, DRAM MOSFET(20B) .

10 5 DRAM , 10 (a) DRAM  
 , 10 (b) .

DRAM (11) 1, 2 MOSFET(20A, 20B) M

IS

T(20B) MOSFET(20A) (24B) (52) ( ) MOSFE

DRAM

(12) (11) (11a) (23A)

MOSFET(20A) (21A) (11b) (23B)

MOSFET(20B) (21B)

(12) (23B) (21B')

(21A, 21B, 21B') (26A) (26B)

(11) MOSFET(20A) (24A) MOSFET

(20B) (24B)

(22A) (22a) MOSFET(20A) (21A)

MOSFET(20B) (21B, 21B') (22B) 가

(22a)

TEOS (41) RIE (21A) TEOS

(41) (21B) (22b)

(22b) (22a)

( , Ti TiN ) CVD

RTA (24B) MOSFET(20B) (24B)

(11) 1 (31a)

CMP

1 (31a) SAC MOSFET(20A) (21A)

(24A) (32A)

1 (31a) MOSFET(20B) (24B)

(52) (52) (32B) ( )

(32B')

(12) (21B')

6B) (32B') (開孔) (2

(32B') (26B) (31a)

(24A) (32A, 32B, 32B') MOSFET(20A) (24B)  
 (52) ; 33A), MOSFET(20B) (21B')  
 (33B')

(11a) 1 (31a) (33A)가 (34)  
 (11b) 1 (31a) (33B) (33B')가 1  
 (35)

2 (31b) (11a) 1, 2 (31a, 31b) MOSF  
 ET(20A) (24A) (36)

(11a) 2 (31b) (36) (37)  
 ( ) (38)

(39) DRAM 가

DRAM (21A)  
 Sa가  $S_a < 2(x + d)$ 가 (21B) Sb가  $S_b < 2(x + d)$ 가

d (22a) , x (22b)

b  $S_b < 2(x + d) + C$ 가 (33B) (C) (21B) S

(21B) (22b) (21A) TEOS (41)  
 가

(22b) MOSFET(20B) (24B)  
 (52)

(22a) (52) MOSFET(20B) (24B)  
 (22b) x 가

(52) MOSFET(20B) (24B) (24B) (52)  
 MOSFET(20B) (24B) (52)

(52) 가

DRAM

11 6 DRAM

DRAM (21A) 5 MOSFET(20A) MOSFET(  
 20B) (24B) (63) (52) (63)

(52)



6) 6 DRAM , MOSFET(20A) (33A) (3  
 가 가 MOSFET(20A) 가  
 , 3 DRAM .

12 7 DRAM . ,  
 (52) .

5 DRAM 가 , (21B, 21B')  
 (22a) ( 12 (a) ), TEOS (41)  
 ( 12 (b) ).

TEOS (41) MOSFET(20A)  
 (21A) TEOS (41) , TEOS (41) ( 12 (c) ).

( 12 (d) ), RTA ( , Ti TiN ; 51) CVD  
 (52) ( 12 (e) ). (51) (24B)

(51) , MOSFET(20B) (24B)  
 (24B) (52) ( 12 (f) ).

OSFET(20B) . TEOS (41) , M  
 가 (24B) (52)

13 8 DRAM . ,  
 (52) .

5 DRAM 가 , (21B, 21B')  
 (22a) , (71) ( 13 (a) )  
 ).

(71) TEOS (41) ( 13 (b) ).

TEOS (41) MOSFET(20A)  
 (21A) TEOS (41) , TEOS (41) ( 13 (c) ).

(71) , (52) (24B)  
 (51) CVD ( 13 (d) )  
 ).

RTA (51) (24B) (52) ( 13 (e) ).

(51) MOSFET(20B) (24B)  
 (24B) (52) ( 13 (f) ).

8 DRAM , TEOS (41) TEOS (41)  
 (71) , (52) 가  
 , TEOS (41) (71) ,  
 (11) .

(22B)

가 .

(22b) 2 가 . 가

(22b) (31, 31a)

5 DRAM( 10 ) MOSFET(20B)

14 (21B) (22a) (22b) (22B)  
MOSFET(20B)

4 (a) (31a) (22b) (22b) 가 . 1

MOSFET(20B) 1 (31a) (22b)  
(25B) (24B)

(31a) 14 (b) (22b) 1  
(31a) 14 (c)

15 (21B) (22B) (22a) (22b)  
(71) MOSFET(20B)

1 (31a) 15 (a) (22b)  
가 .

1a (22b) MOSFET(20B) 15 (b) 1 (3) (31a)  
(22b) 가 . 1 (24B)

(25B)

(31a) 15 (c) (22b) 1  
(31a) 15 (d)

16 (22a) (22b) (71) 가 .  
(32B) (52) (11) 가  
(71) 가

1 (31a) (22b) 1  
(31a) (22b)

17 (21B) (22B) (22a)  
(22a') (52) MOSFET(20B)

(22a') , (22a)

, 1 (31a) , 17 (a) (22b)  
가 .

1a) MOSFET (20B) , 17 (b) 1 (3) (31a)  
(22b) (22b) 가 , 1 (24B) ,

(25B)

(31a) , 17 (c) (22b) 1  
, 17 (d) .

, (22a') (52) , 18  
(32B) 가 .  
(11)

1 (31a) (22b) , 1  
(31a) (22b) ,

, 5 DRAM (21A) Sa가  $Sa < 2(x + d)$ ,  
(21B) Sb가  $Sb < 2(x + d)$ 가 (52)  
, 1 DRAM 가

가 가 .

가 2 가 1

가 가

(57)

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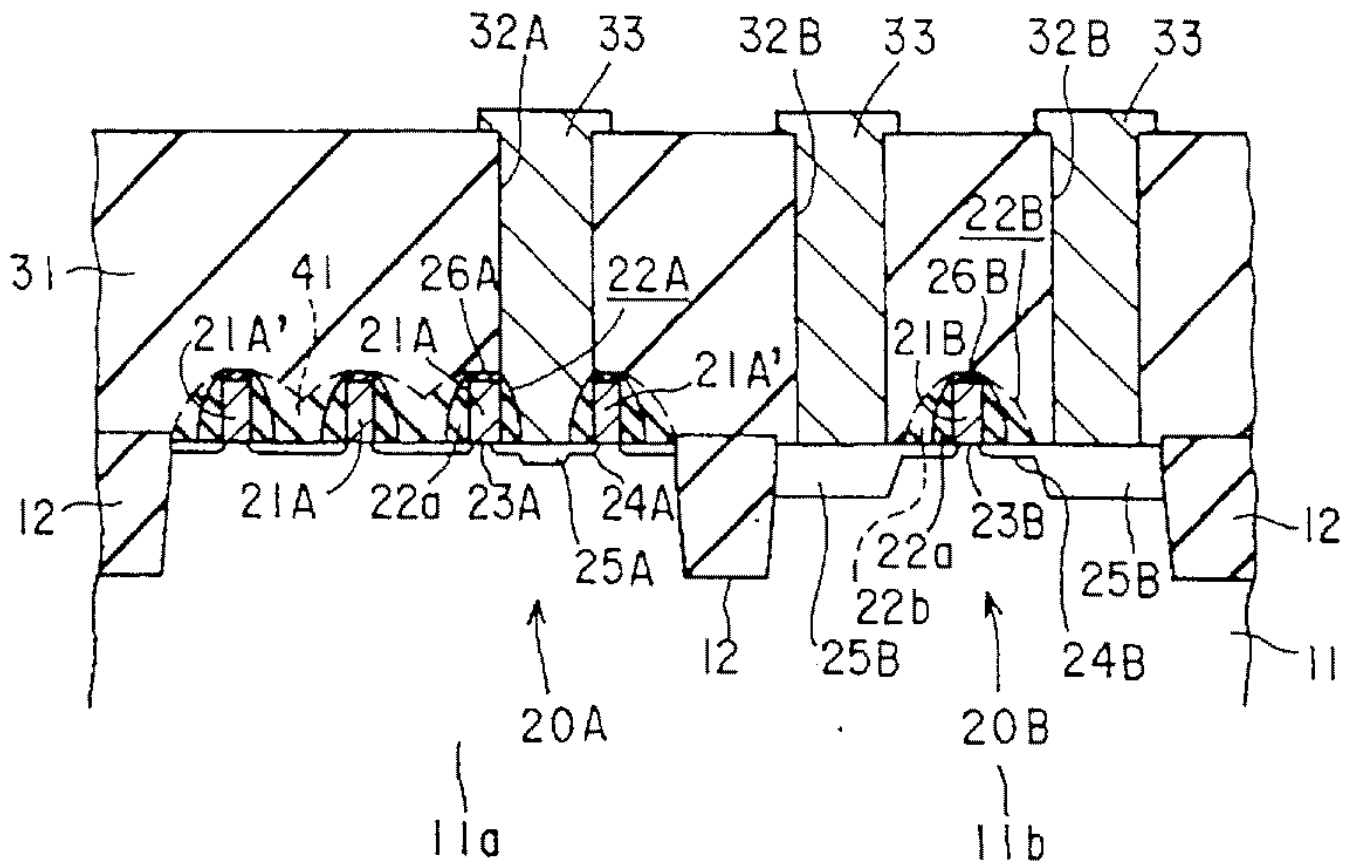
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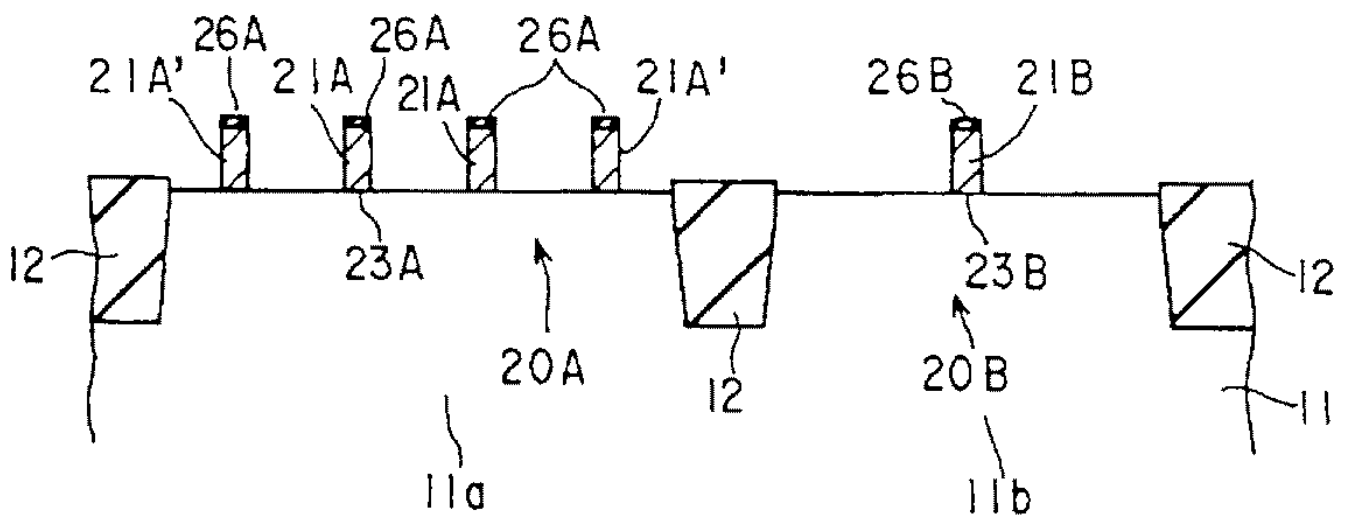
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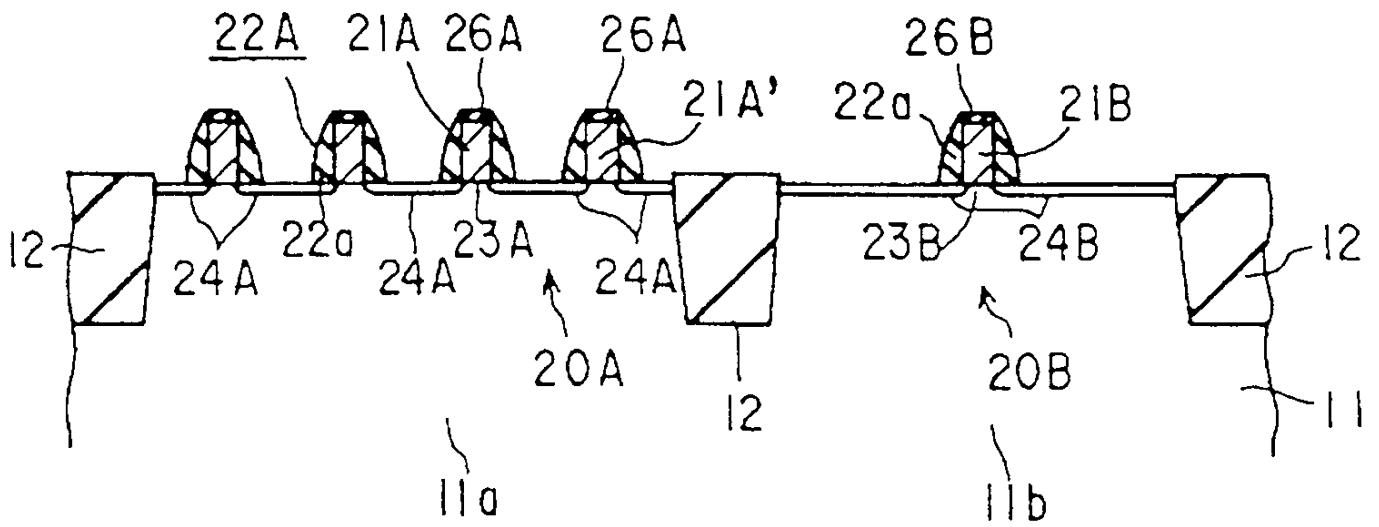
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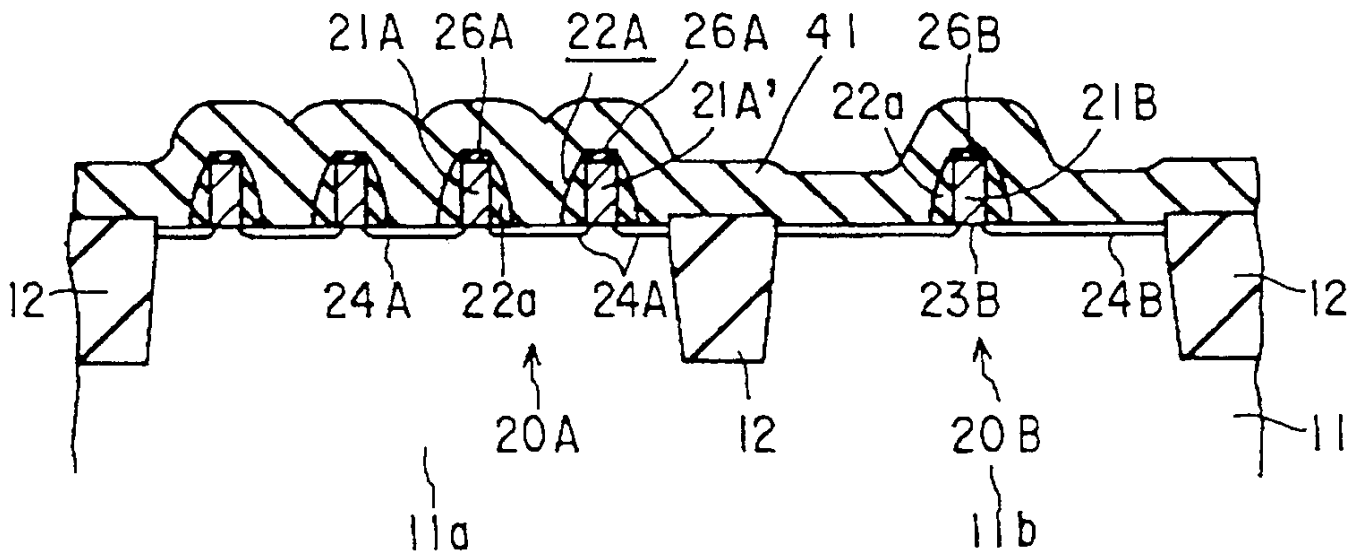
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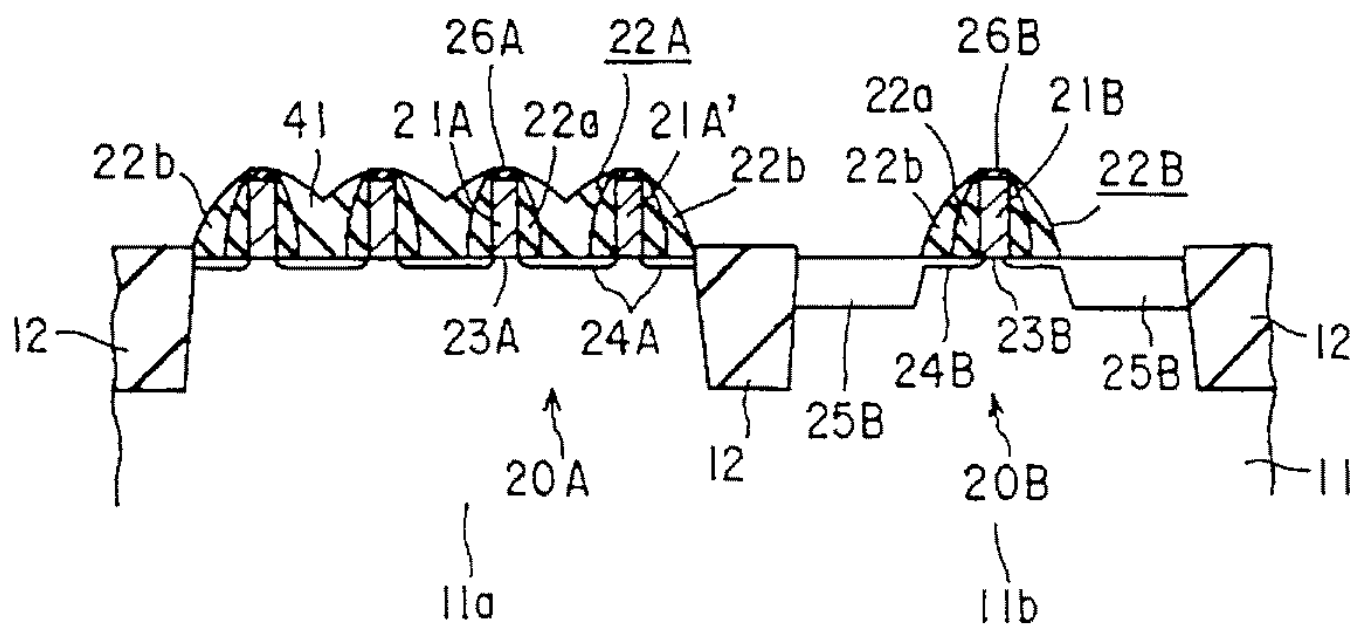
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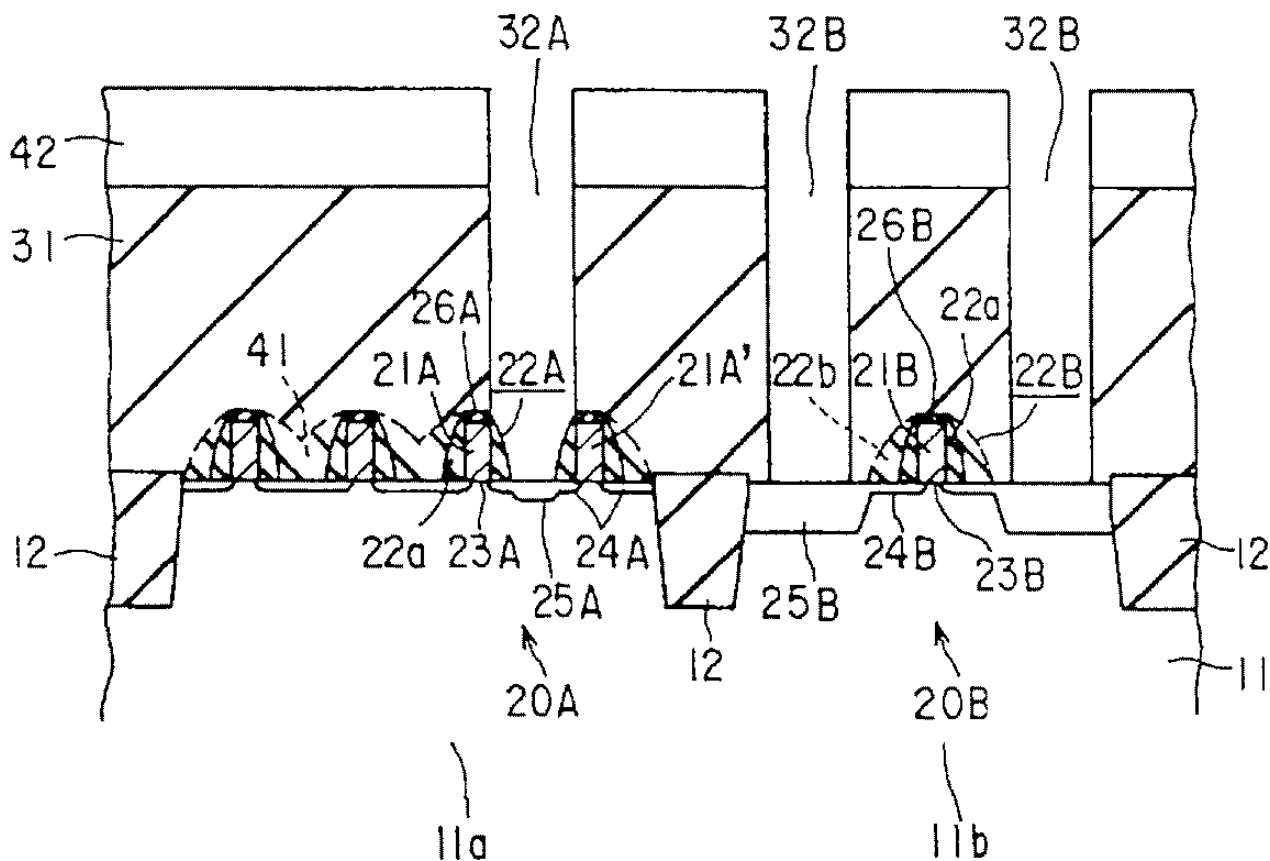
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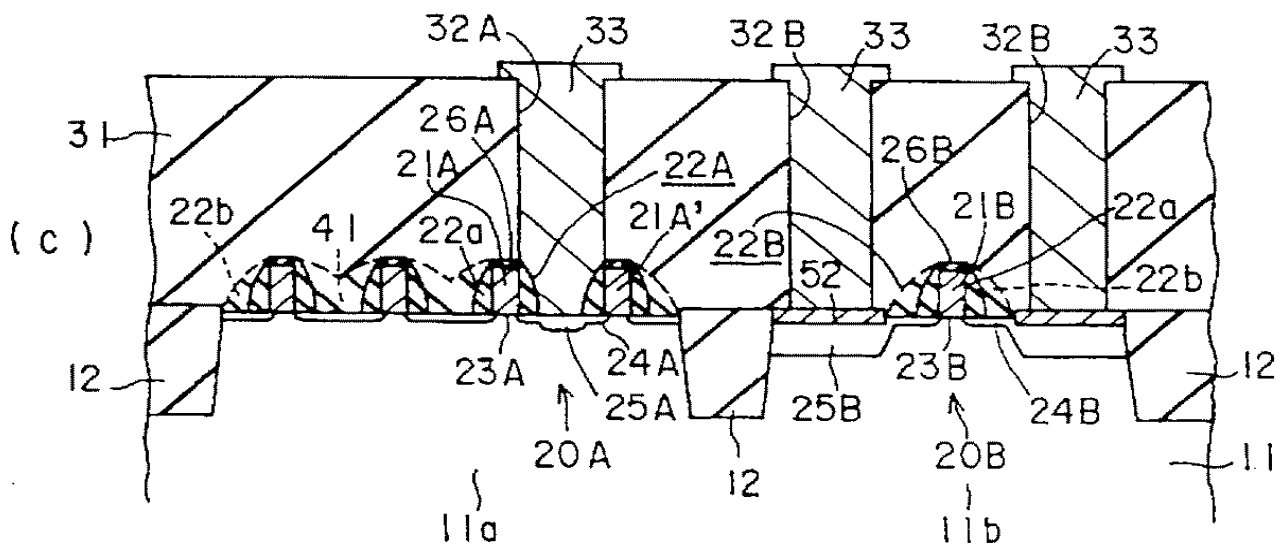
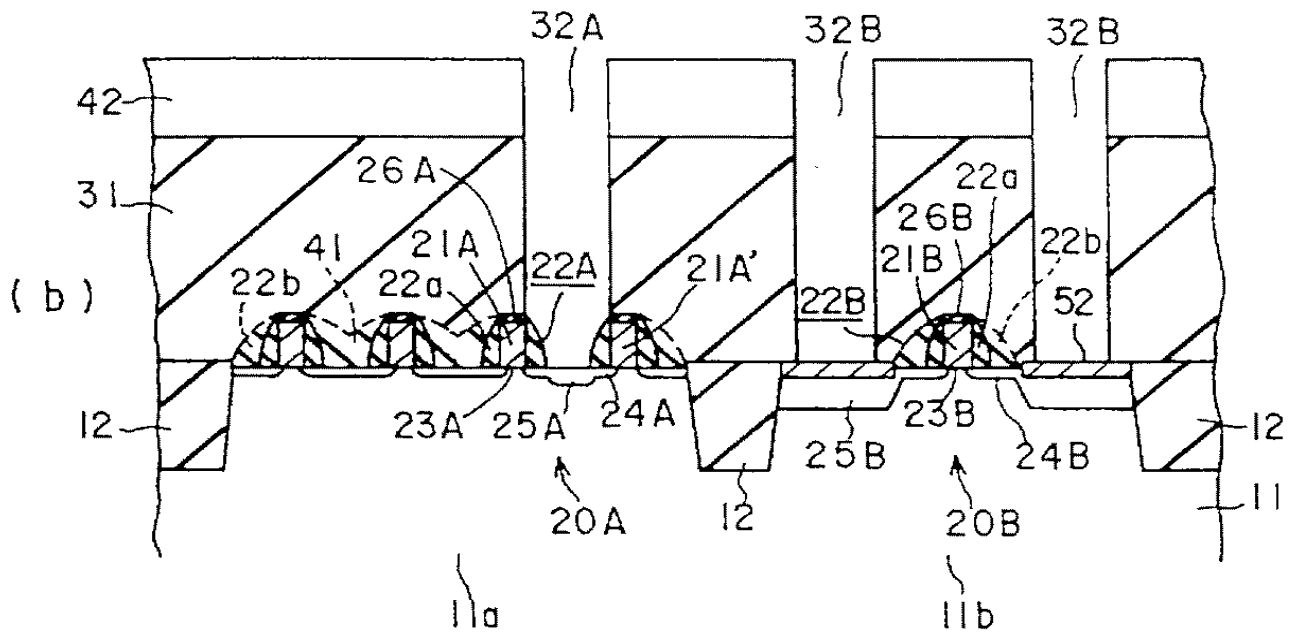
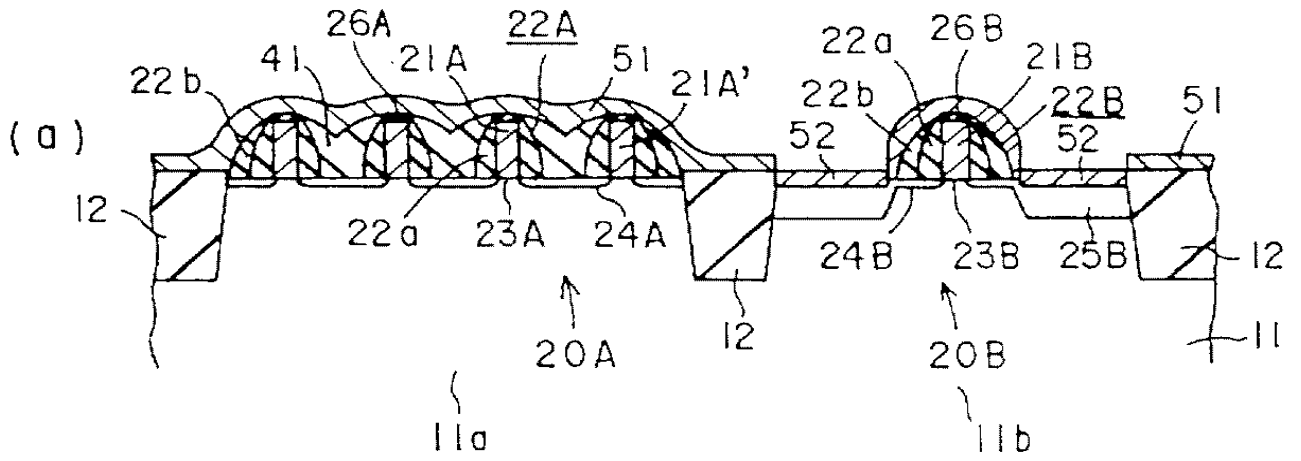
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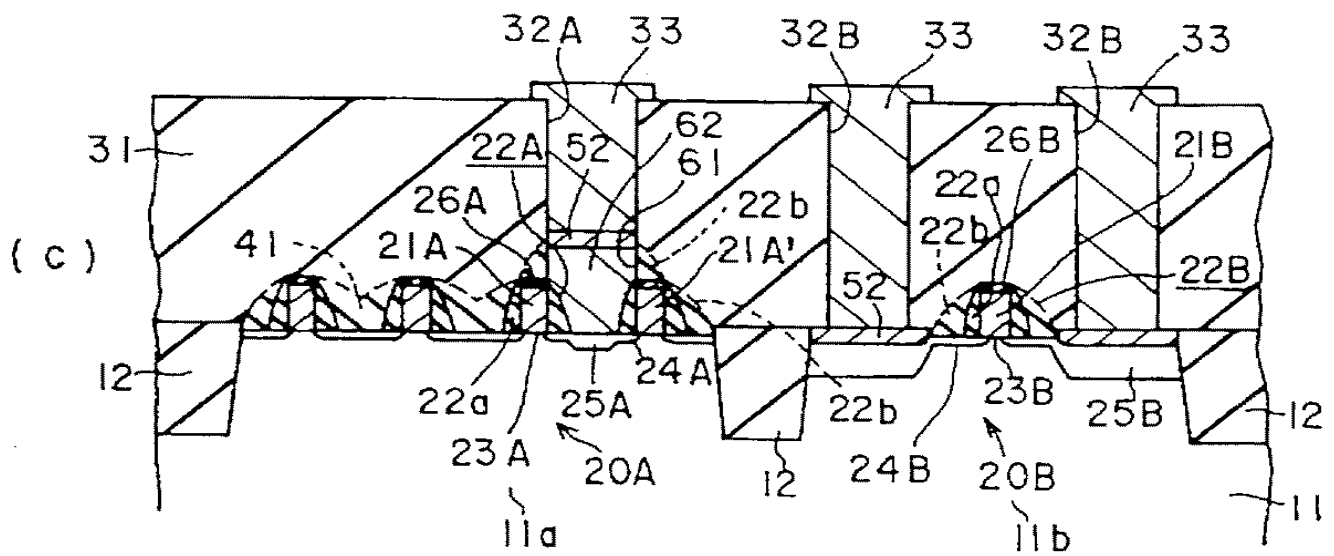
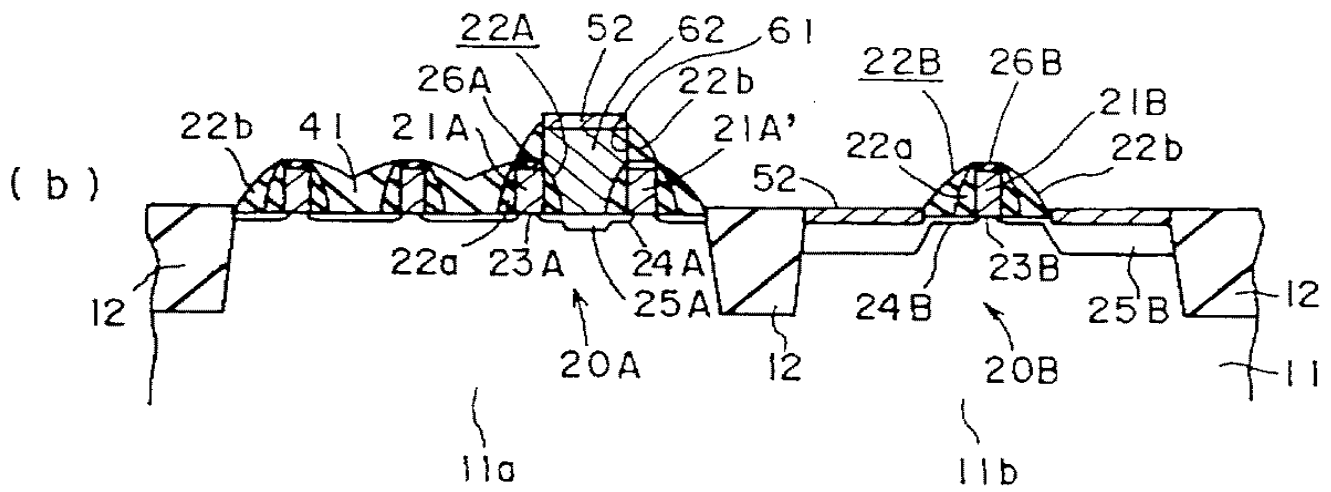
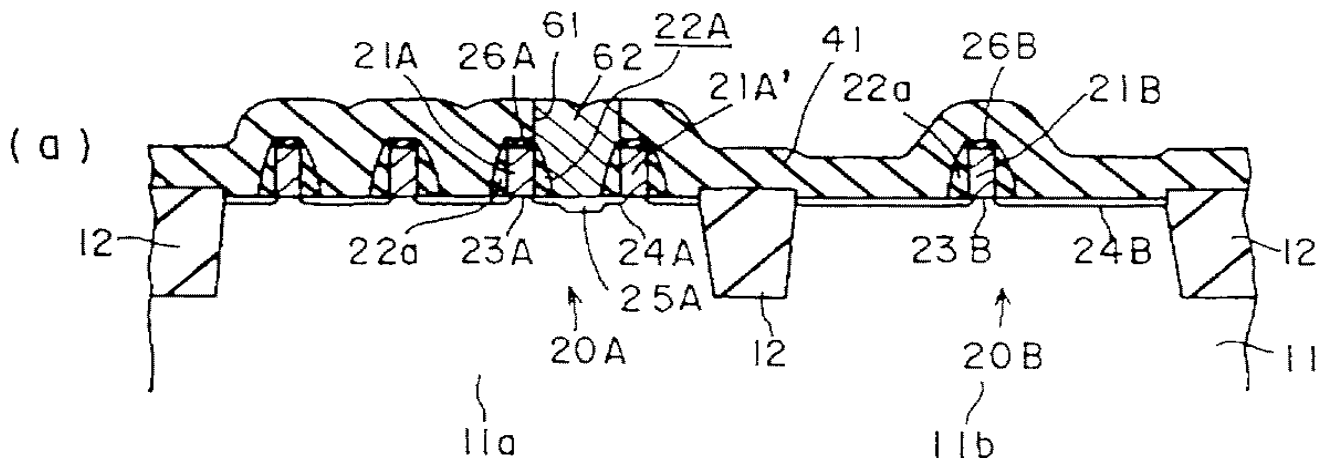


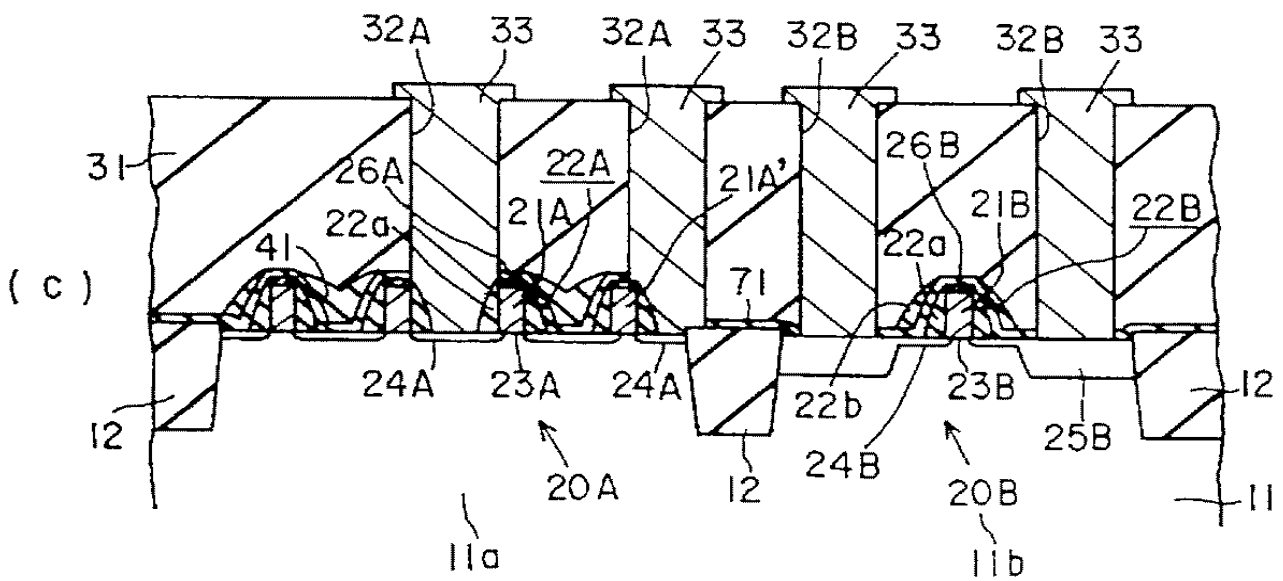
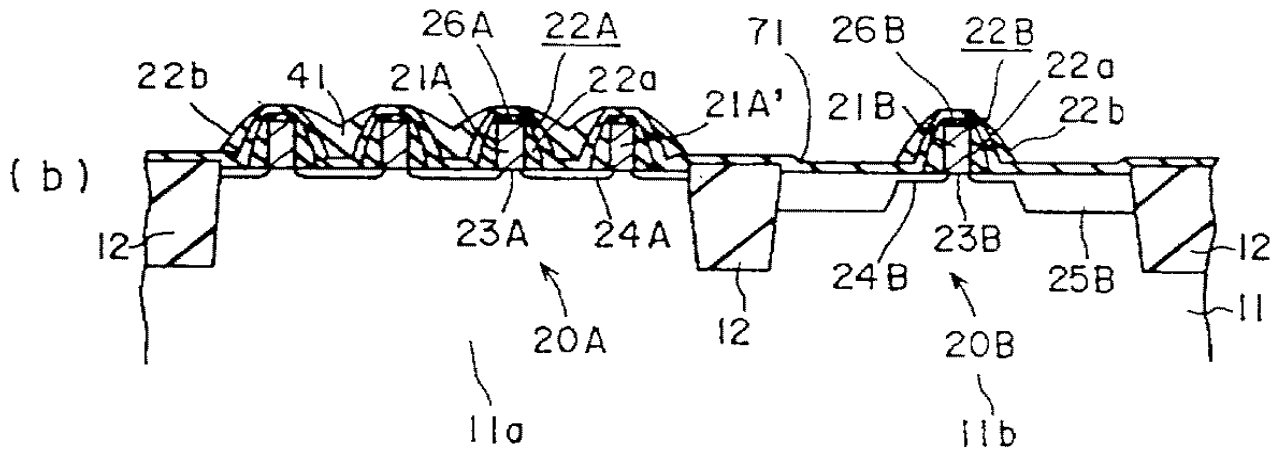
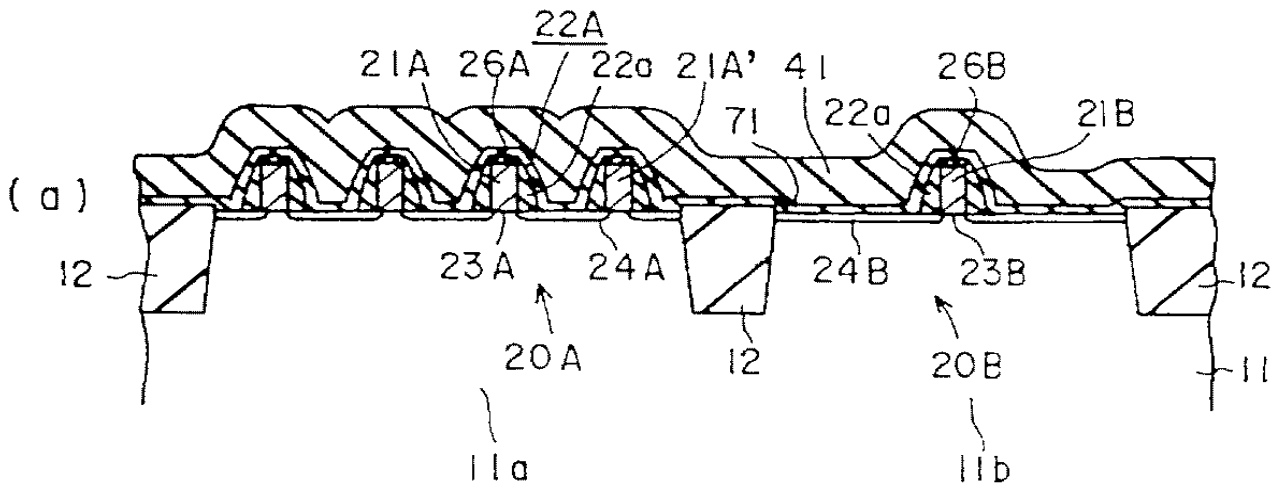
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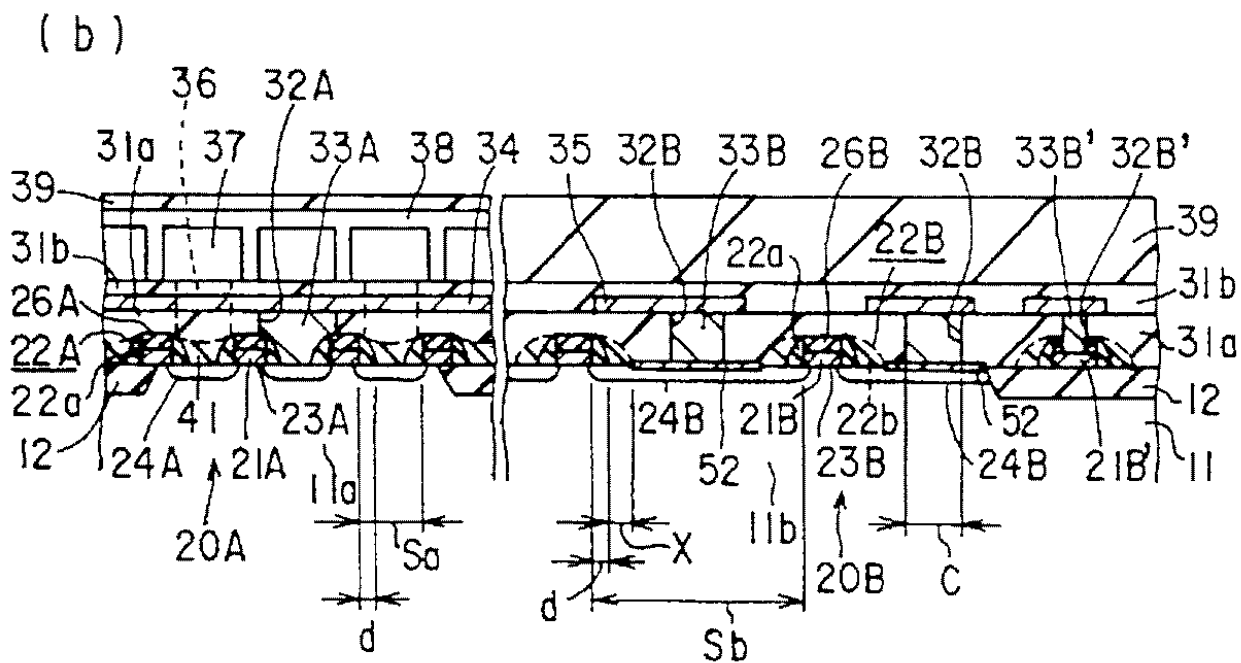
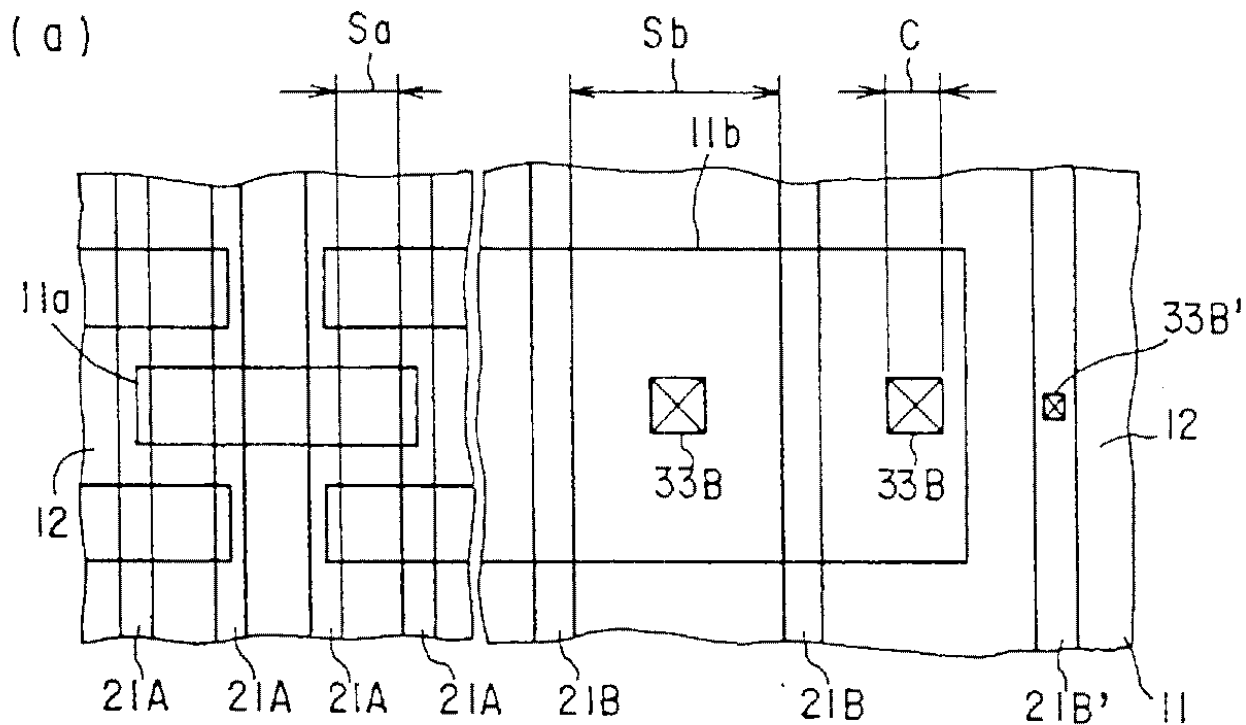




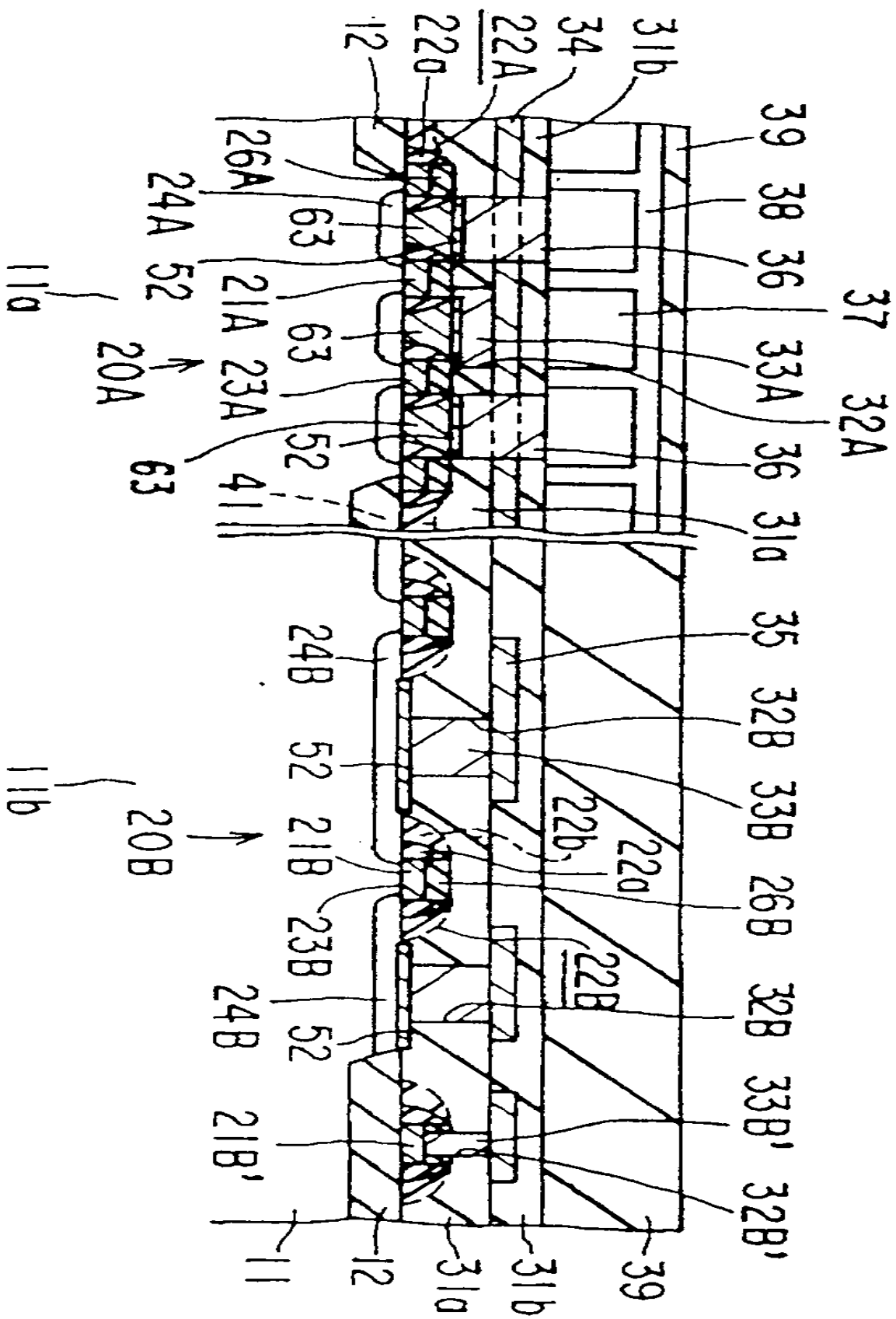


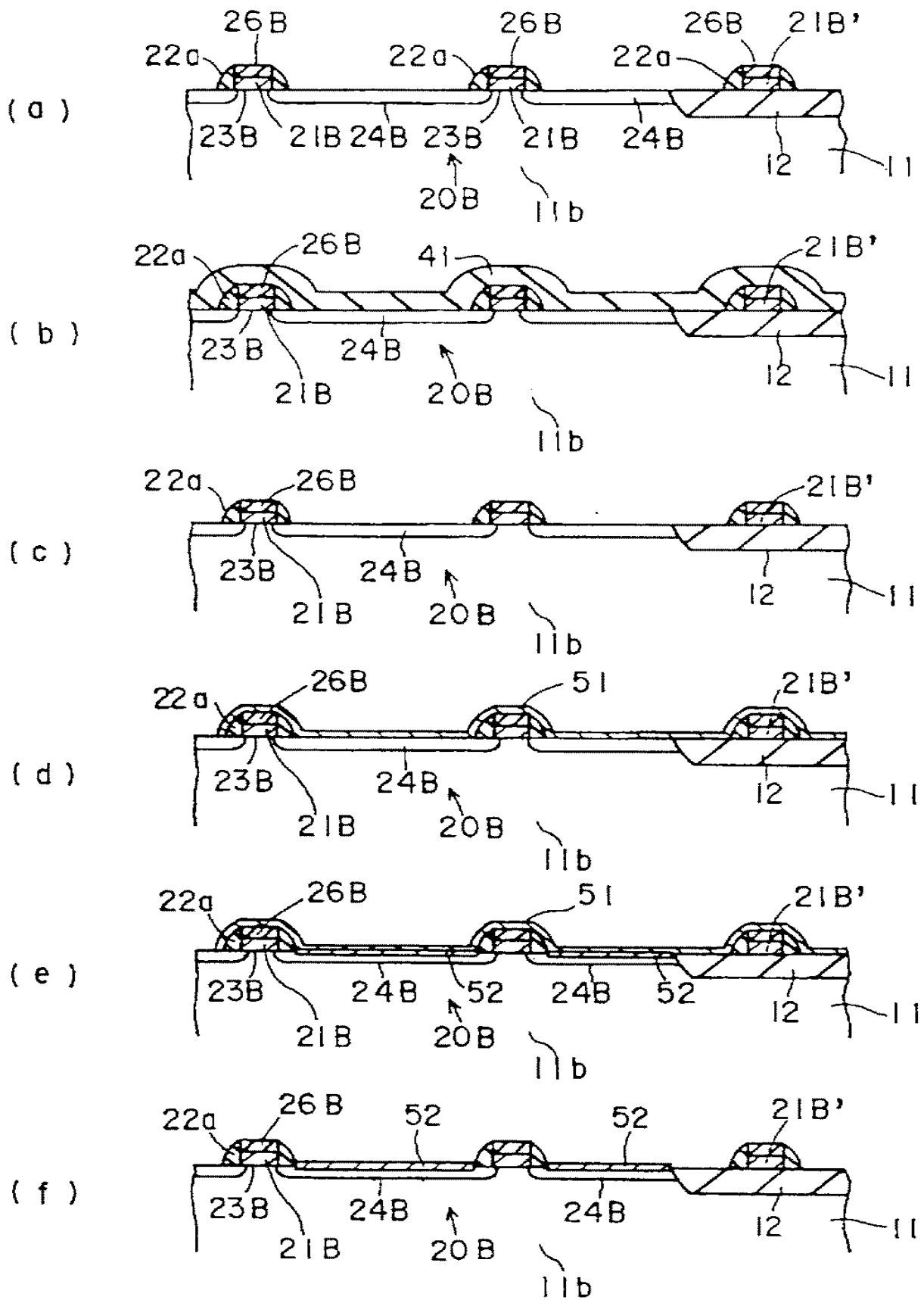


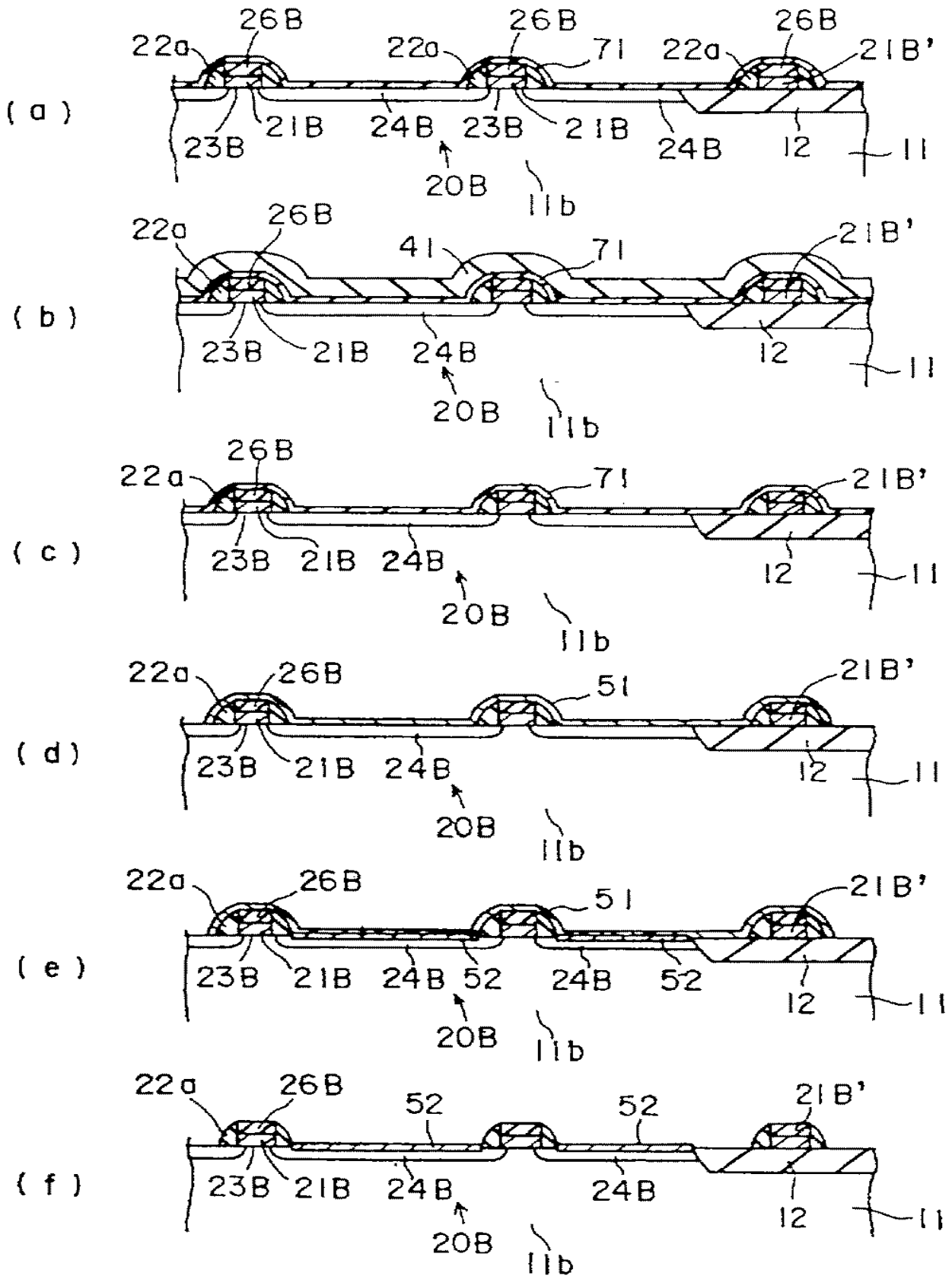
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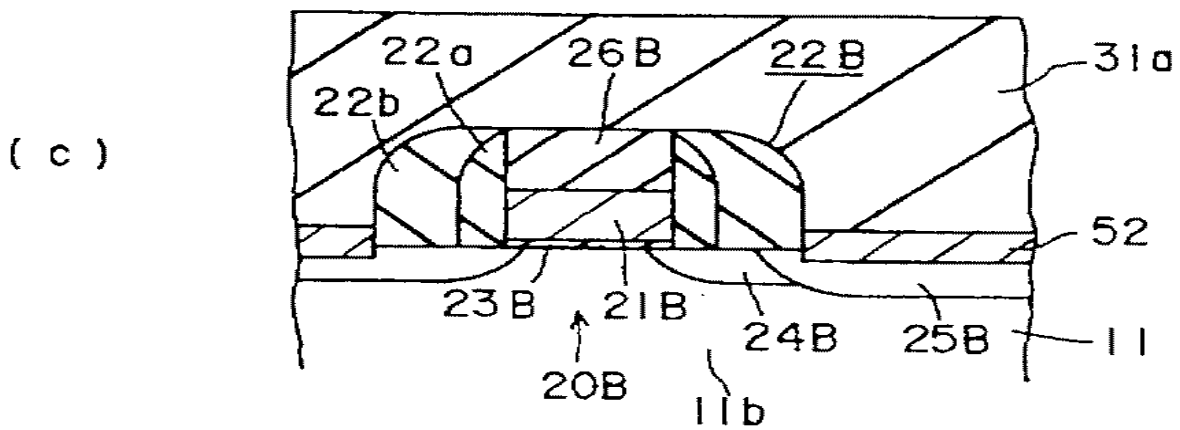
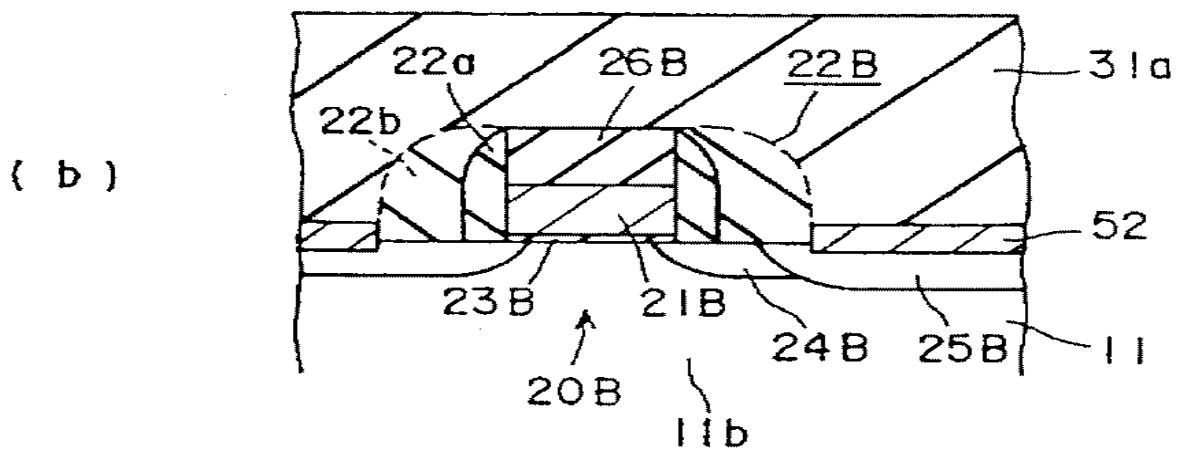
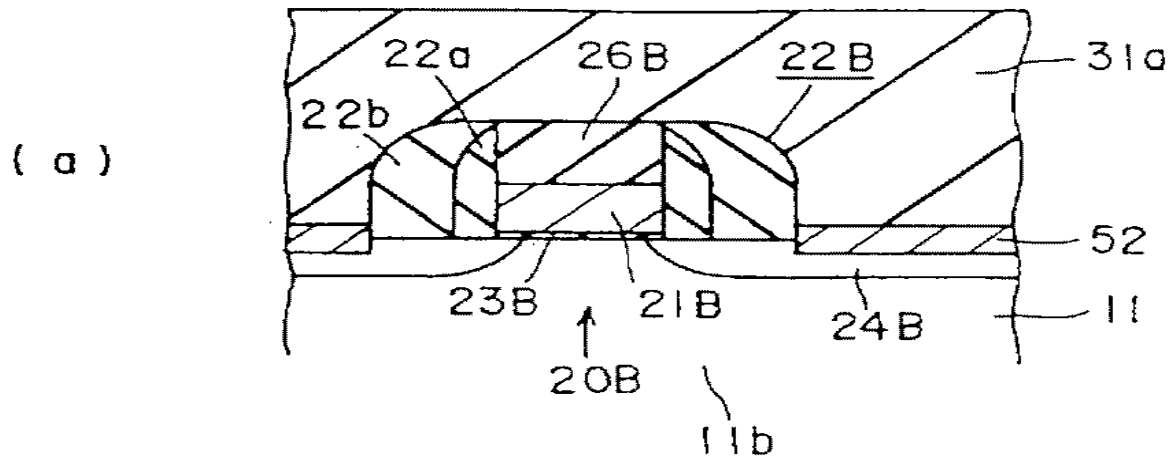


11

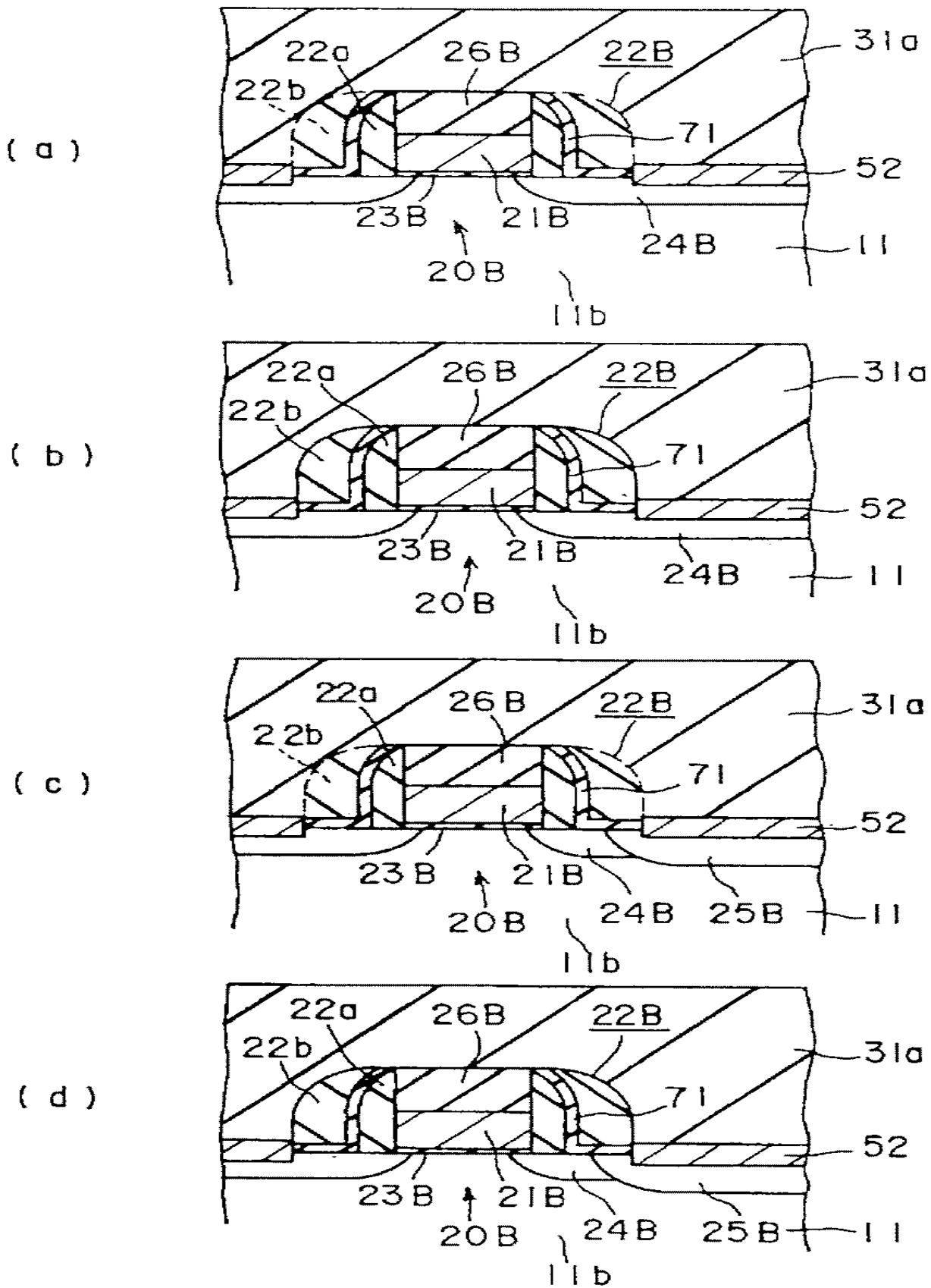




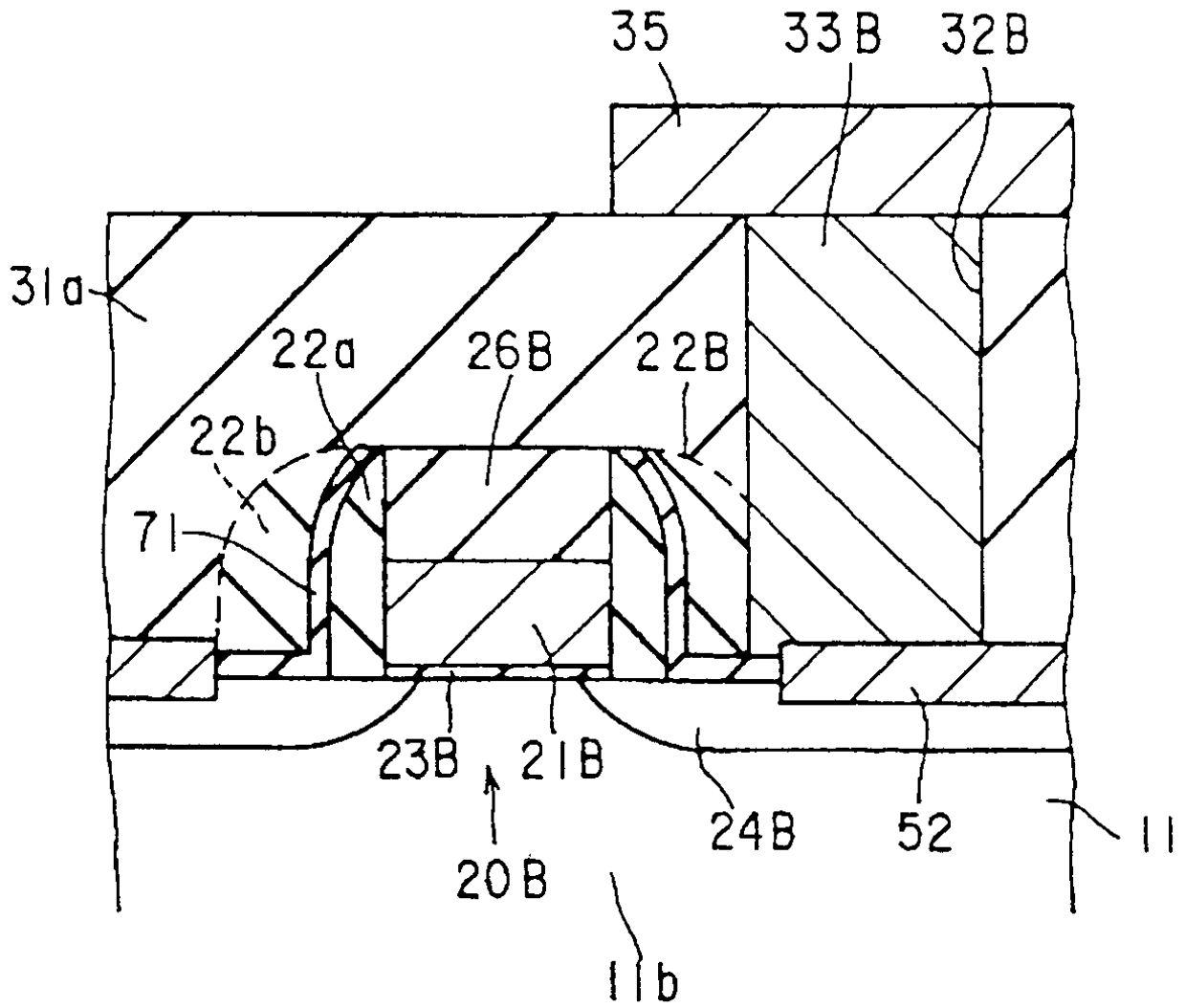


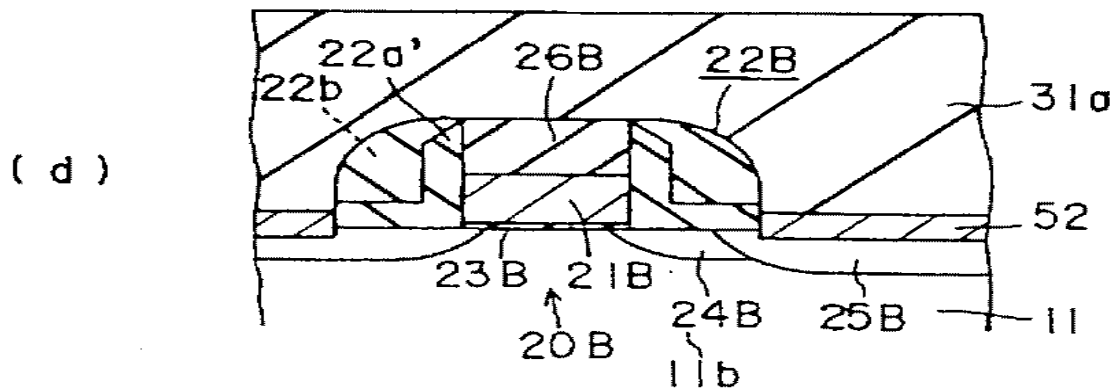
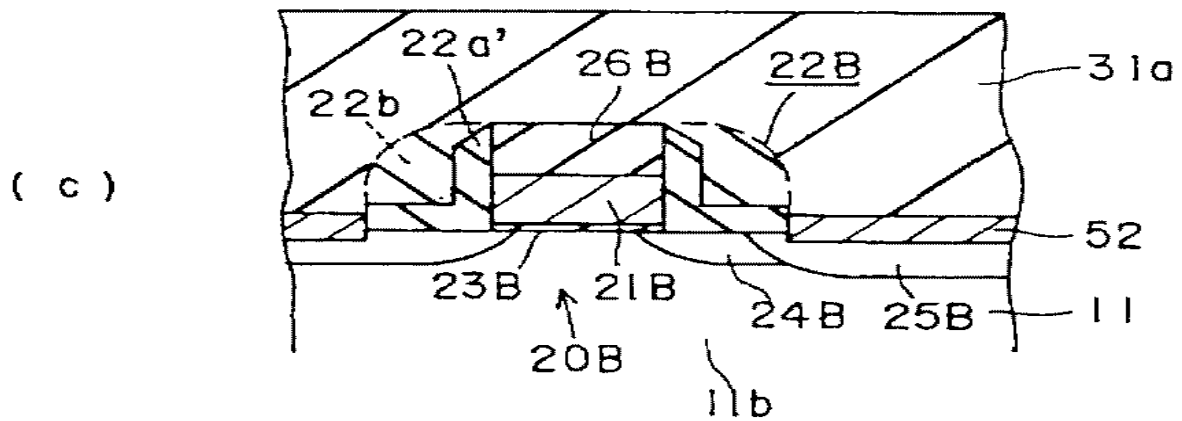
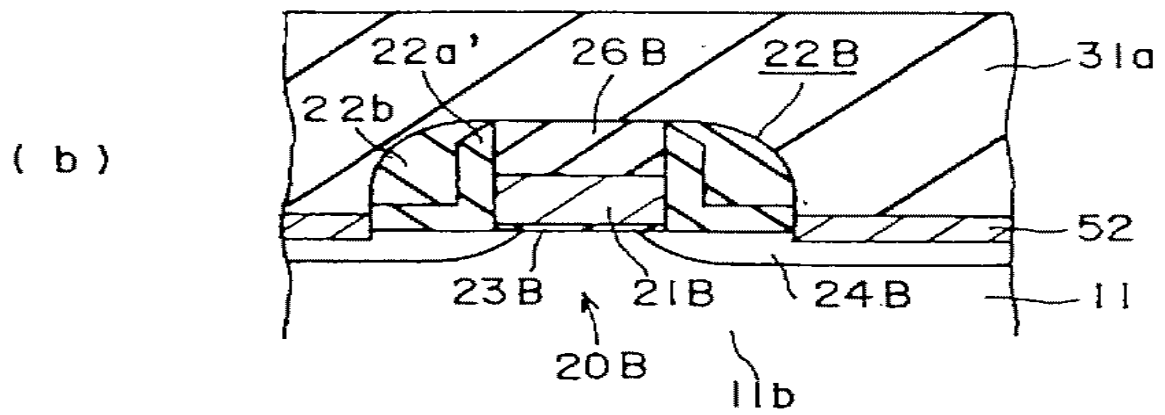
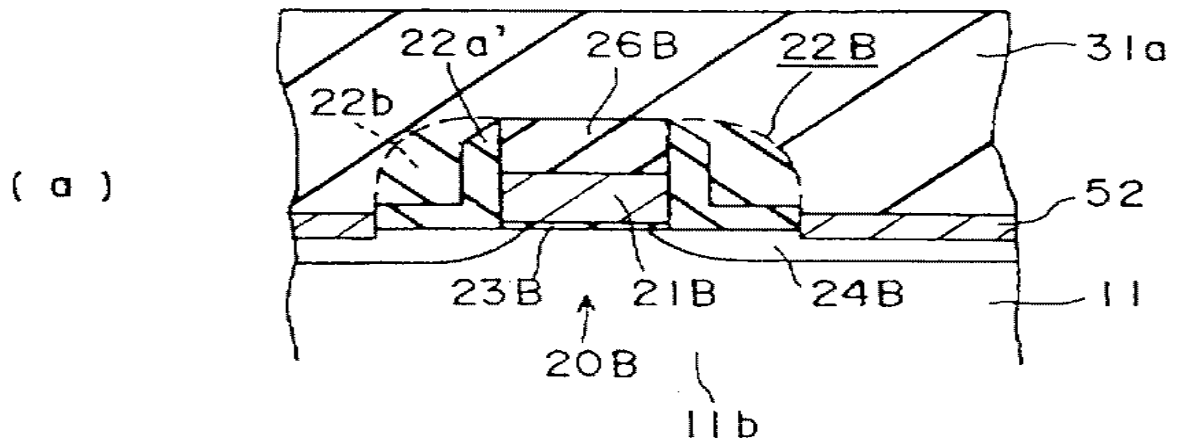






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