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(73) 가 가 , 2 2 3

(72) 2 2 - 3 가 가
2 2 - 3 가 가

(74)

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(54)

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/ (10) (2) , / (10) n (12)
, Co (11) (2) (4) (5)
(2) 가 (11) PN (11) 가
, / (10) (3) 가 .

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33	5	.
34	5	.
35	5	.
36	5	.
37	5	.
38	5	.
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40	6	.
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44	7	.
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3 : P

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9 : n

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11 : Co

12 : n

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18 :

31 : N

41 :

51 : p

52 : n

61 :

71 :

91 : p

100 :

111 : Co

121 : p

181 :

101 :

102 :

103 : P

104 :

105 :

106 :

107 :

108 :

109 : n

200 :

1010 : /

1011 :

1016 :

1017 :

1018 :

가

LSI , 가 가

가 , / 가 (Self - Align

ed silicide) 가 .

55 , 102 , 103 P , 104 , 105 , 106 101 , 107 , 1

, 108 , 109 n , 1010 / , 1011 , 1016 , 1

017 .

(1017) / (1010) (1011) ,

Co, Ni, Ti, W, Pt .

56 (102)

(1011) , (102) / (1010) (102)

(潛入) 가 , Co Ni

가 / (1010) P (103) PN (1011) (1011)

(101) P (103), (104) (105)

가 .

57 , (102) 가 가 .

(102) 가 , (102) (101)
 (1011) (105) (1011) , / (1010) P (103) PN , (101) (104)
 (1011) 가 가 .

(1011) Co Ni (1018) 가 , 58 (1011) , 59
 (1018) 가 , / (1010) P (103)
 PN , (1011) 가 , (1011) / (10
 10) (101) P (103),
 (104) (105) 가 .

/ ,
 가 .
 , / PN 가 가
 가

60 n (1091) 가 .
 4,949,136 .

, (102) (1011) n
 (1091) n (1091) 가

, , (108, 1081) 가 , / (1010)
 가 .

/ , / 가 , /
 PN , 가

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1 1 . 1 1 , 2
 , 3 P , 4 , 5 , 6 , 7 , 8 , 9 n
 , 10 / , 11 Co , 12 n .

NMOS , P (3) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, (4)
 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, (5) 1×10^{17} 1×10^{18}
 $8 / \text{cm}^3$, n (9) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$, / (10) 1×10^{17} 1×10^{18}
 1×10^{21} $1 \times 10^{22} / \text{cm}^3$, n (12) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$.

2 1 , 2 7
 , 100 , 120 , 200 . (120) (100) (7)
 200) . 1 n (12) (120) (7)

1 .
 (7) , / (10) , P (3)
 가 / , 가 . , n (12) P (3)
 , Co (11) n
 Co (11) .

Co Ni, Ti, W, Pt , n ,
 (12) . / (10) n (9) , n
 가 n (12) / (10) n (9) 가 .

, 3 PMOS, 31 N, 91 p, 121 p. N (31)
 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, (4) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$
 (5) $1 \times 10^{19} / \text{cm}^3$, / (10) 1×10^{21} $1 \times 10^{22} / \text{cm}^3$, p (91) 1×10^{18}
 1) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$. (12)

, Co Ni, Ti, W, Pt, p,
 .
 PMOS NMOS 가 가 / 가
 , , p (121) N (31) , Co (11)
 p (121) Co (11)

n (12) p / (10) (2) / (10)
 (2) (121) Co (11)
 (4) (5) (2) 가 (11) PN
 (11) 가 , / (10) (3) 가

4, 5, 6, 7 8 1 4,
 5, 6, 7 8 13 , 14 , 111 Co , 61 .

, 4 (1) 200 (61) 3000
 (14) 3000 5000 (2)

, (61) (SiON), (61) (1)
 1000 (14) (61) (2)

5 (61) (14), (2)
 , p 250keV, 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ P (3)
 100keV, 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ (4)
 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ (5)

, (6) (7), 10 40keV, 1×10^{13} $1 \times 10^{14} / \text{cm}^2$
 , 45 ° n (9) ,
 etching) (8) 20 60keV, 1×10^{15} $1 \times 10^{16} / \text{cm}^2$ RIE(reactive ion
 / (10)

, 6 (7) / (10)
 , 1000 (13) 6
 (facet) n (12)

, 10 40keV, 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ 45 °
 (7) n (12) . , (13)
 . / (10) .

7 (13) 300 , (13) ,
 / (10) (13) /
 (13) / (10) 가 , (7) (13) 가 .

, 8 CVD 50 200 Co (111)
 RTA (rapid thermal anneal) 400 500 , 30 2
 (7) / (10) Co (11) . Co N
 i, Ti, W, Pt .

, Co (mixed acid peroxyhydrate) ($\text{HNO}_3 / \text{CH}_3\text{COOH} / \text{P}_4\text{O}_{10} / \text{H}_2\text{O}_2$) (h
 hydrochloric acid peroxyhydrate) ($\text{HCl} / \text{H}_2\text{O}_2$) , 700 900 , 30 2
 RTA 1 (2) n (12)
 .

, PMOS NMOS 가 3000 5000 (2)
 n 1.2MeV, 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ N (31)
 , 350keV, 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ (4)
 , 40keV 200keV, 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ (
 5) .

(6) (7) 5keV 40keV 1×10^{14}
 $1 \times 10^{15} / \text{cm}^2$ 7 ° p (91) , NMOS 가
 (8) 10keV 50keV 1×10^{15} $1 \times 10^{16} / \text{cm}^2$
 / (10) .

, NMOS 가 (13) 5keV 40keV 1×10^{14}
 $1 \times 10^{15} / \text{cm}^2$ (121) , (13) (7)
 p (121) .

, NMOS 가 Co (11) 3 가 .
 (13) / (10) NMOS .

PMOS, NMOS (5) (4) .

, PMOS, NMOS (5) (4)
 , (5) 0.15 μm
 .

PMOS NMOS가 .

n (12) p (121) (7) / (
 10) (13) , 가 가
 (2) (2) (1)

, / (10) (2) , / (10) n (12)
p (121) Co (11) (2)
(2) 가 (11) PN ,
(4) (5) / (10) (3) 가
(11) 가

9, 10, 11, 12 13 1
. 9, 10, 11, 12 13 14 , 71
.

, (1) 200 (61) 1000 (14)
3000 5000 (2) .

9 (2) (14) p
300keV 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ P (3)
100keV 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ (4) ,
60keV 110keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ (5) .

(boron range distance) 3 4 , (5)
(2) , (2)
(14) .

, 10
(14) (61) (6)
(71) .

, 11 (15) (7)
. , (15) .

, 12 10keV 40keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ 45 °
(7) n (12)
. , (14) .

, 10keV 40keV 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ 45 ° n
(9) . , CVD RIE (reactive ion etching)
(8) 20keV 60keV 1×10^{15} $1 \times 10^{16} / \text{cm}^2$ /
(10) .

, 13 CVD 50 200 Co (111)
RTA (rapid thermal anneal) , 400 500 , 30 2
(7) / (10) Co (11) . Co N
i, Ti, W, Pt .

, Co (HNO₃/CH₃COOH/P₄O₁₀/H₂O₂) (HCl/H₂O₂)
, 700 900 , 30 2 RTA 1 (2)
n (12) .

, PMOS NMOS 가 , 200 1000
3000 5000 .

$1 \times 10^{14} / \text{cm}^2$, N (31) n 1.3MeV, 1×10^{13}
 cm^2 (4) 350keV 1×10^{12} $1 \times 10^{13} / \text{cm}^2$
 (5) 200keV, 1×10^{12} $1 \times 10^{13} /$

$0^{15} / \text{cm}^2$ (6) (7) 5keV 40keV 1×10^{14} 1×1
 (121) (14) p

5keV 40keV, 1×10^{14} $1 \times 10^{15} / \text{cm}^2$, 7 ° p
 (91) NMOS 가 (8) 10keV 50keV 1×1
 0^{15} $1 \times 10^{16} / \text{cm}^2$ / (10)

, NMOS 가 Co (11), 3 가

PMOS, NMOS (5) (4)

, 14 PMOS, NMOS (5) (7)
 (14) (61) (6)

NMOS, 50keV, 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 °, PMOS
 100 180keV, 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 °, PMOS
 10keV 20keV, 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 °

(5) / (10) (7)
 가 가 가

, PMOS, NMOS (5) (4)
 (5) 0.15 μm

, n (12) p (121) (2)
 (14) (2) (1)

, / (10) (2), / (10) n (12)
 p (121) (11) (2)
 (2) 가 (11) PN 가
 (4) (5), / (10) (3)
 11) 가, /

1, 가,
 가

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15 2 . 15 41

15 NMOS , (41) , (2)
 1×10^{17} $1 \times 10^{18} / \text{cm}^3$. (41) 1×1
 PMOS , (41) , (2)
 1×10^{17} $1 \times 10^{18} / \text{cm}^3$.
 n , / (10) (2) , / (10)
 (12) p (121) , Co (11)
 (2) (2) 가 (11)
 (4) (5) , / (10) PN ,
 (11) 가 , /
 .

, (2) ,
 , .

16 2 .

, 1 가 , 200 (61) 1000 (14)
 (2) , 16 NMOS 100keV , 1×10^{12} ,
 $1 \times 10^{13} / \text{cm}^2$ (41) .
 , (61) (14) 1 가 P (3), (5),
 (6), (7), n (9), (8), / (10) .
 , 1 가 , (7) / (10)
 , 1000 (13) , n (12)
 . (13) Co (11) .
 , PMOS NMOS 가 . , PMOS , 350keV , 1×10^{12}
 $1 \times 10^{13} / \text{cm}^2$ (41) .

1 가 , / (10) (13) ,
 (13) 300 , (13) , / (1
 0) (13) / (13) / (1
 0) 가 , (7) (13) 가 .

PMOS, NMOS (5) ,
 (5) $0.15 \mu\text{m}$.

n (12) p (121) (7) / (
 10) (13) , 가 가
 (2) (2) (1)

, / (10) (2) , / (10) n (12)
p (121) , Co (11) (2)
(2) 가 (11)
(4) (5) , / (10) (3) PN ,
(11) 가 , 가
.
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.
17 18 2
, 1 가 (2) 17 200 (12)
61) 3000 (14) NMOS 100keV , 1×10^{12}
 $1 \times 10^{13} / \text{cm}^2$ (41)
, (14) 가 1000 (5)
, 1 가 (2) P (3)
, 18 , 1 가 (14)
(61) , (6) (71)
(15) (7)
(15) 1 가 (7)
n (12) , (14)
, 1 가 , n (9), (8), / (10) Co (11)
.
, PMOS NMOS 가 , PMOS 350keV , 1×10^{12}
 $1 \times 10^{13} / \text{cm}^2$ (41)
PMOS, NMOS , (5)
(5) 0.15 μm
, 1 가 PMOS, NMOS (5) (7)
(14) (61) (6)
NMOS 50keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° , PMOS
100keV 180keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° , PMOS
10keV 20keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° .
, (5) / (10) 가 가 (7)
, 가 가
, n (12) p (121) (2)
(14) (2) (1)

, / (10) (2) , / (10) n (12)
p (121) , Co (11) (2)
(2) 가 (11)
(4) (5) / (10) (3) PN ((11)
11) 가 / 가

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가

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19 NMOS , P (3) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, (4)
 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, (5) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$
, n (9) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$, / (10) 1×10^{18}
 10^{21} $1 \times 10^{22} / \text{cm}^3$, n (12) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$.

(7) , / (10) 가 , , P (3)
가 , / 가 . , n (12) P (3)
Co (11) n

, Co Ni, Ti, W, Pt , n ,
n (12) , / (10) n (9) ,
가 , n (12) , / (10) n (9) 가 .

, 20 PMOS , N (31) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$,
(4) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, (5) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$
 $10^{18} / \text{cm}^3$, p (91) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$, / (10) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$
 1×10^{21} $1 \times 10^{22} / \text{cm}^3$, p (121) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$.

, Co Ni, Ti, W, Pt , p ,

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PMOS NMOS 가 가 , / 가
, , p (121) N (31) , Co , Co (11) (1
1) p (121) ,

n (12) p / (10) (18) , / (10)
 (18) (121) , Co (11)
 (18) 가 (11)
 (5) / (10) PN (11)
 가 / 가

21, 22 23 3

, 21 (1) 300 (61) 2000
 (14) (14), (61)
 (1) 3000

22 TEOS (181) 7000 CMP(Chemica
 I Mechanical Polishing) (18)

, 23 , 1 가 P (3), (5), (6),
 (7), n (9), (8), / (10) 1000 (13)
 (7) / (10) n (12) , (13) Co (11)

1 가 / (10) (13)
 (13) 300 (13) , / (10)
 (13) / (13) / (10)
 가 (7) (13) 가
 , PMOS NMOS 가 , PMOS, NMOS (5) (4)

, n (12) p (121) (7) /
 (10) (18) (13) , 가 가
 (18) (18) (1)

, / (10) (18) / (10) n (12)
 p (121) , Co (11) (18)
 (18) 가 (11) (11) (11) 가
 5) , / (10) PN 가
 /

24, 25, 26 27 3

, 24 (14), (1) 300 (61) 2000
(14), (61)
(1) , 3000
TEOS (181) 7000 .

25 CMP(Chemical Mechanical Polishing) (14)
, P (3) 300keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$
(4) 100keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, (5)
60 110keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$. (14)
TEOS (181) .

, 26 , 1 가
(14) (61)
(6) , (71) , (15)
(7) . (15) .

, 27 가 , 1
0keV 40keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ 45 ° , (181)
(7) n (12) . (14) ,
(61) TEOS (181) .

, 1 가 (6), (7), n (9), (8), /
(10) , Co (11) .

PMOS NMOS 가 , p (121) 5keV 10k
eV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ 45 ° .

PMOS, NMOS (5) (4)
, , (5) 0.15 μm
.

, 1 가 PMOS, NMOS (5) (7)
(14) (61) .

NMOS , 50keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° , PMOS
100keV 180keV 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° , PMOS
10keV 20keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° .
, (5) / (10) 가 가 (7)
, , 가 가 가 .
, n (12) p (121) (18)
(14) (61) (18) (1)

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, / (10) (18) / (10) n (12)
p (121) , Co (11) (18)
(18) 가 (14)

(5) , / (10) PN (11) 가
 , / 가
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 가 .

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28 NMOS , (41) (18)
 $\times 10^{17}$ $1 \times 10^{18} / \text{cm}^3$, 19 . (41) 1

PMOS (41) , (18)
 3 , (41) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$.

n , / (10) (18) , / (10)
 (12) p (121) , Co (11)
 (18) (18) 가 (11)
 (5) , / (10) PN 가 (11)
 가 / , 가 .

, (18) ,
 , . ,
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29 30 4 .

, 3 가 , (1) 300 (61) 2000
 (14) (14), (61)
 , (1) 3000 .

29 , NMOS 5keV 10keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$
 (41) , 3 가 (18)

, 30 3 가 P (3), (5), (6),
 (7), n (9), (8), / (10) , (7)
 / (10) 1000 (13)
 n (12) , (13) Co (11)

, PMOS NMOS 가 , PMOS 5keV 10keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ (41) .

3 가 / (10) (13) , / (10) (13) 300 (13) , / (10) 가 (7) (13) 가 (13) (13) / (10)

PMOS, NMOS (5) 0.15 μm , (5)

(10) , n (12) p (121) (7) / (18) , (18) (13) 가 (1) 가 ,

, / (10) (18) , / (10) n (12) p (121) , Co (11) (18) (5) , / (18) 가 (11) (11) 가 , / (10) PN (11) 가 , /

, , ,

31 32 4 .

31 , 3 (1) 300 (61) 2000 (14) , (14), (61) , (1) , 3000 , 5keV 10keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$ (41) , TEOS (181) 7000 .

, 3 가 (14) , P (3) (5) .

32 (14) (61) (6) (71) (15) (7) , (15) .

, 3 가 , 가 , n (12) (181) (7) , n (18) (14) , (61) TEOS (181) .

, 3 가 (6), (7), n (9), (8), / (10) , Co (11) .

PMOS, NMOS 가 p (121) 5keV 10 keV, 1×10^{12} , $1 \times 10^{13} / \text{cm}^2$ 45 ° .

, 3 가 , PMOS, NMOS (5) (7) (14) (61) , (6) .

NMOS , 50keV 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° , PMOS 100keV 180keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° , PMOS 10keV 20keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$, 7 ° .

, (5) / (10) (7) 가 , 가 가 .

, n (12) p (121) (18) (14) (18) (1) .

, / (10) (18) , / (10) n (12) p (121) (11) (18) Co 가 (11) (11) 가 (5) / (10) PN 가 .

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4 , 가 , 가 .

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33 34 5 . 33 34 51 p , 52 n .

33 NMOS , P (3) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, (4) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, n (9) 1×10^{18} , p (51) $1 \times 10^{19} / \text{cm}^3$, / (10) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$.

21 $1 \times 10^{22} / \text{cm}^3$, n (12) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$.

(7) , / (10) , P (3) 가 / 가 n (12) P (3) , Co (11) n .

Co (11) .

, Co Ni, Ti, W, Pt n , (10) n (9) n
 , / (10) n (9)
 (12) n (12) 가 .
 , 34 PMOS , N (31) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$,
 (4) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, n (52) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, p (91) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$, / (10) $1 \times 10^{19} / \text{cm}^3$.
 1×10^{21} $1 \times 10^{22} / \text{cm}^3$, p (121) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$.
 PMOS NMOS 가 가 , / 가
 1) p (121) N (31) , Co , Co (11) (1)
 p (121) Co
 , Co Ni, Ti, W, Pt , p ,
 .
 MOS, PMOS 1 .
 n , / (10) (2) , / (10)
 (12) p (121) , Co (11)
 (2) (2) 가 (11)
 (4) / (10) PN , (11)
 가 , / 가
 .
 , p (51) n (52) n (9) p (91)
 , 가 가 가 가
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 35 36 5 .
 , 1 가 , 200 (61) 3000 (14)
 (2) P (3) .
 , (61) (61)
 , (14) (61) (1) 1000
 (2) .
 , 1 가 (6), (7), n (9) , 35
 5keV 30keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ 45 ° p
 (51) , (8), / (10) , p (51) n (9)
 .
 , 1 가 (7) / (10)
 1000 (13) , n (12)
 , (13) Co (11) .

, PMOS NMOS 가 , 36 가
 (2) N (31) (6), (7), p (91) 5keV
 60keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$, 7 ° n (52) , (8),
 / (10) , n (52) p (91) .

1 가 , / (10) (13) ,
 (13) 300 (13) (13) / (10)
 (13) / (13) / (10)
 가 (7) (13) 가 .

NMOS, PMOS 1 1 (5) (4) (5)

, n (12) p (121) (7) /
 (10) (13) , 가 가
 (2) (2) (1)

, / (10) (2) / (10) n (12)
 p (121) , Co (11) (2)
 (2) 가 (11)
 (4) , / (10) PN , (11) 가
 , / 가

, p (51) n (52) , n (9) p (91)
 , 가 가 가 가

37, 38 39 5

, 1 가 , 200 (61) 1000 (14)
 (2) , (2) P (3) (4) .

, 37 , 1 가 , (14)
 (61) (6) (71) ,
 (15) (7)
 (15) , 1 가 (7)
 n (12) , (14) .

, 1 가 n (9) , 38 5keV
 30keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$ 45 ° p (51) (8),
 / (10) Co (11) , p (51) n (9)

, PMOS NMOS 가 , 39 , 1 가
 (2) N (31) , (6), (7), p (91) 5keV
 60keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$, 7 ° , n (52) , (8), / (10) , n (52) p (91) .

NMOS, PMOS 1 1 (5) (4) (5)

, n (12) p (121) (2)
 (14) (2) (1)

, / (10) (2) , / (10) n (12)
 p (121) Co (11) (2)
 (4) , / (2) 가 (11) (11) 가
 (10) PN (11) 가
 / 가

, p (51) n (52) n (9) p (91)
 , 가 가 가 가

5 , 가 ,
 가

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40 6 .

40 NMOS (41) (2)
 33 (41) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$.

PMOS (41) , (2)
 1 , (41) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$.

NMOS, PMOS 1 .

/ (10) (2) , / (10)
 n (12) p (121) , Co (11)
 (2) (2) 가 (11) (11)
 (4) / (10) PN (11) 가
 가 / 가

(2)

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, ,

, p (51) n (52) n (9) p (91)

, 가

, 가 가 가

41 42 6

, 5 가 , 200 (61) 1000 (14)

(2) 41 NMOS 100keV , 1×10^{12}

$1 \times 10^{13} / \text{cm}^2$ (41)

, (61) (14) 5 가 P (3), (6),

(7), n (9), p (51), (8), / (10)

, 42 5 가 (7)

/ (10) 1000 (13)

n (12) (13) Co (11)

, PMOS NMOS 가 , PMOS 350keV , 1×10^{12}

$1 \times 10^{13} / \text{cm}^2$ (41)

5 가 , / (10) (13)

(13) 300 (13) (13) , / (10)

(13) / (13) / (10)

가 (7) (13) 가

NMOS, PMOS 1 1 (5)

(5) (4)

n (12) p (121) (7) / (

10) (13) 가 가

(2) (2) (1)

, / (10) (12)

p (121) (2) , Co (11) (2)

(2) 가 (11)

(4) , / (10) PN , (11) 가

/

, p (51) n (52) n (9) p (91)
 , 가 , 가 , 가

43 6

, 5 (14) 가 (2) 200 (61) 3000
 NMOS 100keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$
 (41)

, (14) 가 , 1000
 , 5 가 (2) P (3)

, 43 , 1 가 , (14)
 (61) , (6) (71)
 (15) (7)

(15) n , 1 가 , (7)
 (12) (14)

, 5 가 n (9), p (51), (8), / (10) Co
 (11)

, PMOS NMOS 가 , PMOS 350keV , 1×10^{12}
 $1 \times 10^{13} / \text{cm}^2$ (41)

NMOS, PMOS 1 (5) 1 (5)
 (4)

(14) n (12) p (121) (2)
 (2) (1)

, / (10) (2) , Co , / (10) n (12)
 p (121) (11) (2)

(4) (2) 가 (11) (11) 가
 (10) PN
 / 가

, p (51) n (52) , n (9) p (91)
 , 가 , 가 , 가
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 6 , 가 ,
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 44 45 7
 44 NMOS , P (3) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, (4)
 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, p (51) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$
 , n (9) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$, / (10) 1×10^{18}
 $1 \times 10^{22} / \text{cm}^3$, n (12) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$.
 (7) , / (10) , P (3)
 가 / 가 , n (12) P (3)
 , Co (11) n
 , Co (11)
 , Co Ni, Ti, W, Pt , n ,
 , / (10) n (9) n
 (12) , / (10) n (9)
 가 n (12) 가
 , 45 PMOS , N (31) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$,
 (4) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, n (52) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$, p (91) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$, / (10)
 1×10^{21} $1 \times 10^{22} / \text{cm}^3$, p (121) 1×10^{18} $1 \times 10^{19} / \text{cm}^3$.
 , Co Ni, Ti, W, Pt , p ,
 .
 PMOS NMOS 가 , 가 , / 가
 , p (121) N (31) , Co , Co (11) (11)
 11) p (121) , Co (11)
 .
 , NMOS, PMOS 1
 , / (10) (18) , / (10)
 n (12) p (121) (18) , Co (11)
 (18) 가 , (11)
 (11)

(10) PN (11) 가
 , / 가 .

, p (51) n (52) n (9) p (91)
 , 가 , 가 가 가

46 47 7 .

S , 3 가 , (1) 3000 TEO
 (181) (18) .

, 3 가 , P (3), (6), (7), n (9) ,
 46 , 5keV 30keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$, 45°
 , p (51) , (8), / (10) . , p (51) n
 (9) .

, 3 가 , (7) / (10) ,
 1000 (13) n (12)
 . , (13) , Co (11) .

, PMOS NMOS 가 3 가 (2) N (31)
 (6), (7), p (91) 47 5keV
 60keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$, 7° , n (52) (8),
 / (10) . , n (52) p (91) .

3 가 , / (10) , (13) ,
 (13) 300 , (13) , / (10)
 (13) , / (13) / (10)
 가 (7) (13) 가 .

NMOS, PMOS 1 1 (5) (4) (5)

(10) , n (12) p (121) (7) /
 (18) (13) , 가 가
 (18) (1) .

, / (10) (18) , / (10) n (12)
 p (121) , Co (11) (18)
 (18) 가 (11) 가
 / (10) PN (11) 가
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, p (51) n (52) n (9) p (91)
가 가 가 가

48 49 7

, 48 3 가 (1) 300
(61) 2000 (14) (1)
14), (61) , TEOS (181) 7000
3000 .

, 3 가 (14) , P (3)
(4) (61) (14)
(15) (6) (71)
(15) (15) (7) .

, 3 가 , 가
(181) (7) n (12)
(14) (61) TEOS (181) (18)

, 49 , 3 가 (6), (7), n
(9) 5 가 p (51), (8), / (10) , Co
(11) . p (51) n (9)

, PMOS NMOS 가 p (91) 5 가
5keV 60keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$, 7 ° , n (52)
n (52) p (91)

NMOS, PMOS 1 1 (5)
(5) (4)

, n (12) p (121) (18)
(14) (18) (1)

, / (10) (18) , / (10) n (12)
p (121) , Co (11) (18)
(18) 가 (11) 가 ,
/ (10) PN , (11) 가 /
가

, p (51) n 가 (52) n (9) p (91) .
 , 가 가 가 가 .

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50 8 .

50 NMOS (41) , (18)
 44 (41) 1
 $\times 10^{17}$ $1 \times 10^{18} / \text{cm}^3$.

PMOS (41) , (18)
 7 (41) 1×10^{17} $1 \times 10^{18} / \text{cm}^3$.

NMOS, PMOS 1 .

n (12) , / (10) (18) , / (10)
 (18) p (121) , Co (11)
 (18) 가 (11) 가
 , / (10) PN (11) 가
 / 가 .

, (18)
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, p (51) n 가 (52) n (9) p (91) .
 , 가 가 가 가 .

51 52 8 .

, 3 가 , (1) 300 (61) 2000
 (14) , (14), (61)
 , (1) 3000 .

51 , NMOS 5keV 10keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$
 , (41) , 3 가 (18) .

7, 3 가 P (3), (6), (7), n (9),
 1) n 가 p (51) (8), / (10) . p (5)

52 3 가 (7)
 / (10) 1000 (13)
 n (12) , (13) Co (11) .

, PMOS NMOS 가 (6), (7), P (91)
 5 60keV , 1×10^{13} $1 \times 10^{14} / \text{cm}^2$, 7 ° , n (52)
 (8), / (10) . n (52) p (91)

3 가 , / (10) (13)
 (13) 300 , (13) , / (10)
 (13) / (13) / (10)
 가 (7) (13) 가 .
 NMOS, PMOS 1 1 (5) (4) (5)

, n (12) p (121) (7) /
 (10) (18) , (13) , 가 가
 (18) , (18) (1) ,

, / (10) (18) , / (10) n (12)
 p (121) , Co (11) (18)
 / (10) 가 (11) (11) 가 /
 가 PN , (11) 가

, p (51) n (52) n (9) p (91)
 , 가 가 가 가

53 54 , 8

53 , 3 가 , (1) 300
 (61) 2000 (14) , (14),
 (61) , (1) 300
 0 . , 5keV 10keV , 1×10^{12} $1 \times 10^{13} / \text{cm}^2$
 (41) , TEOS (181) 7000 .
 , 3 가 , (14) P (3) .
 , 3 가 ,
 (14) (61) (6)
 (71) (15) (7)
 . , (15) .
 , 54 3 가 가 n (12)
 (181) (7)
 (14) , (61) TEOS (181)
 (18) .
 , 3 가 (6), (7), n (9), p (51),
 (8), / (10) , Co (11) .
 , PMOS NMOS 가 (6), (7), p (91), n
 (52) (8), / (10) .
 NMOS, PMOS 1 1 (5) (4) (5)
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 , n (12) p (121) (18)
 (14) (18) (1)
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 , / (10) (18) , / (10) n (12)
 p (121) , Co (11) (18)
 , (18) 가 (11) (11)
 / (10) PN 가 ,
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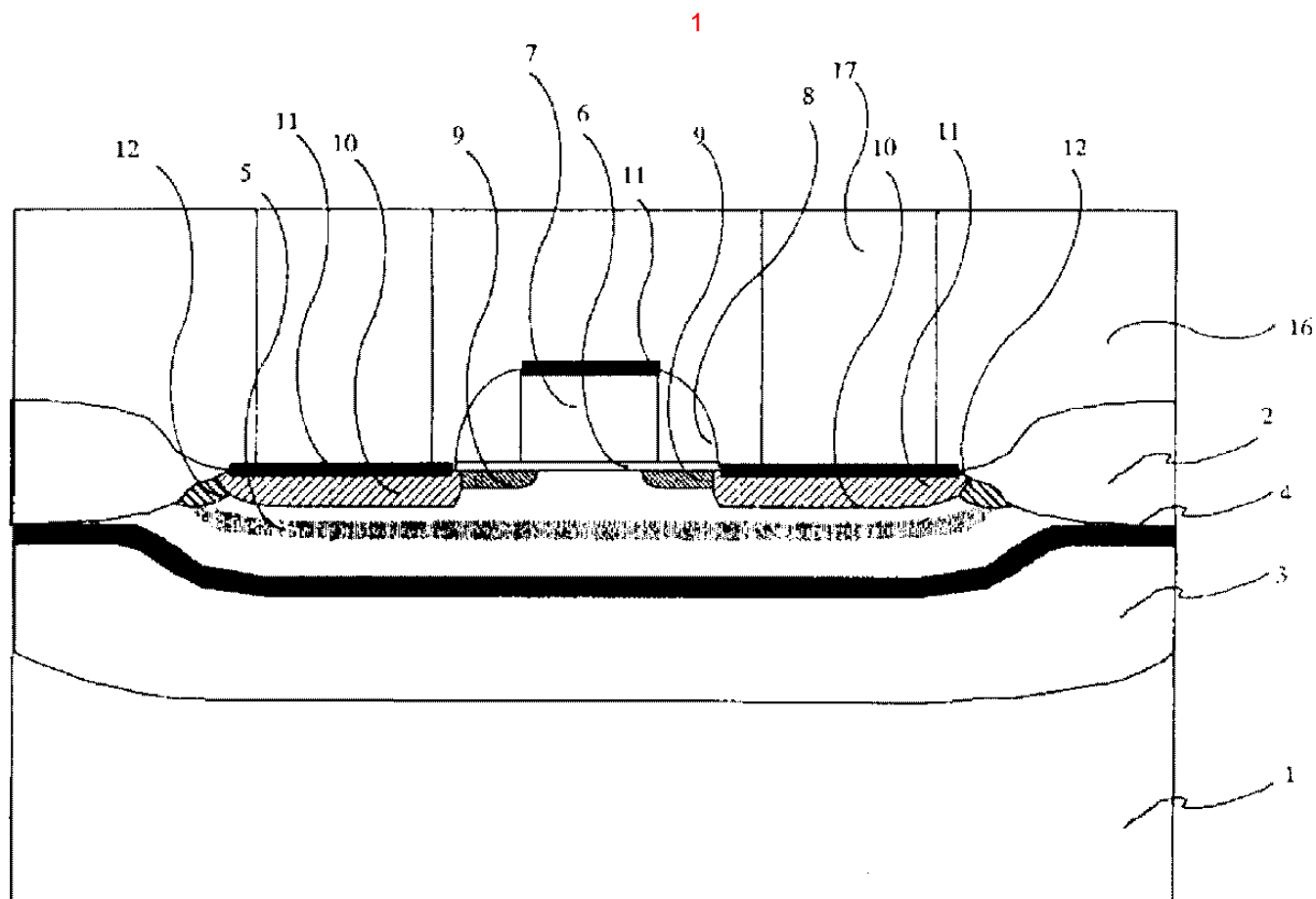
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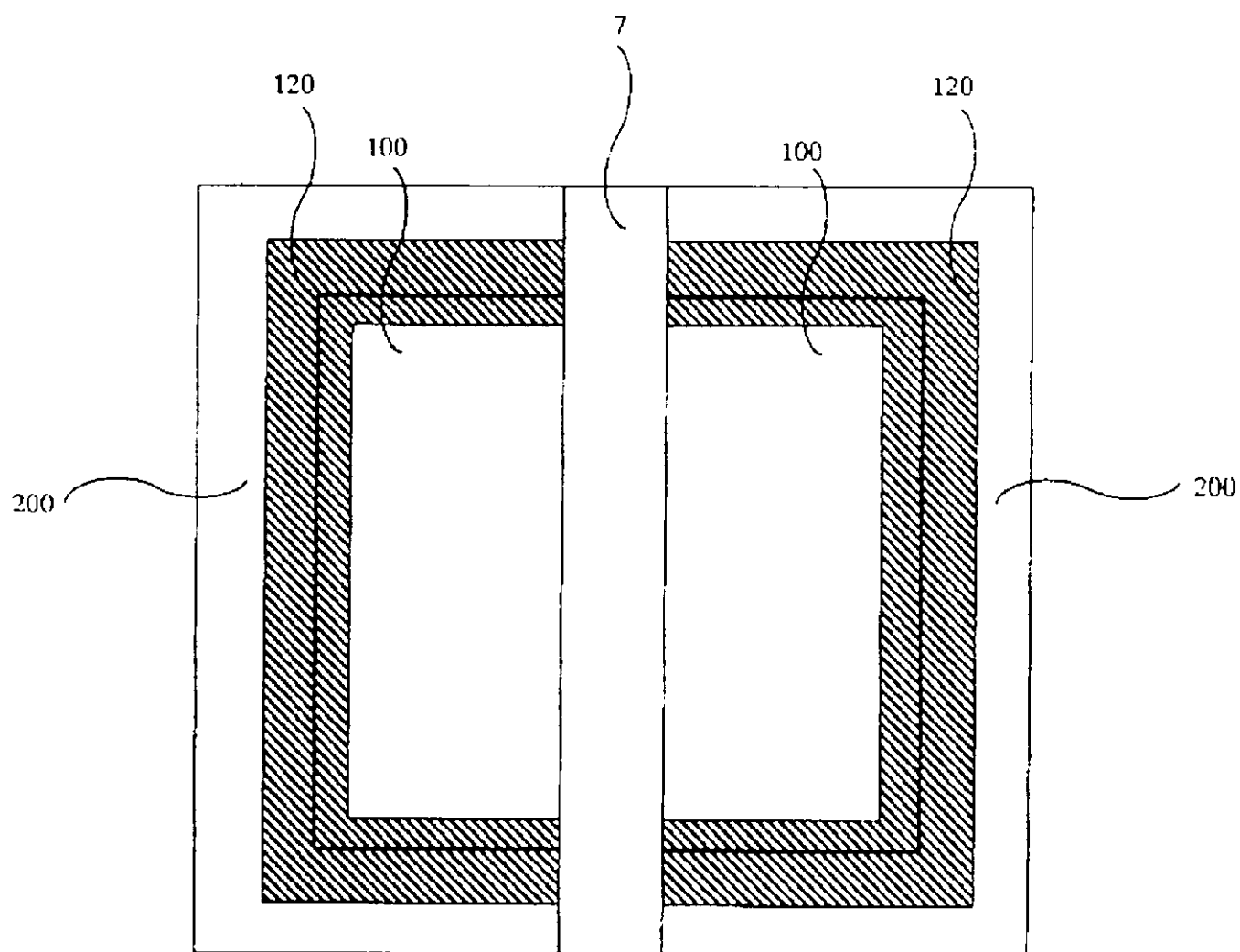
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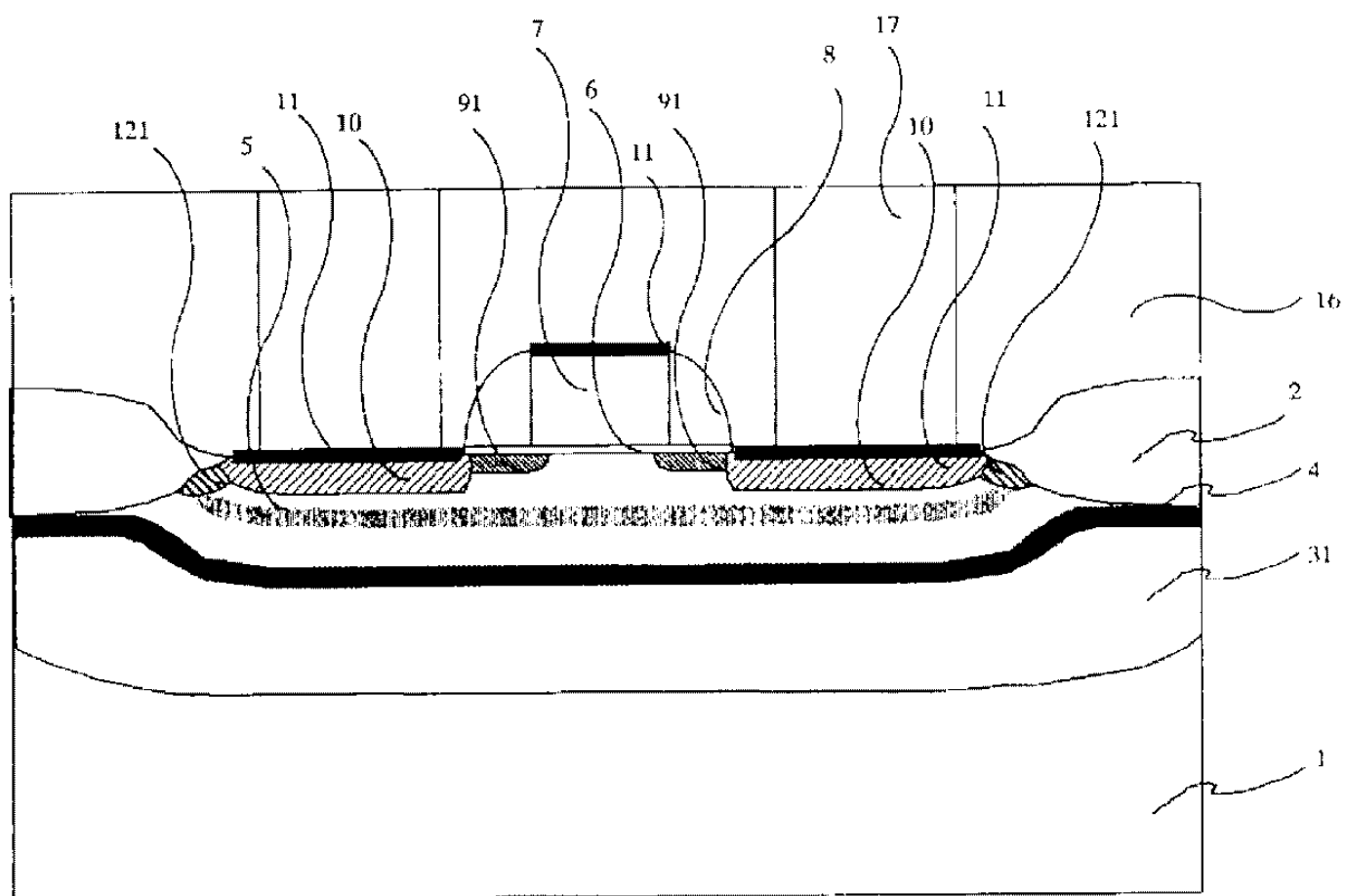
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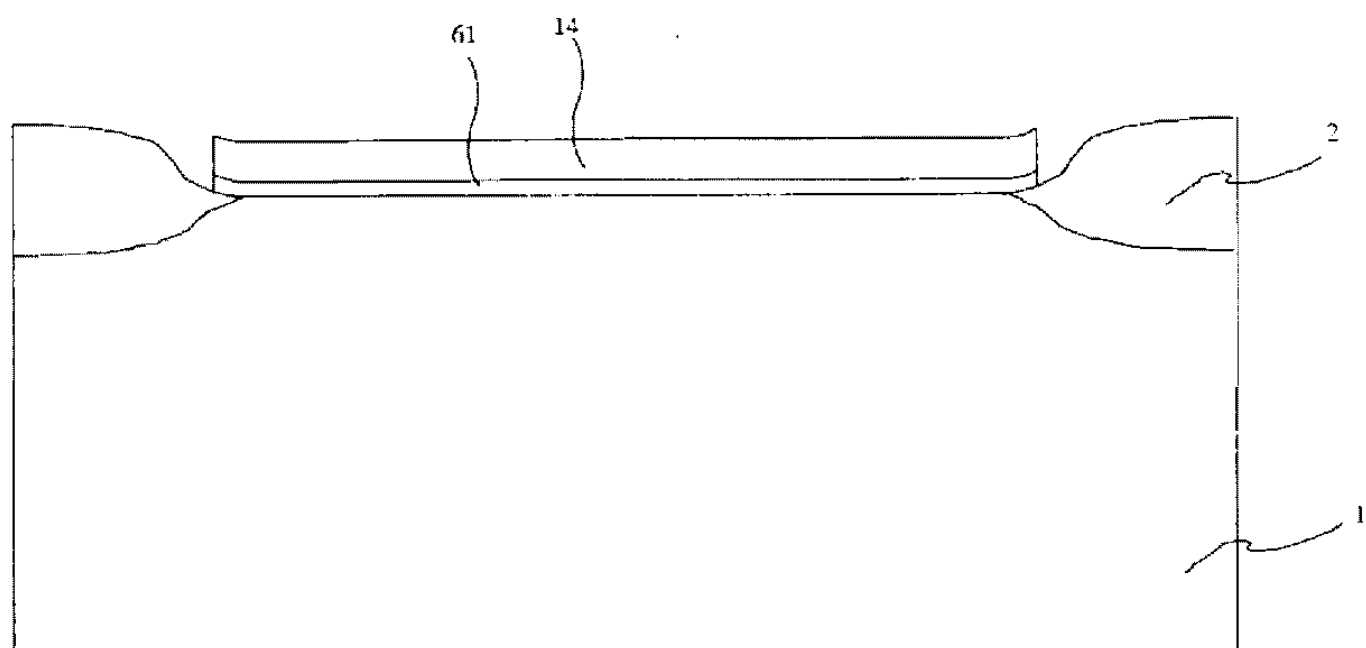
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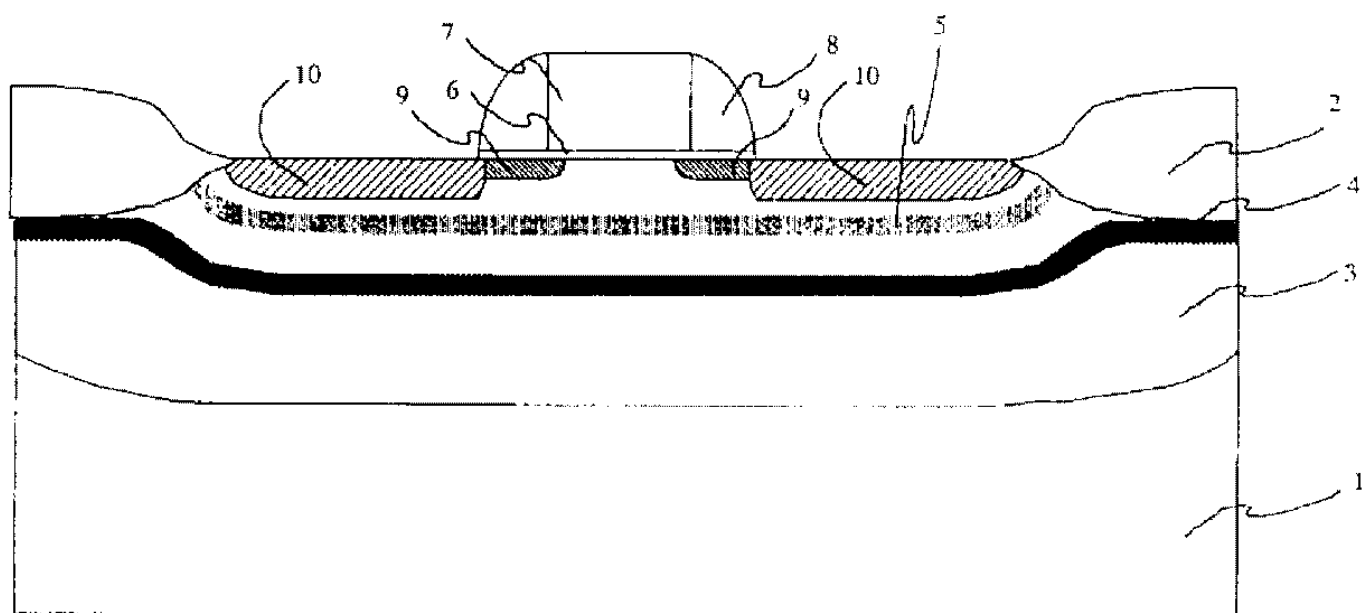
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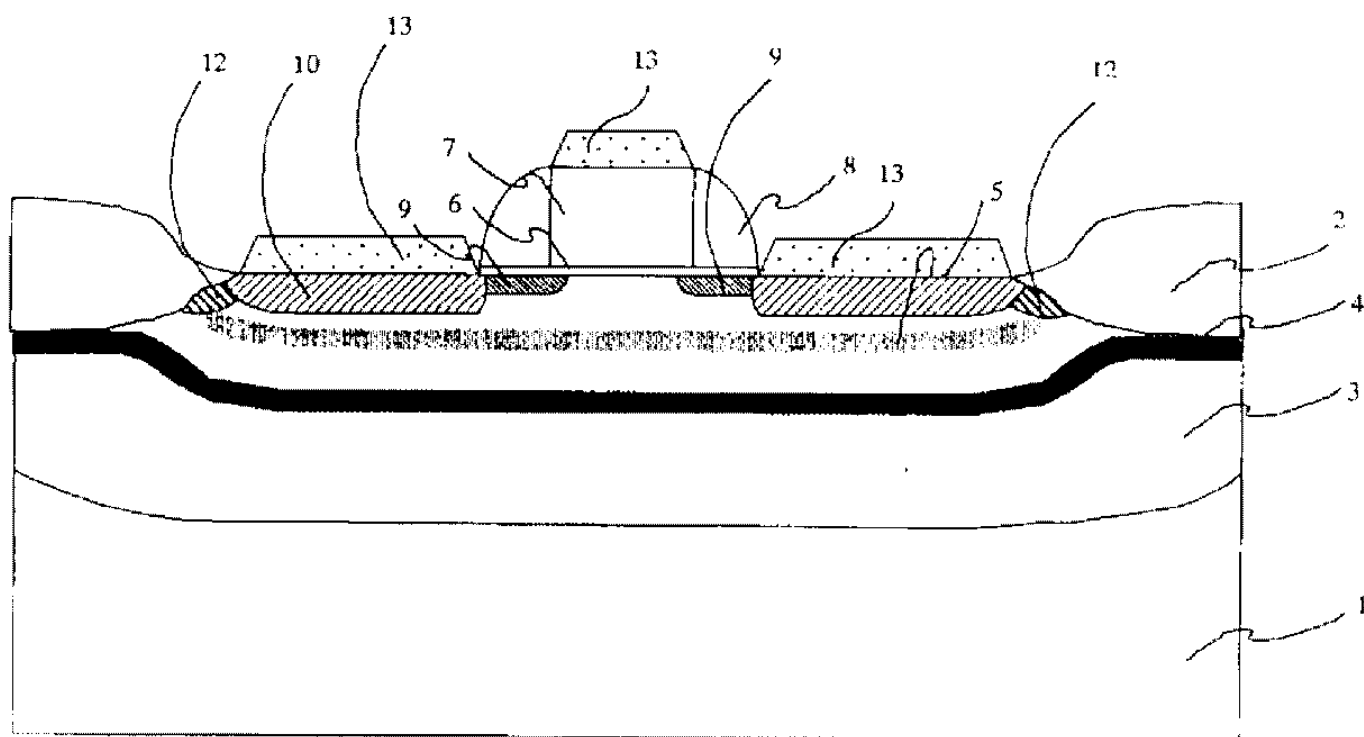
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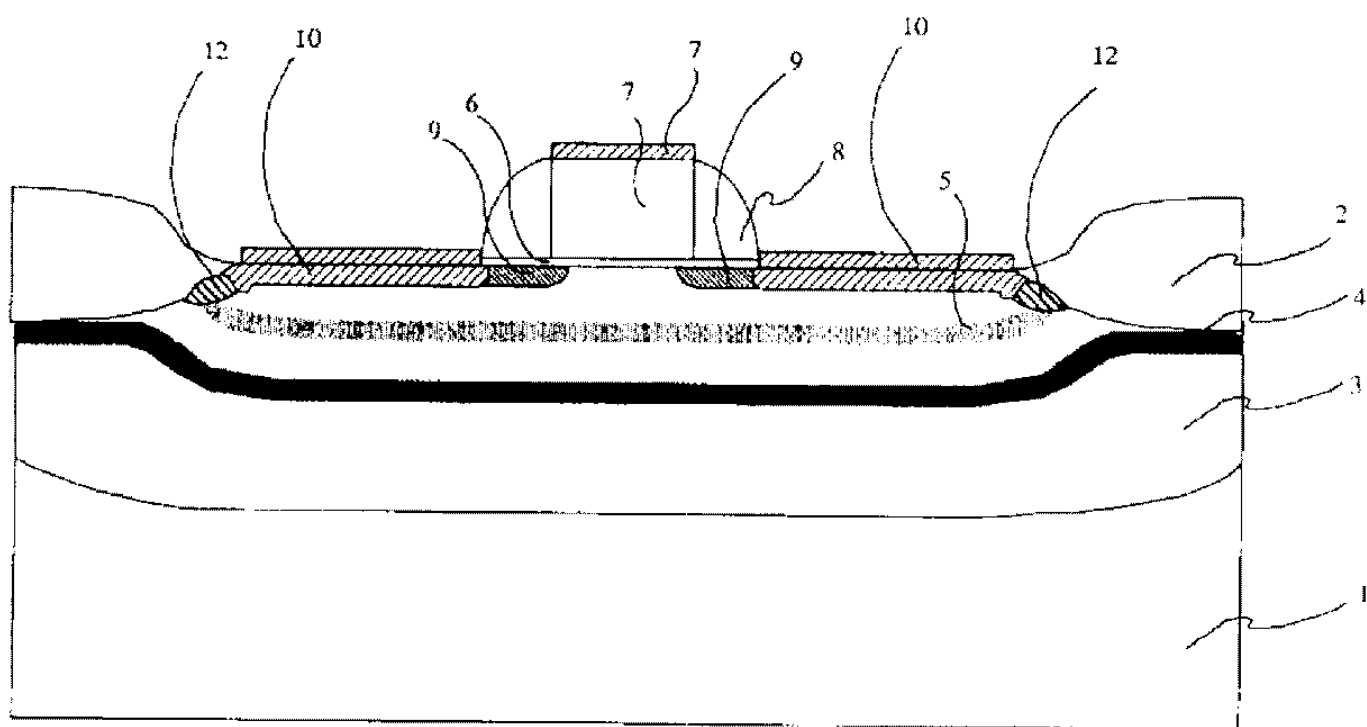
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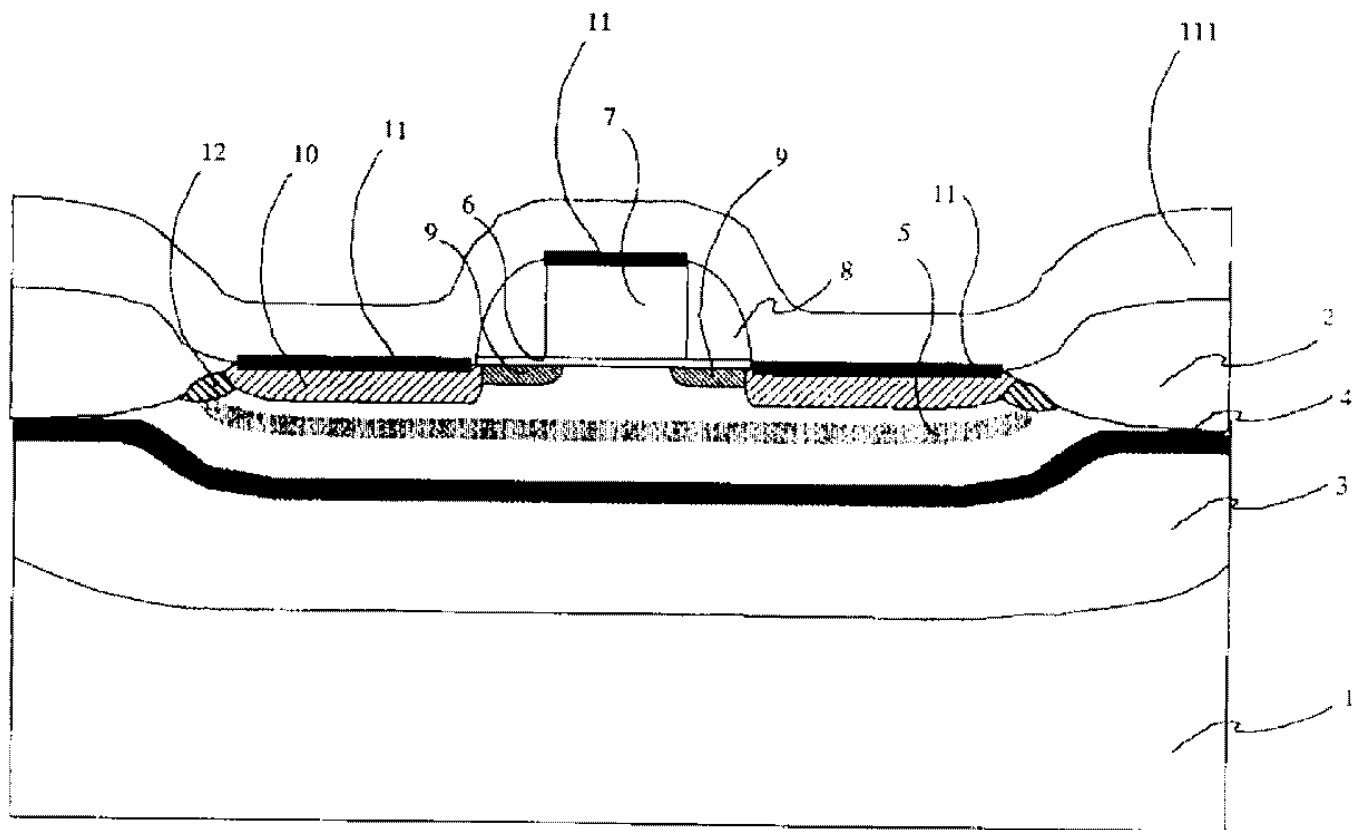
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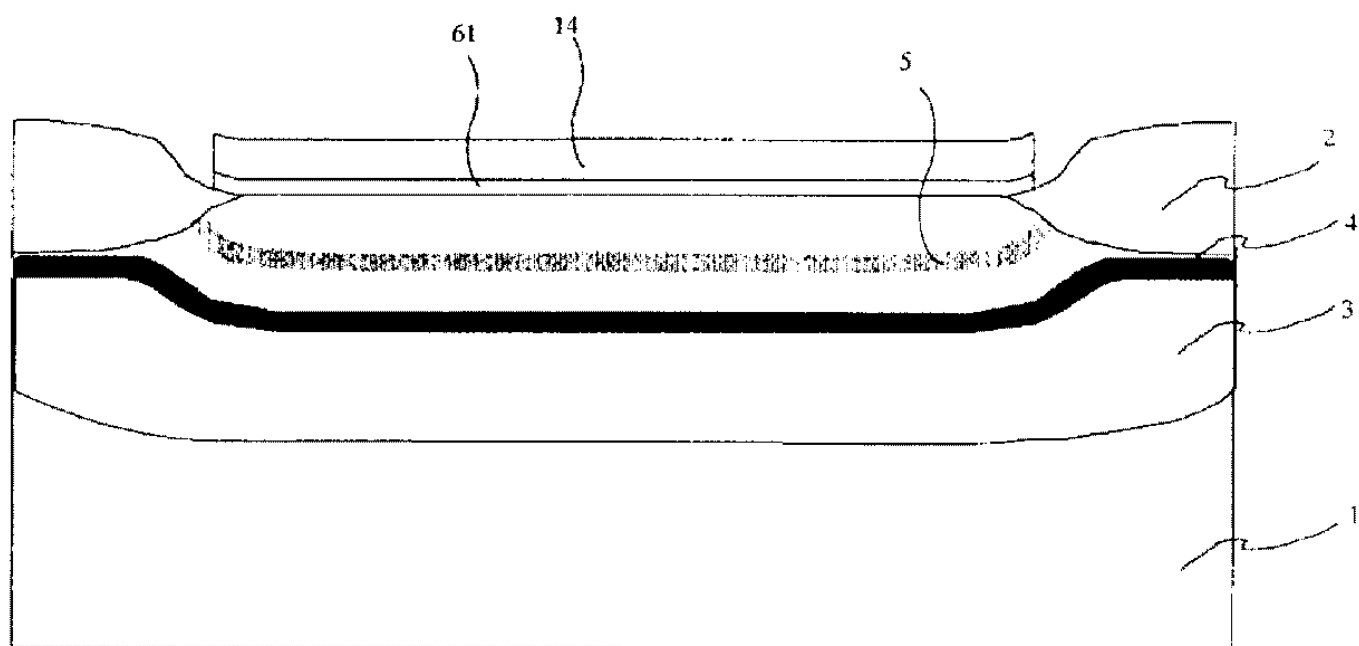
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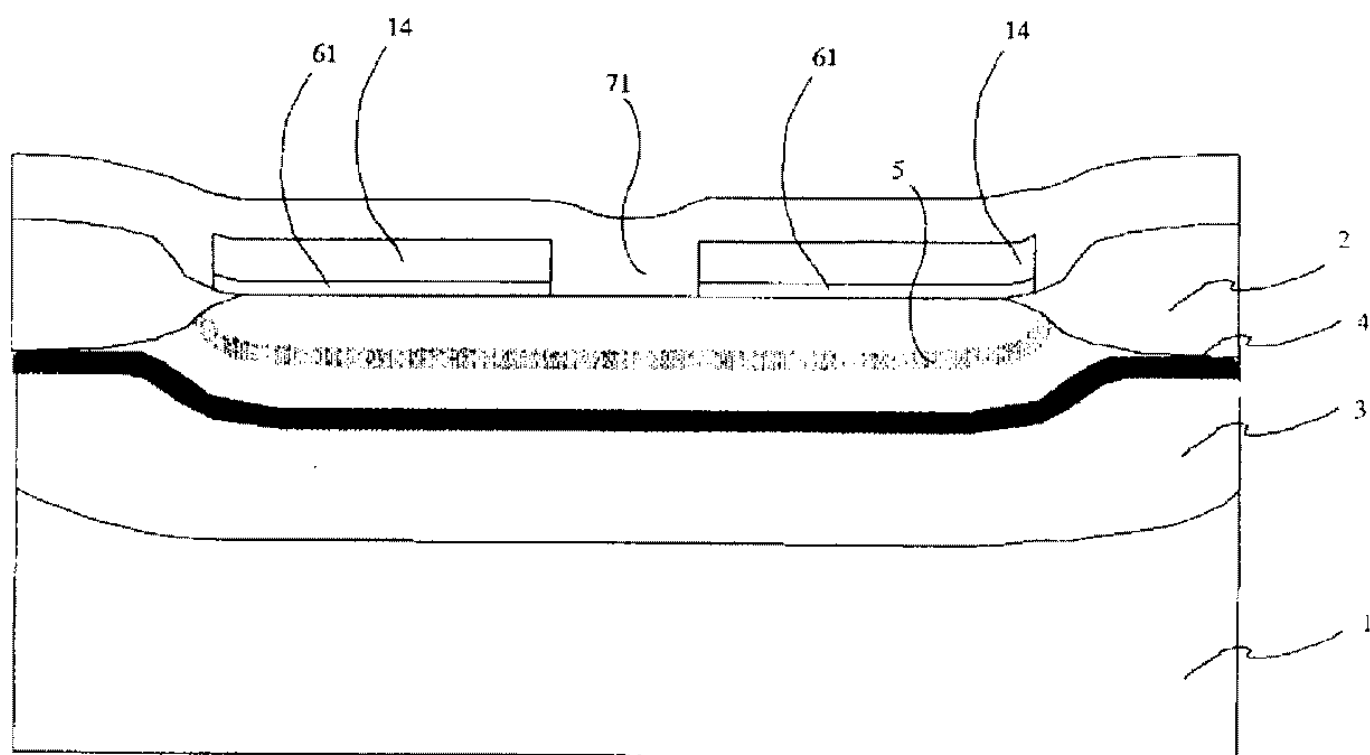
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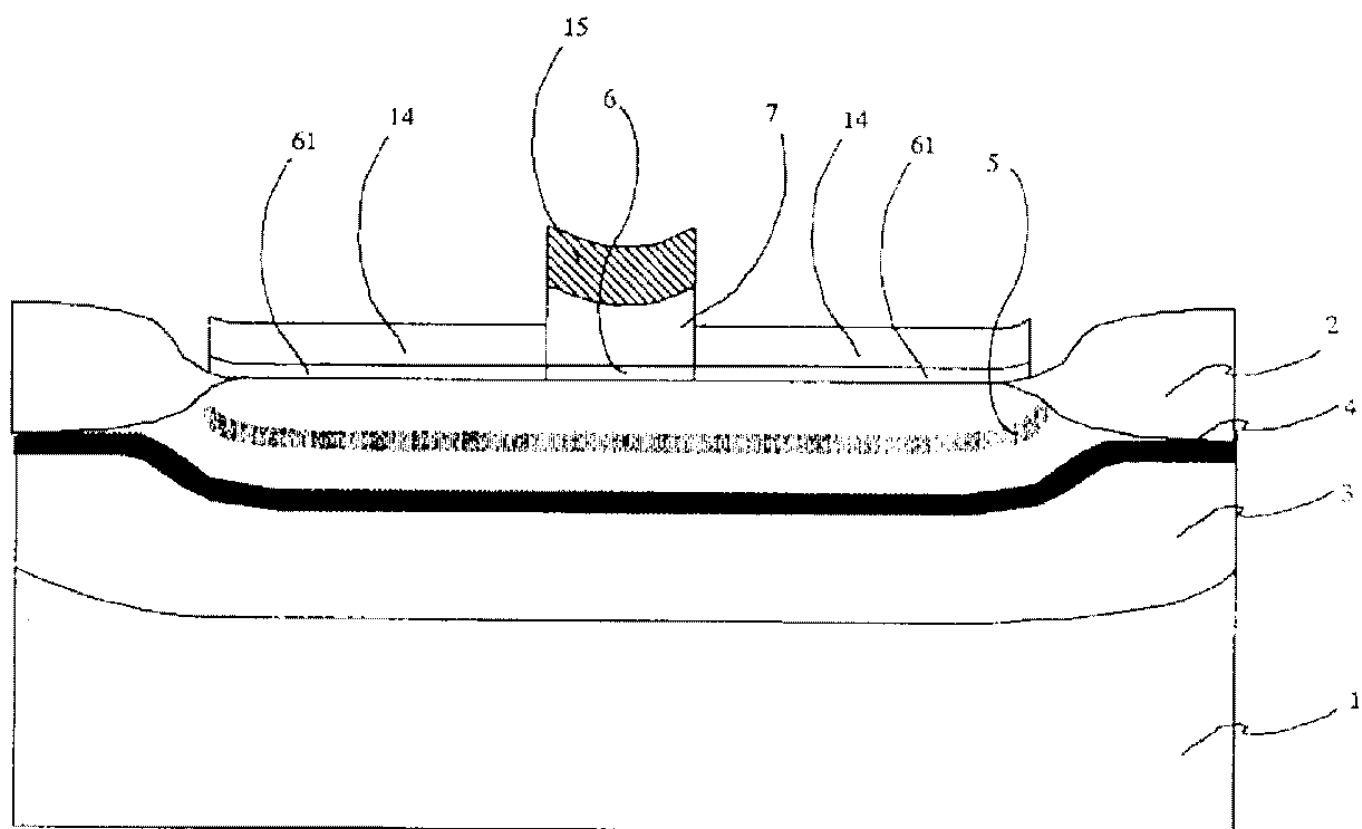
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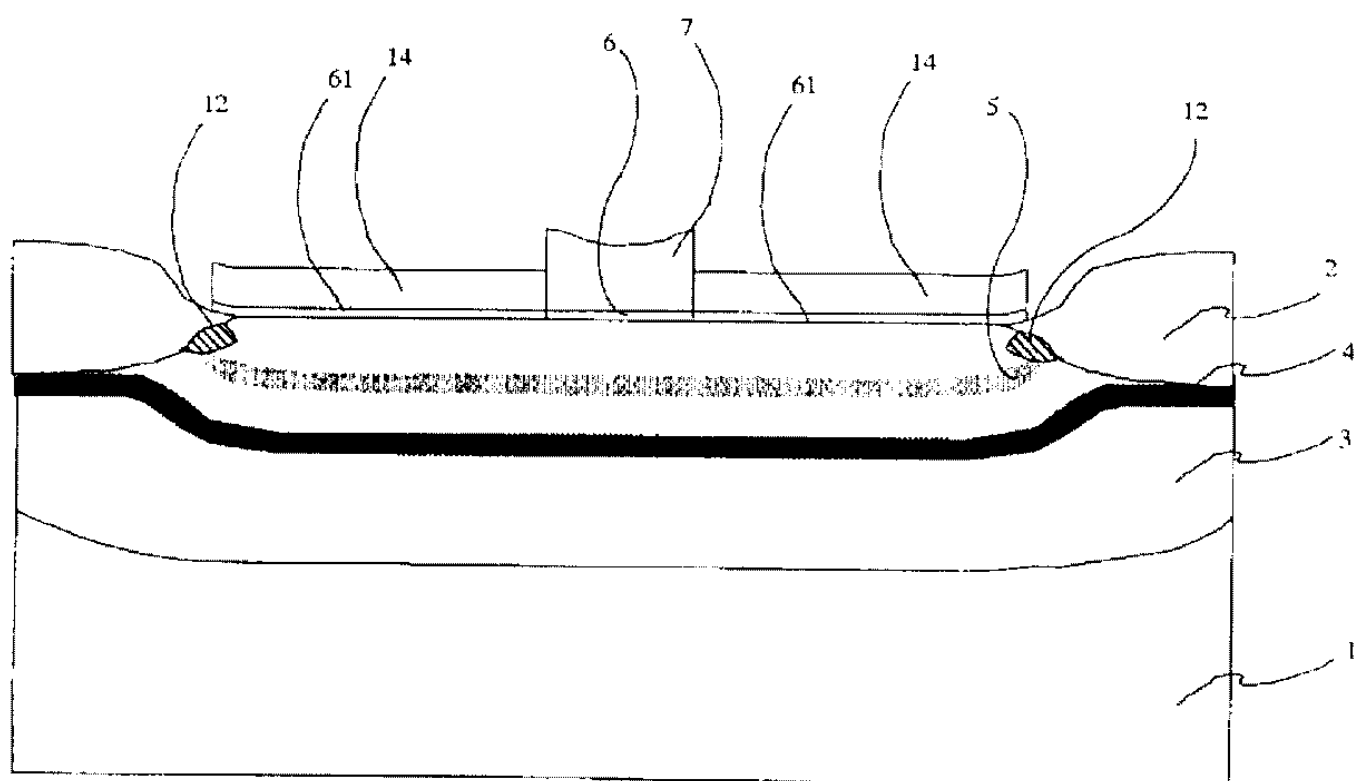
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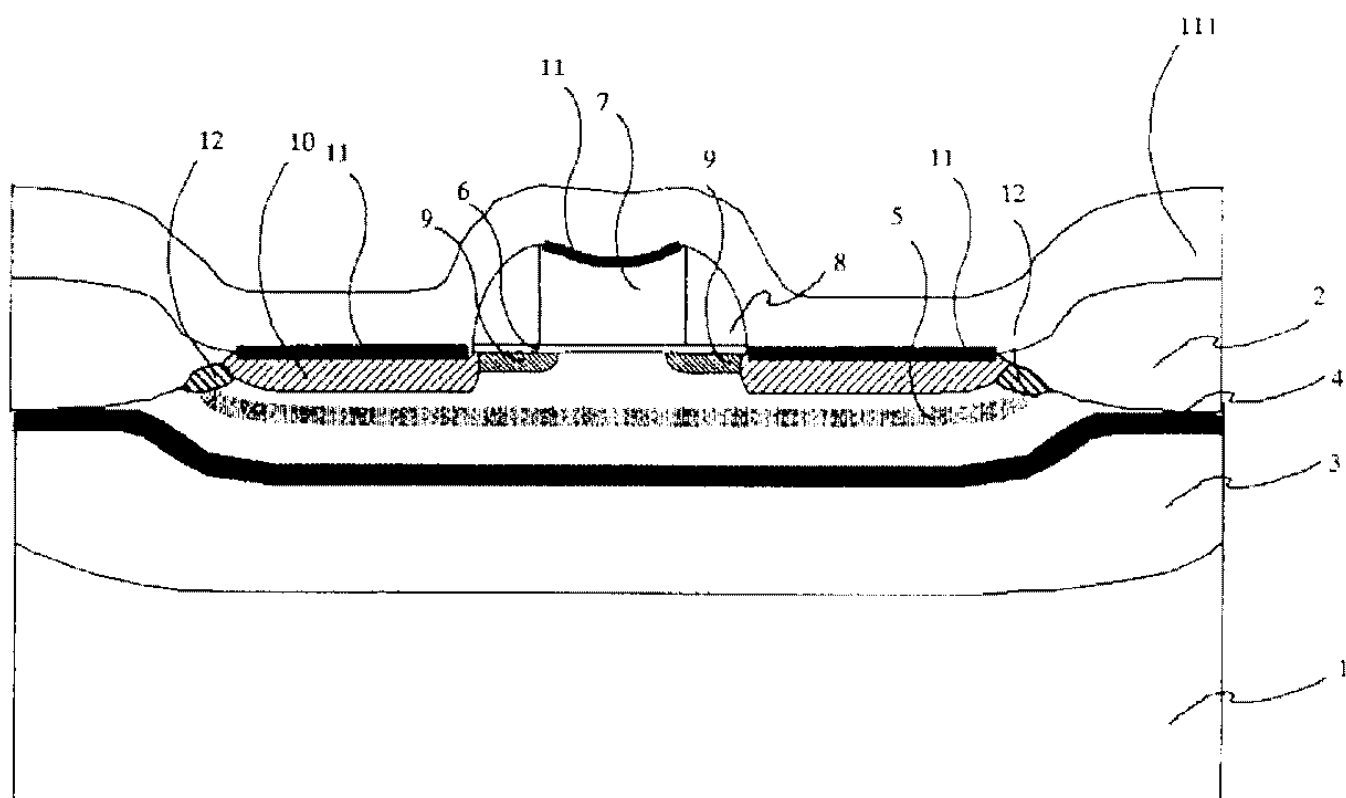
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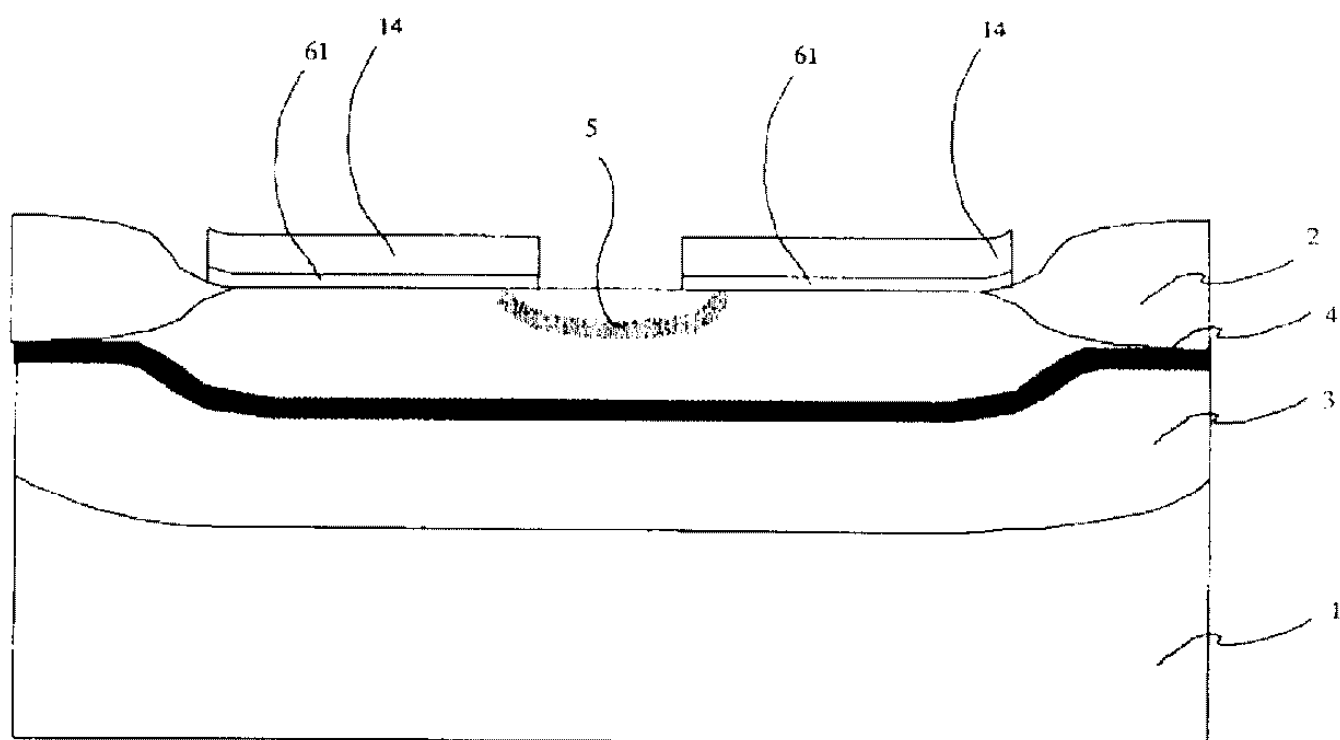
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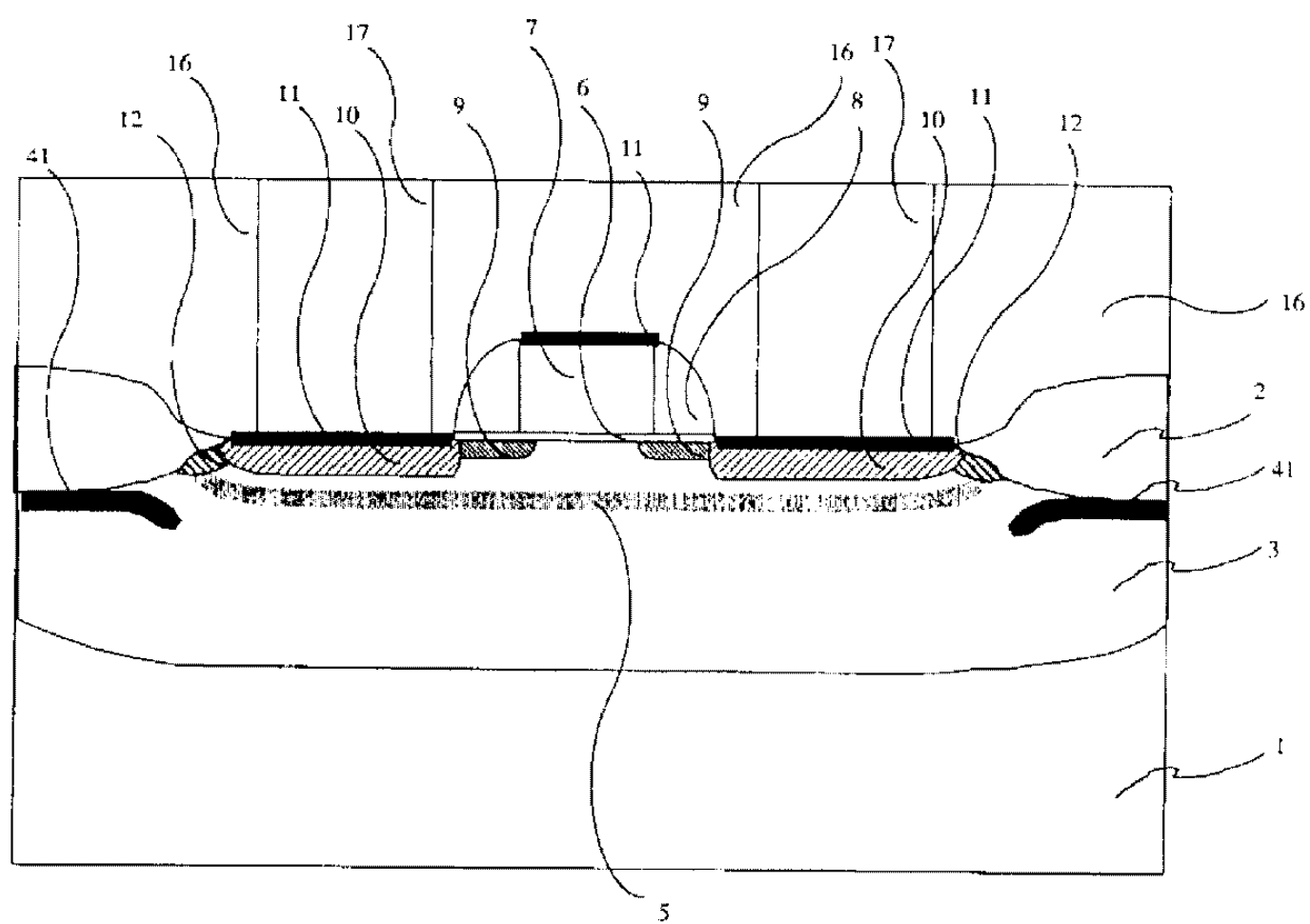
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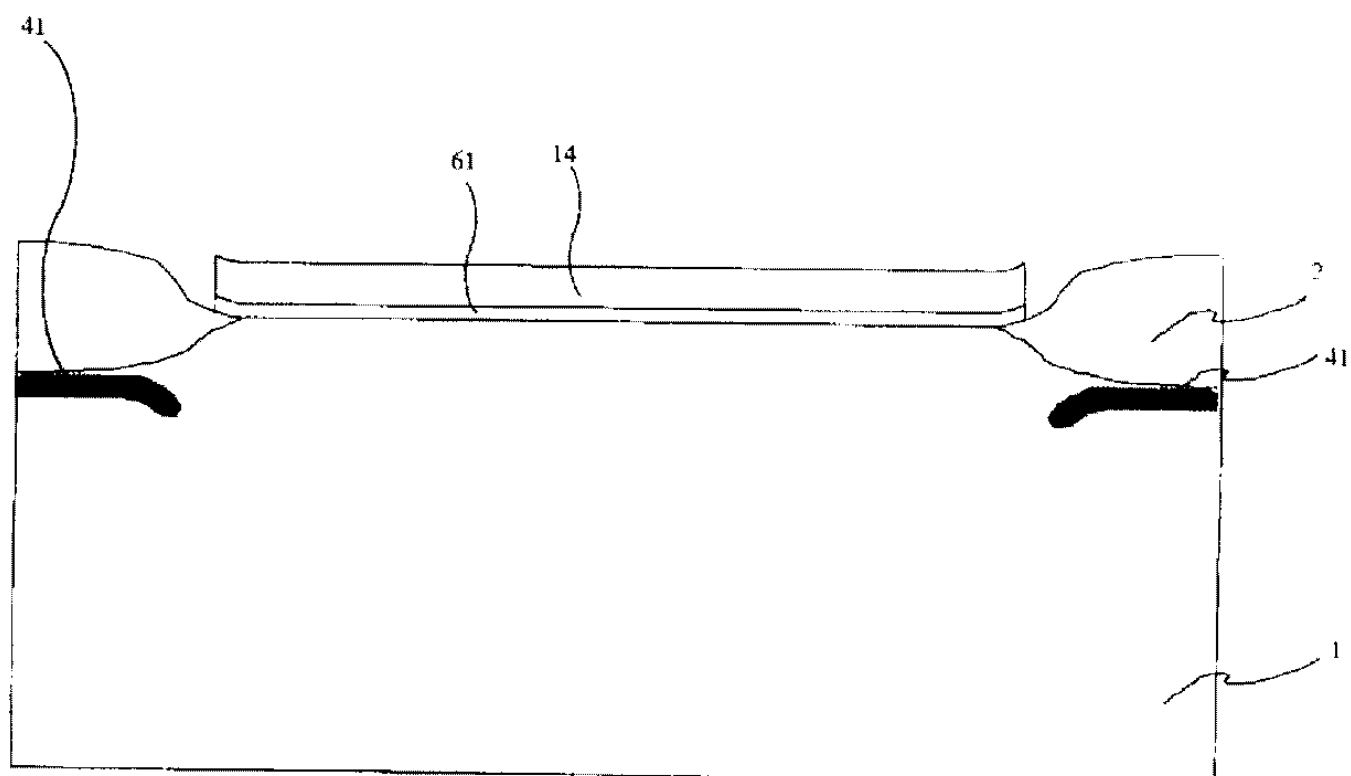
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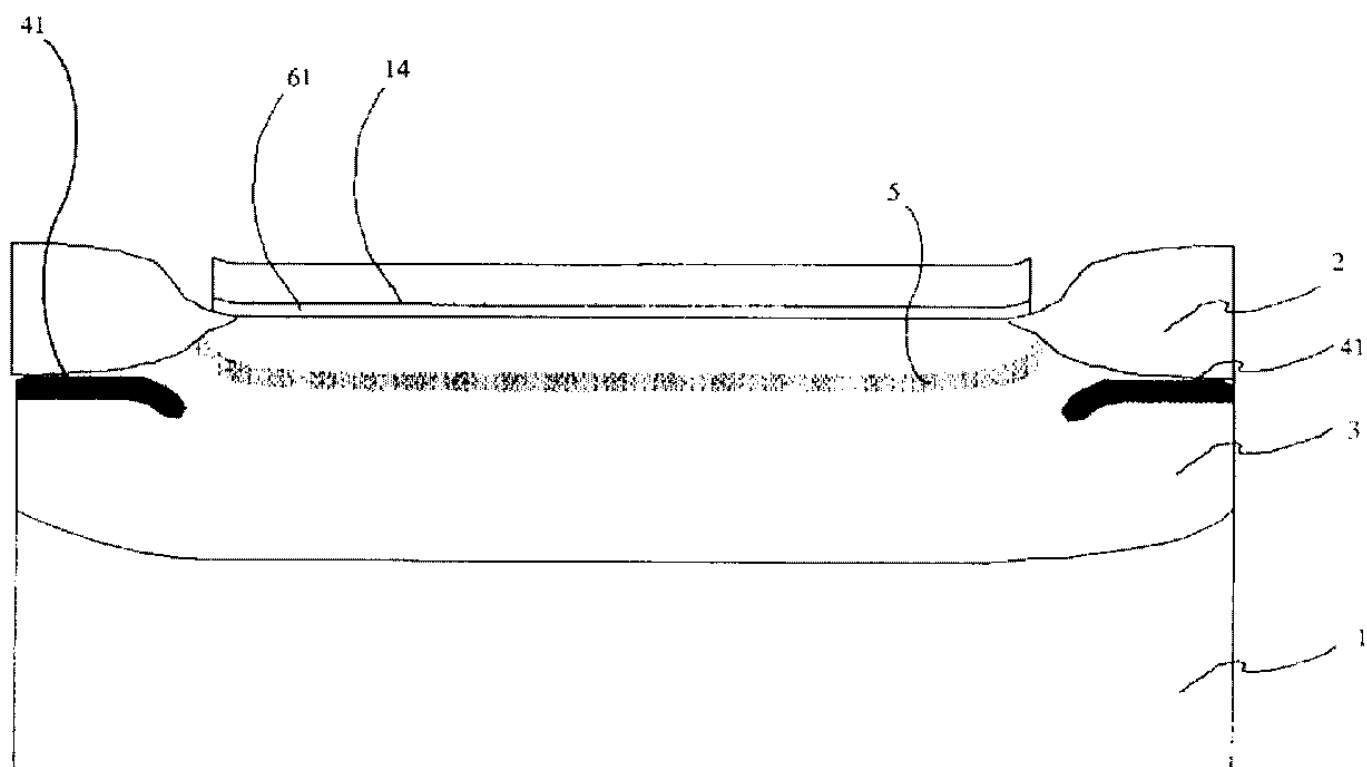
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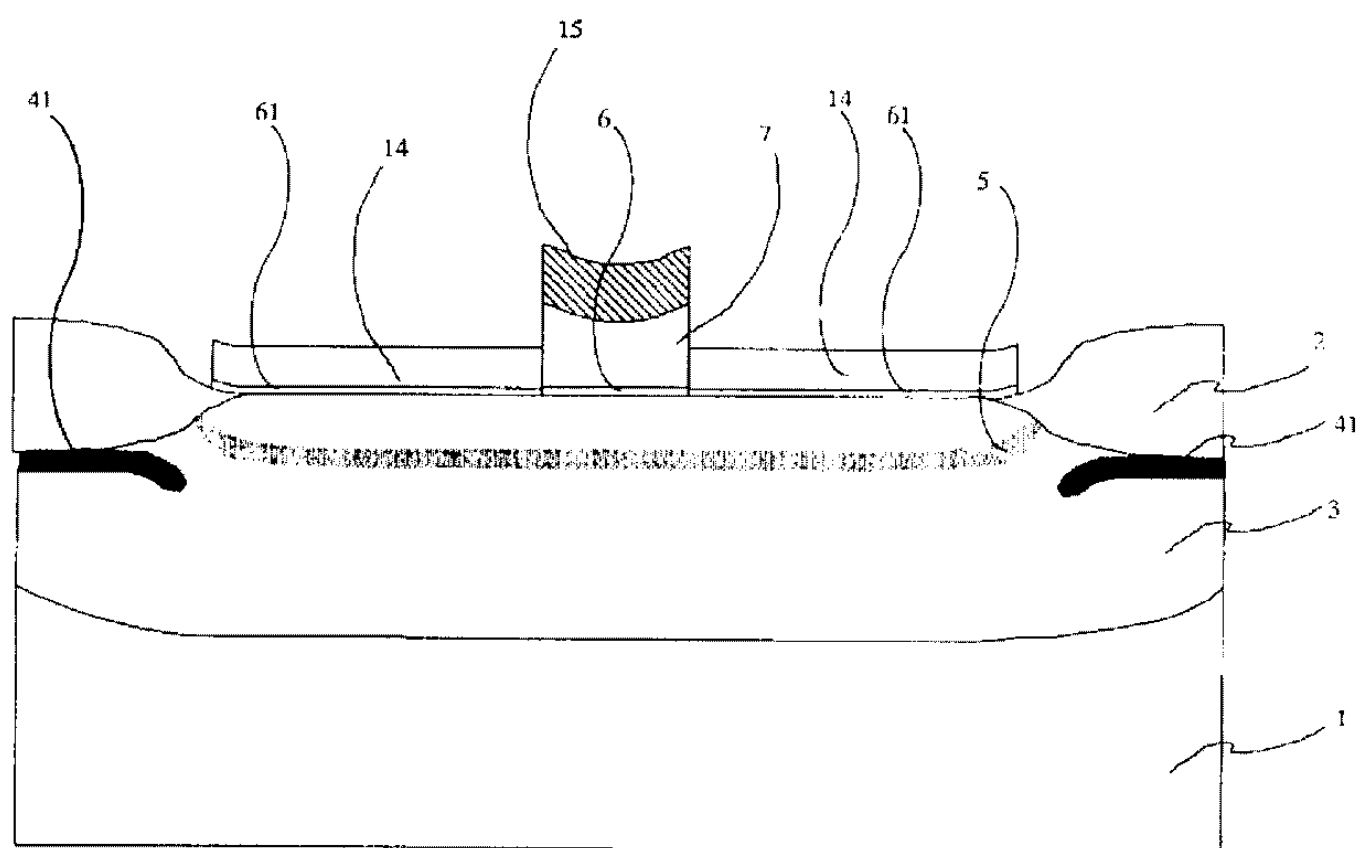
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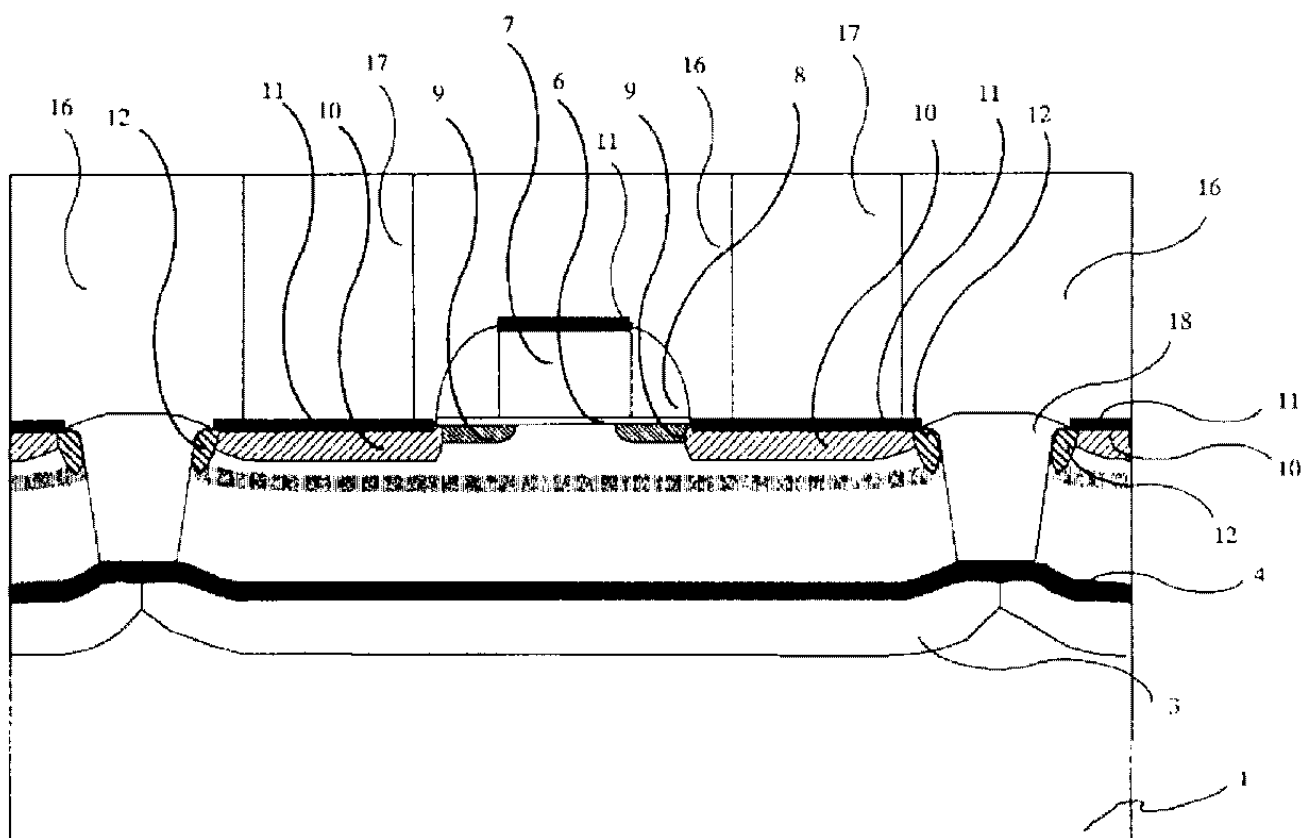
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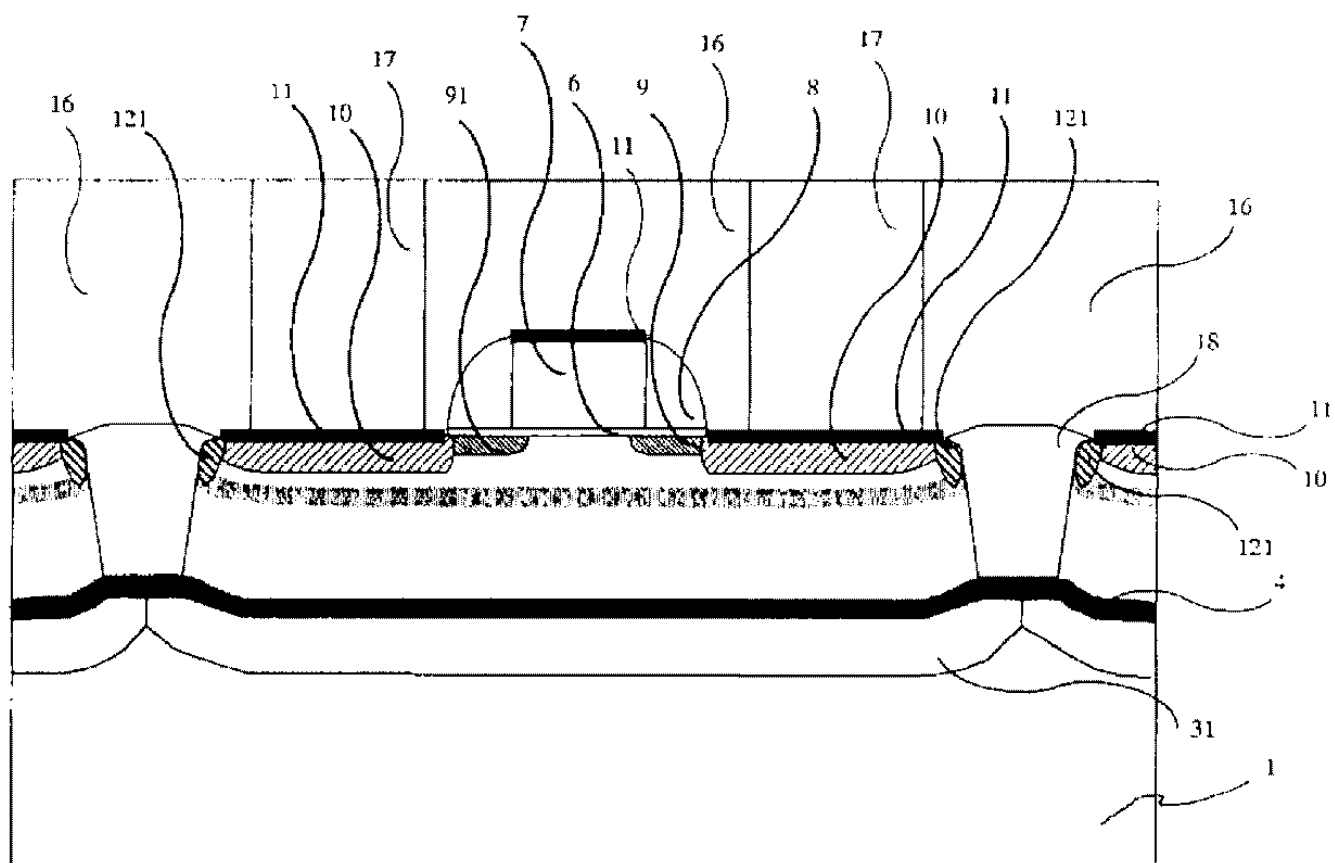
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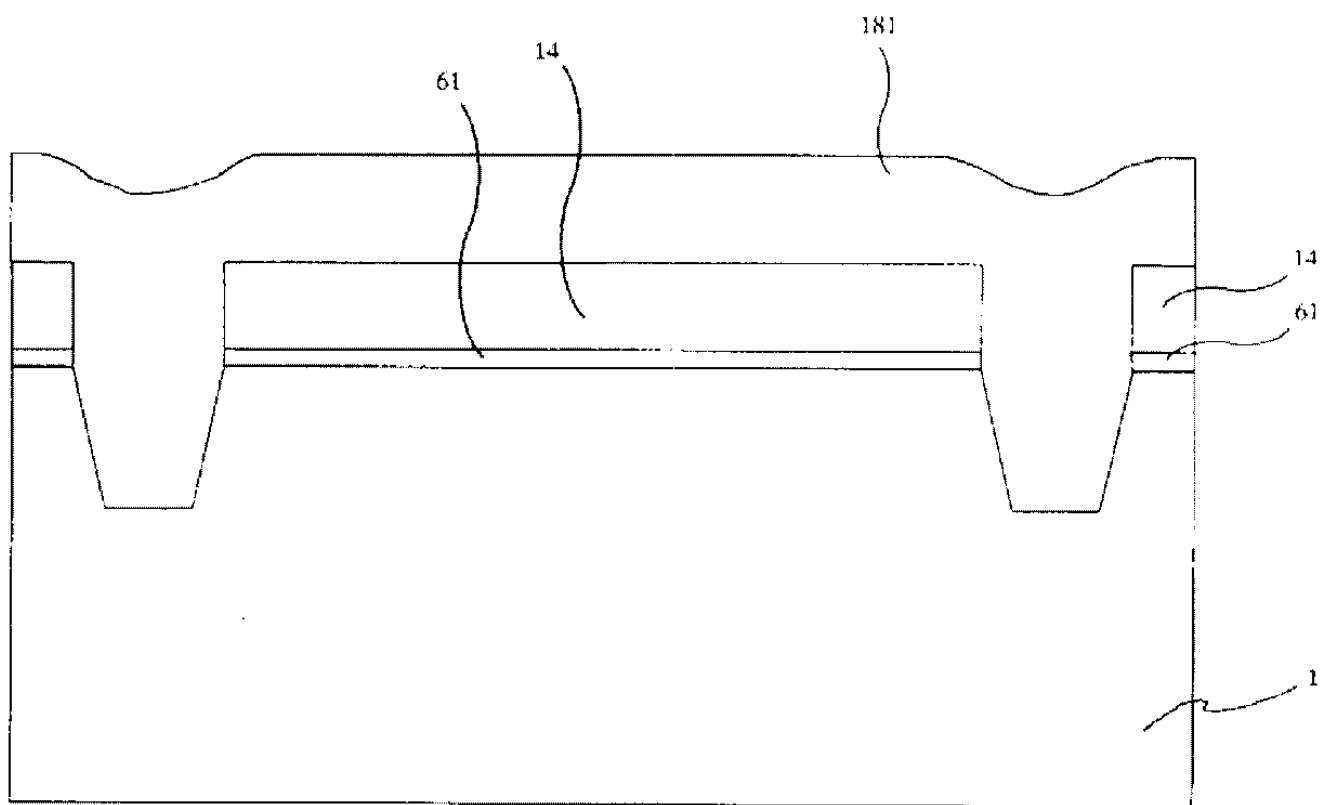
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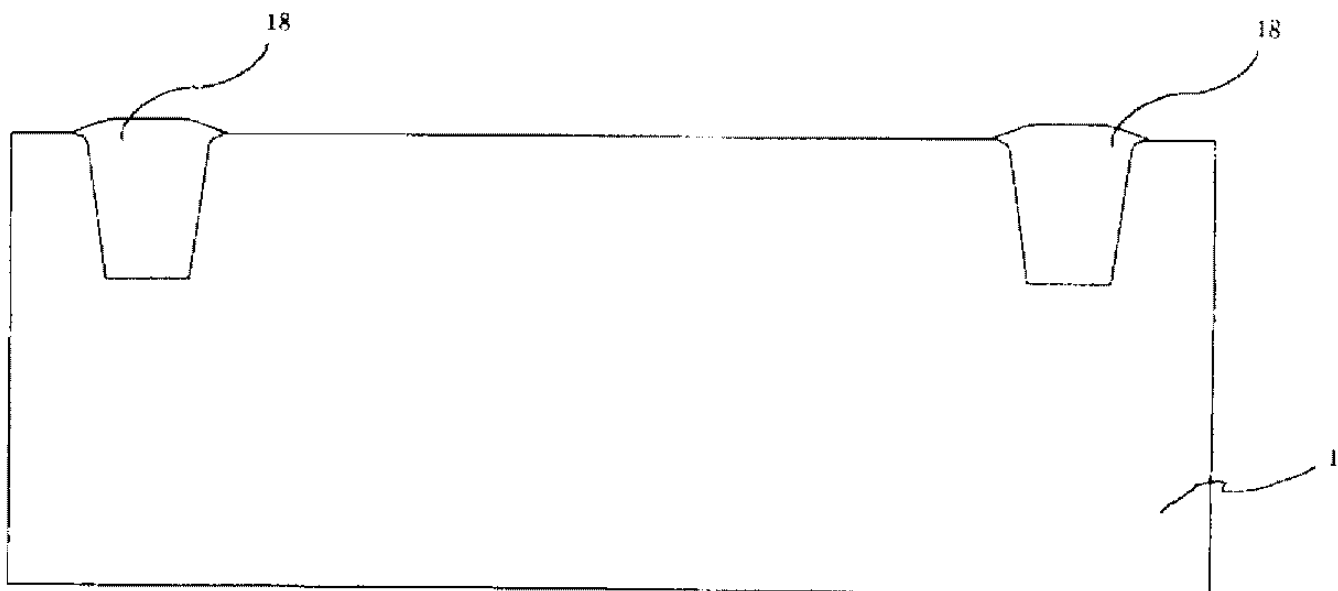
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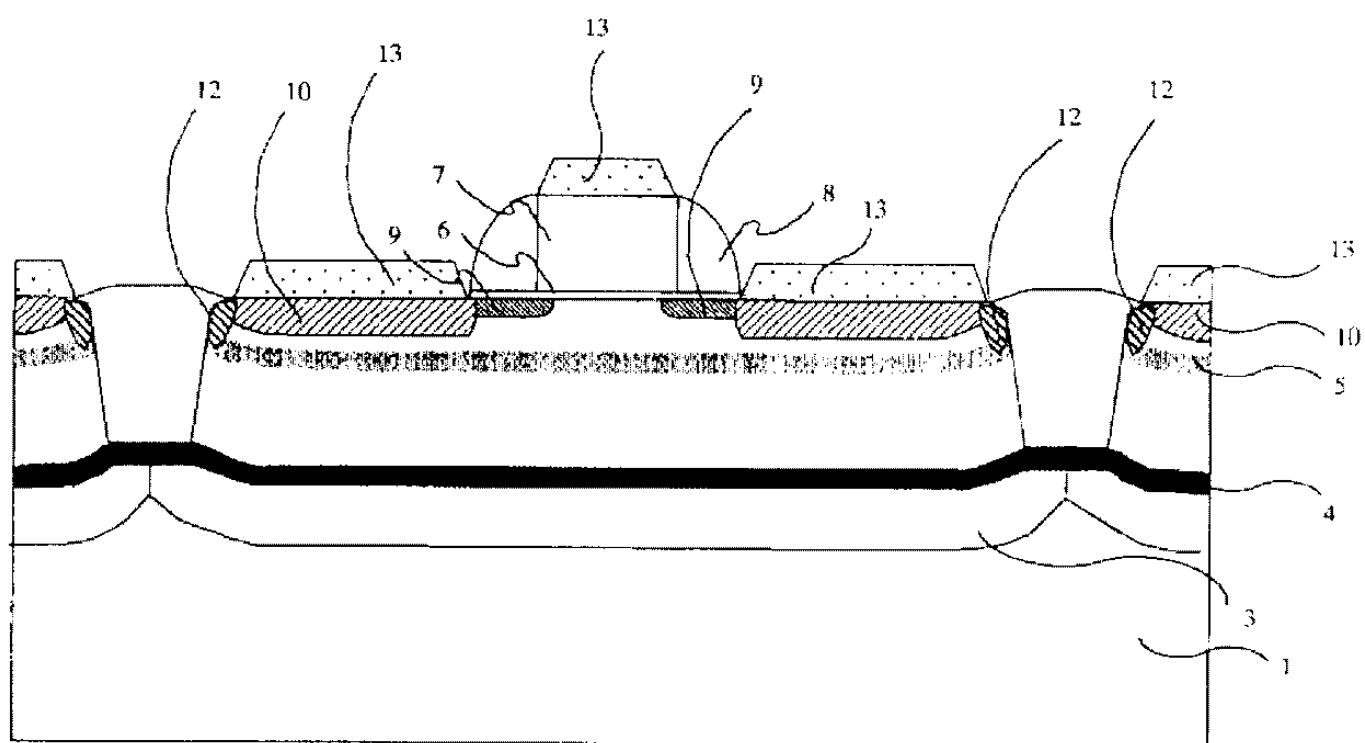
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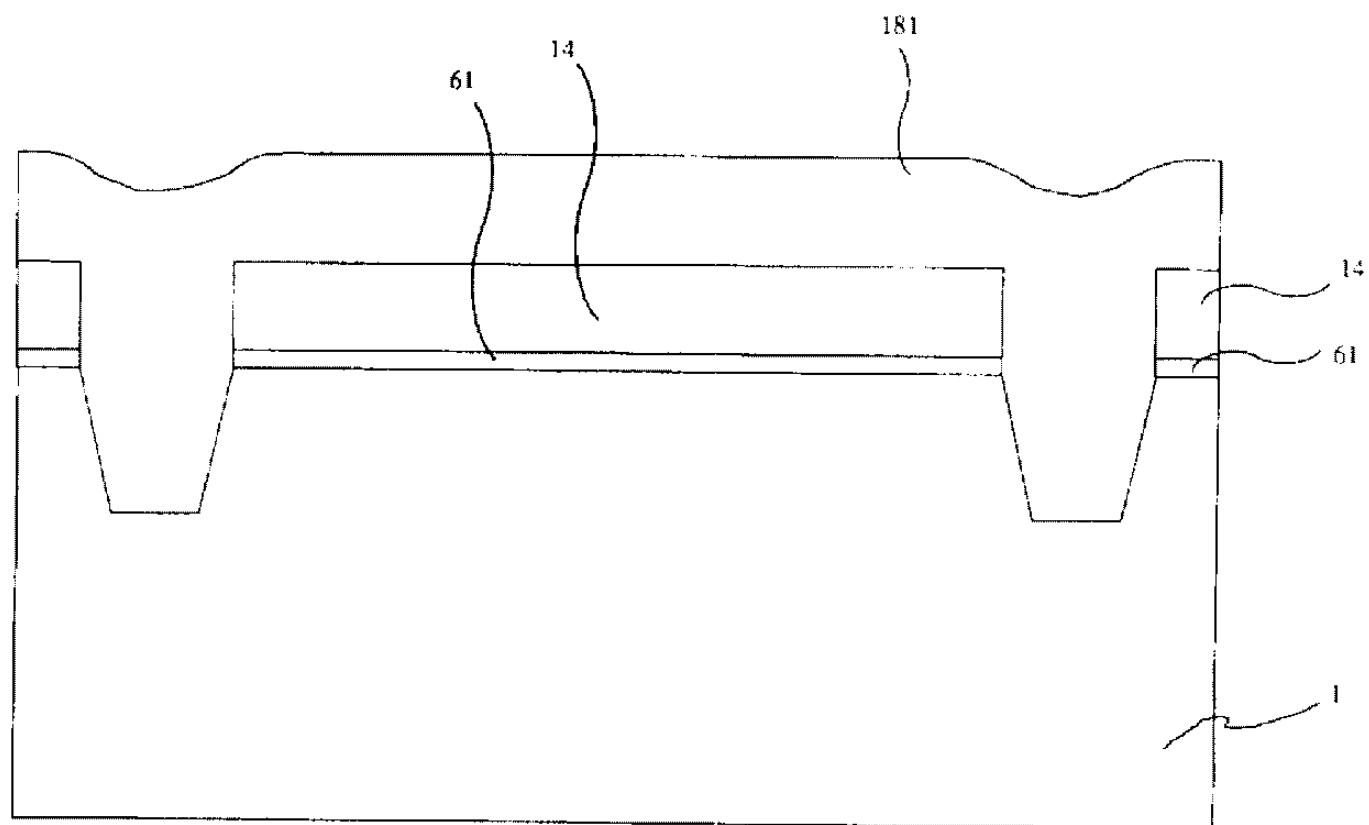
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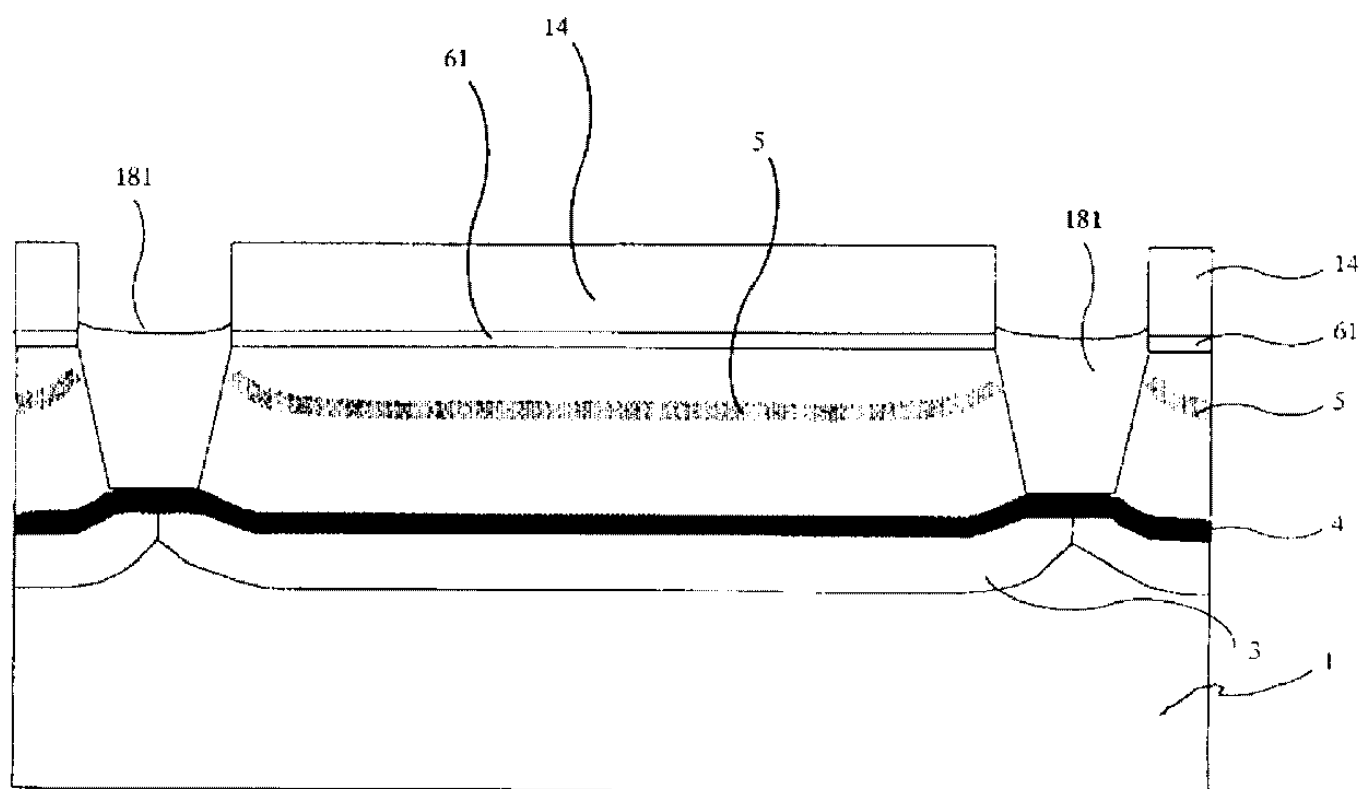
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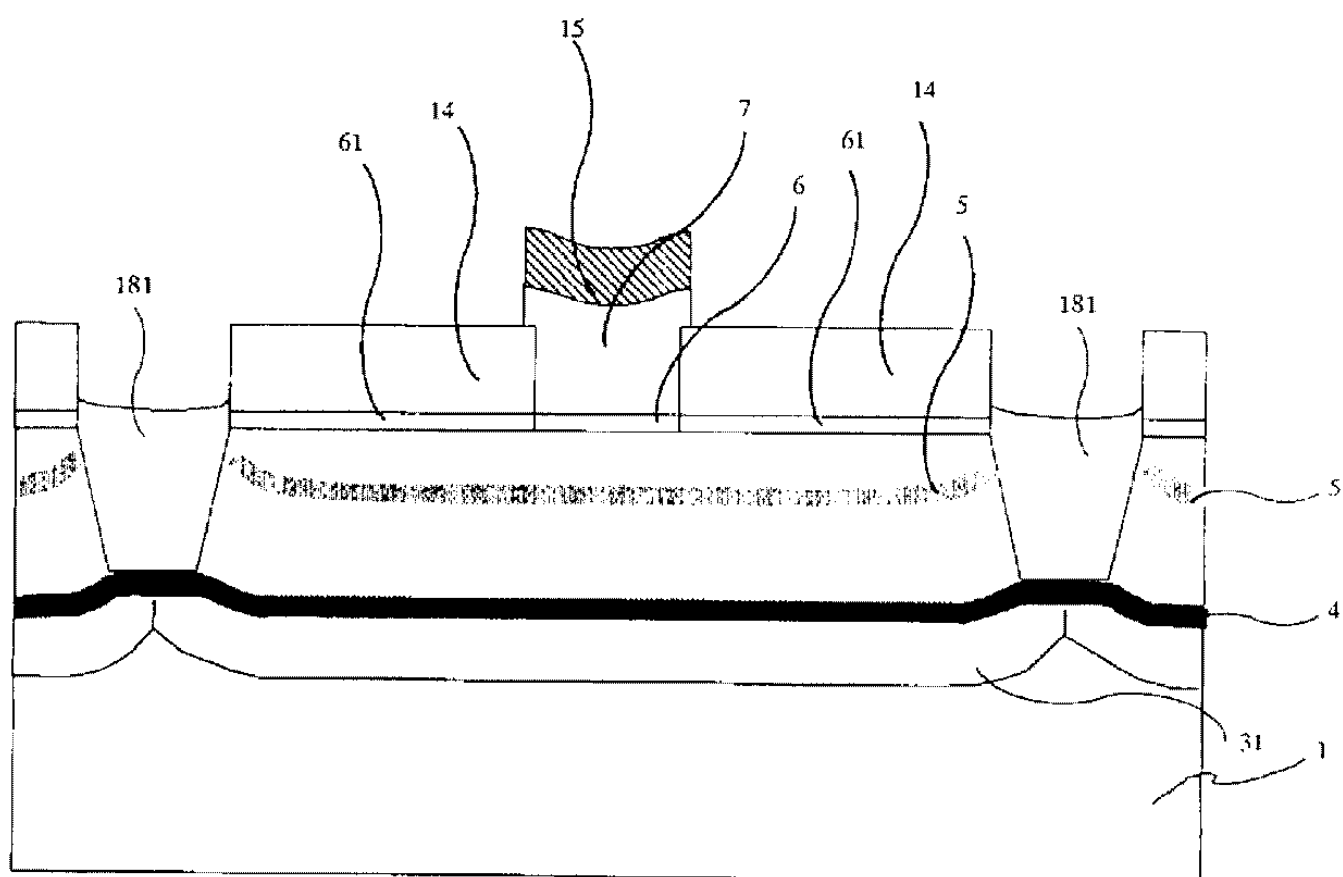
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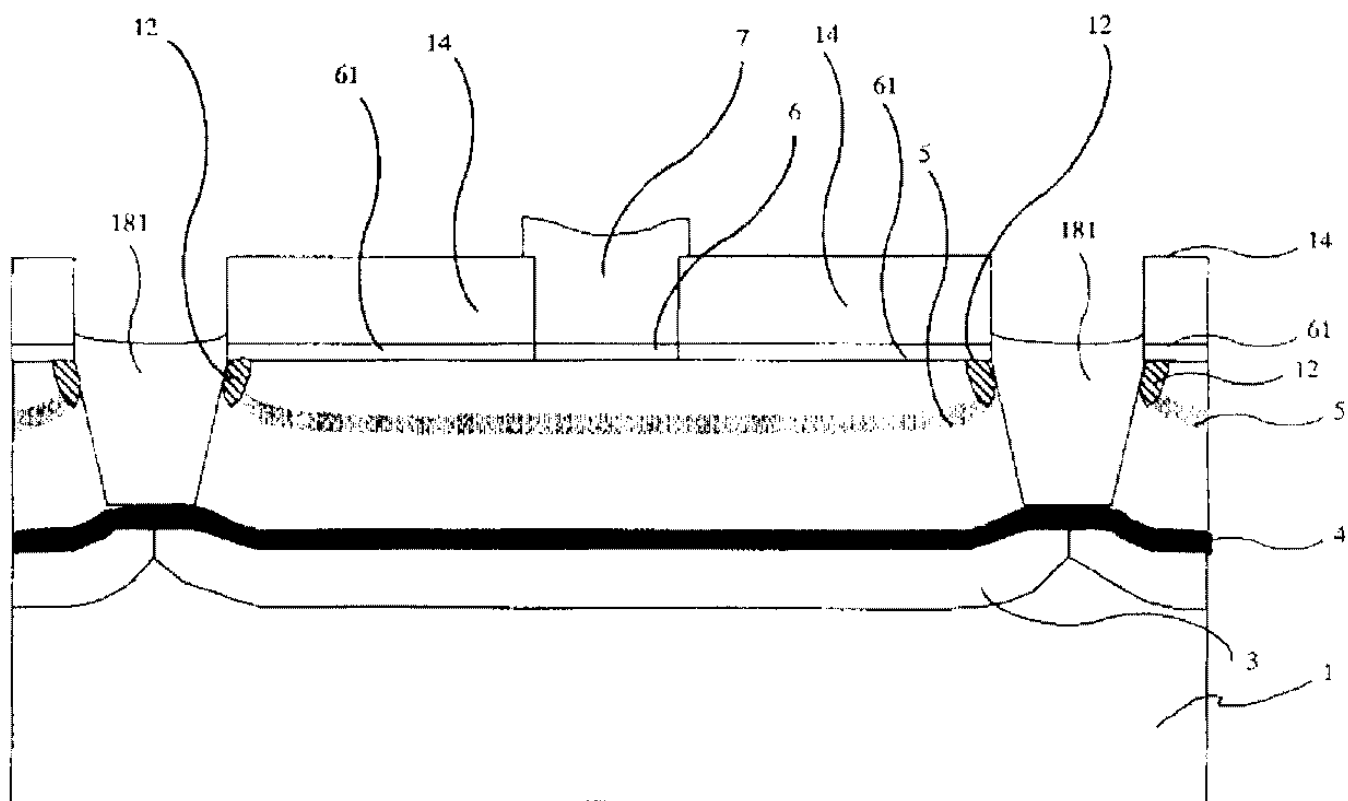
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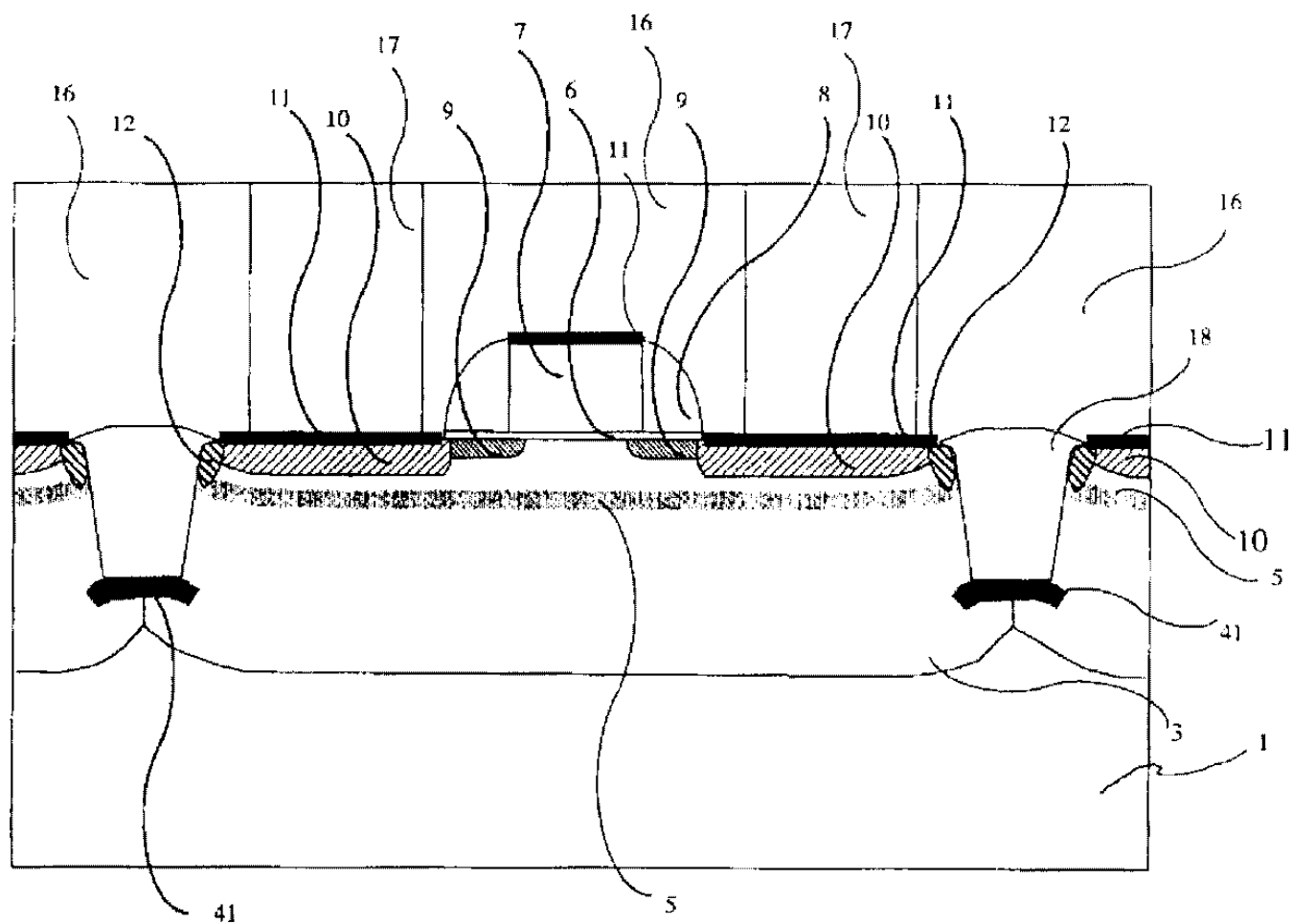
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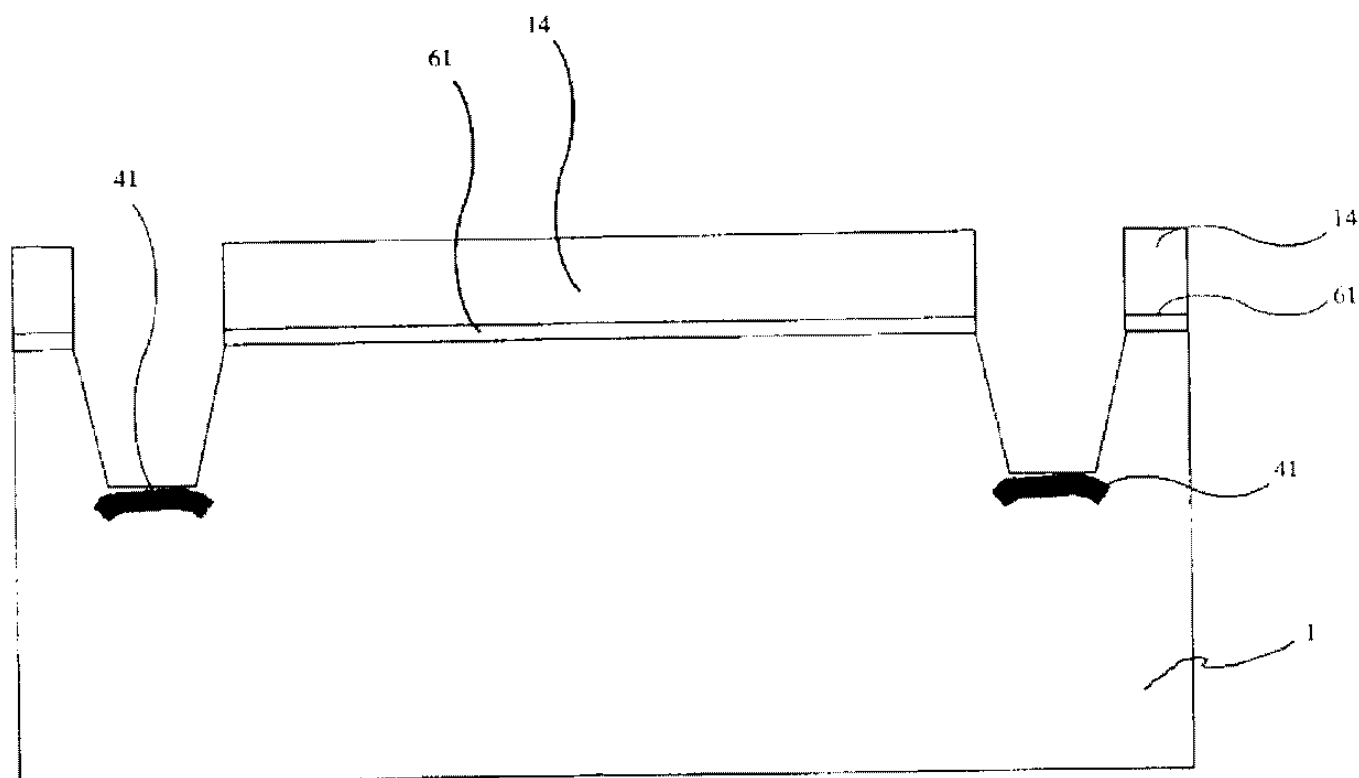
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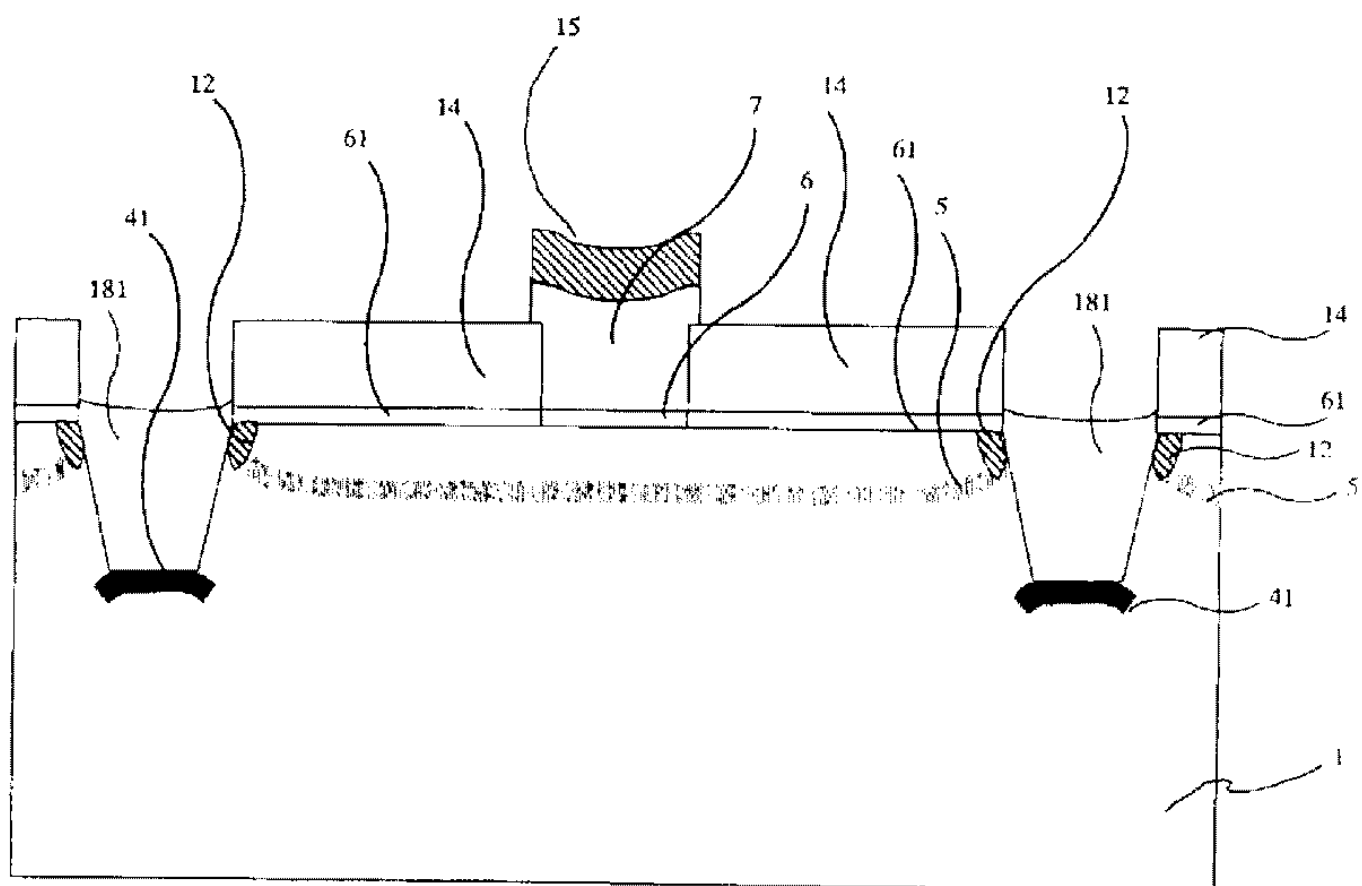
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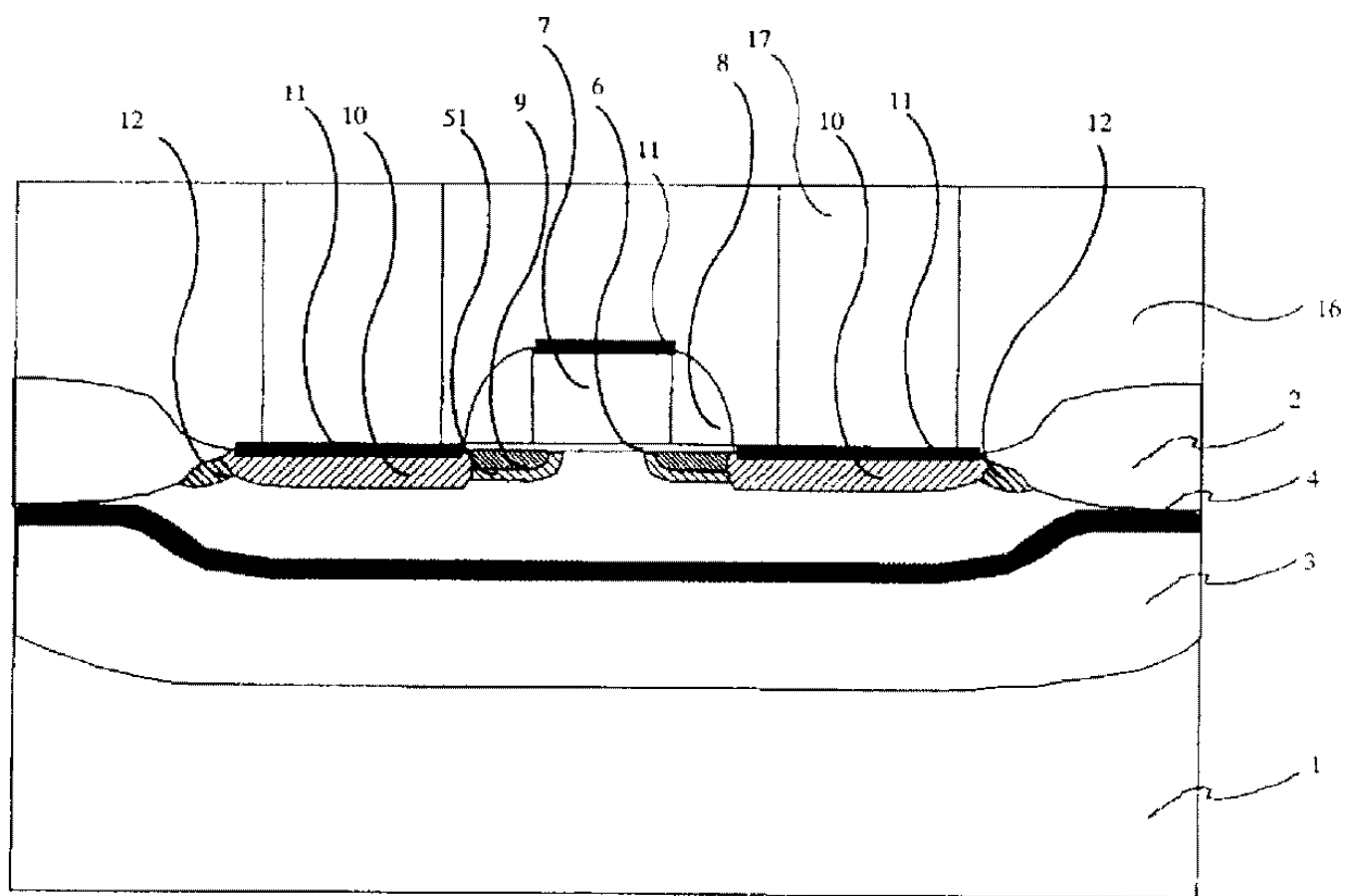
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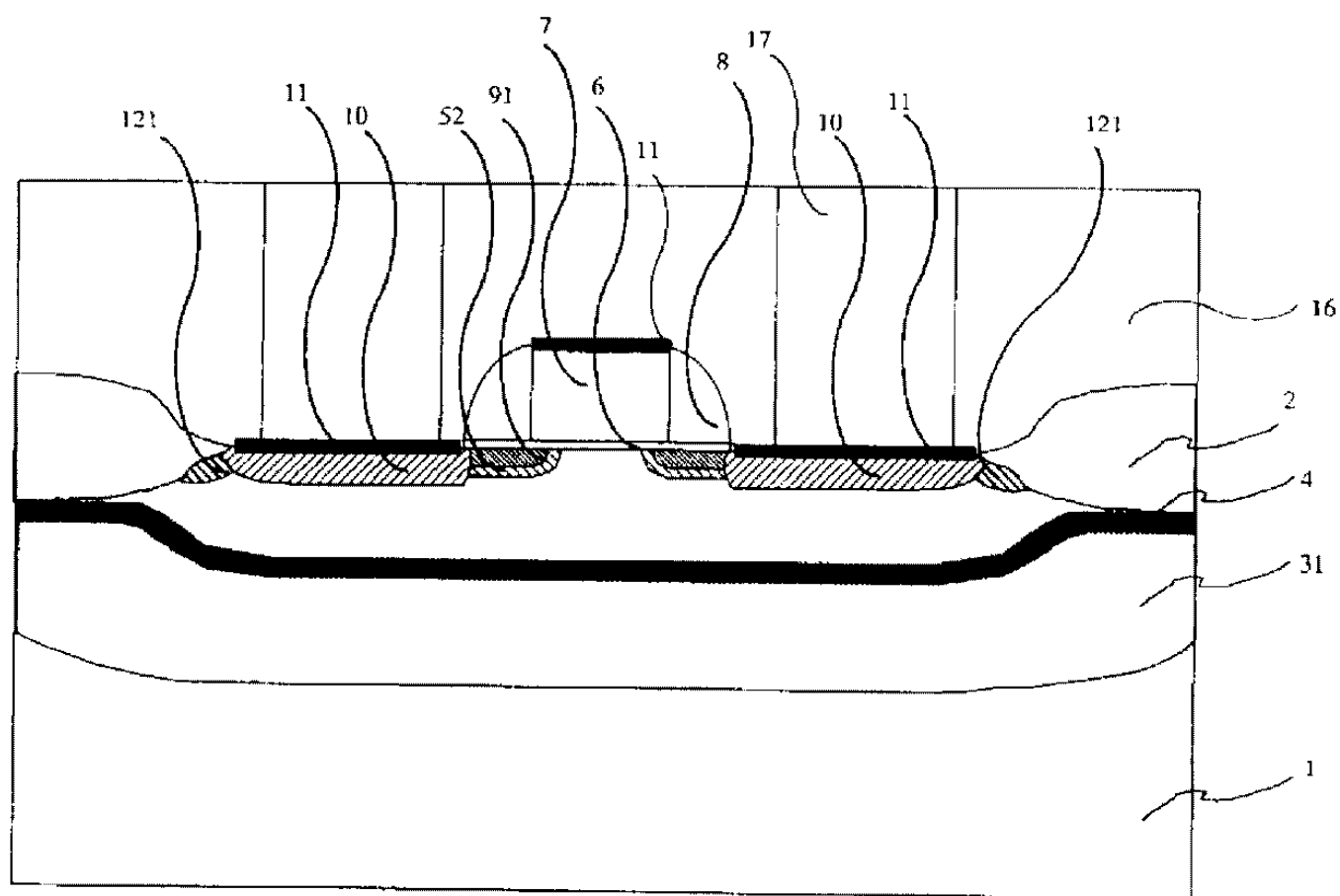
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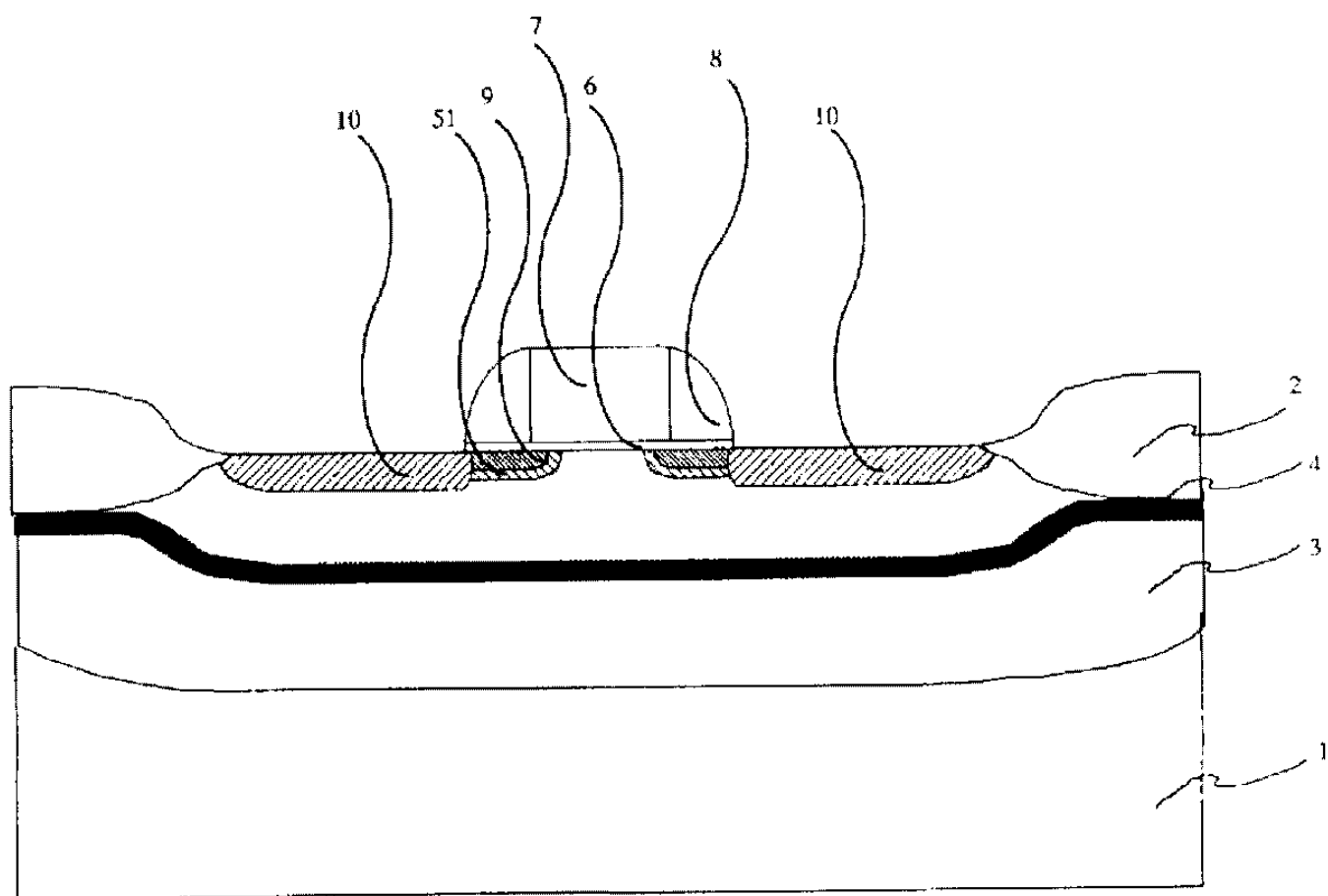
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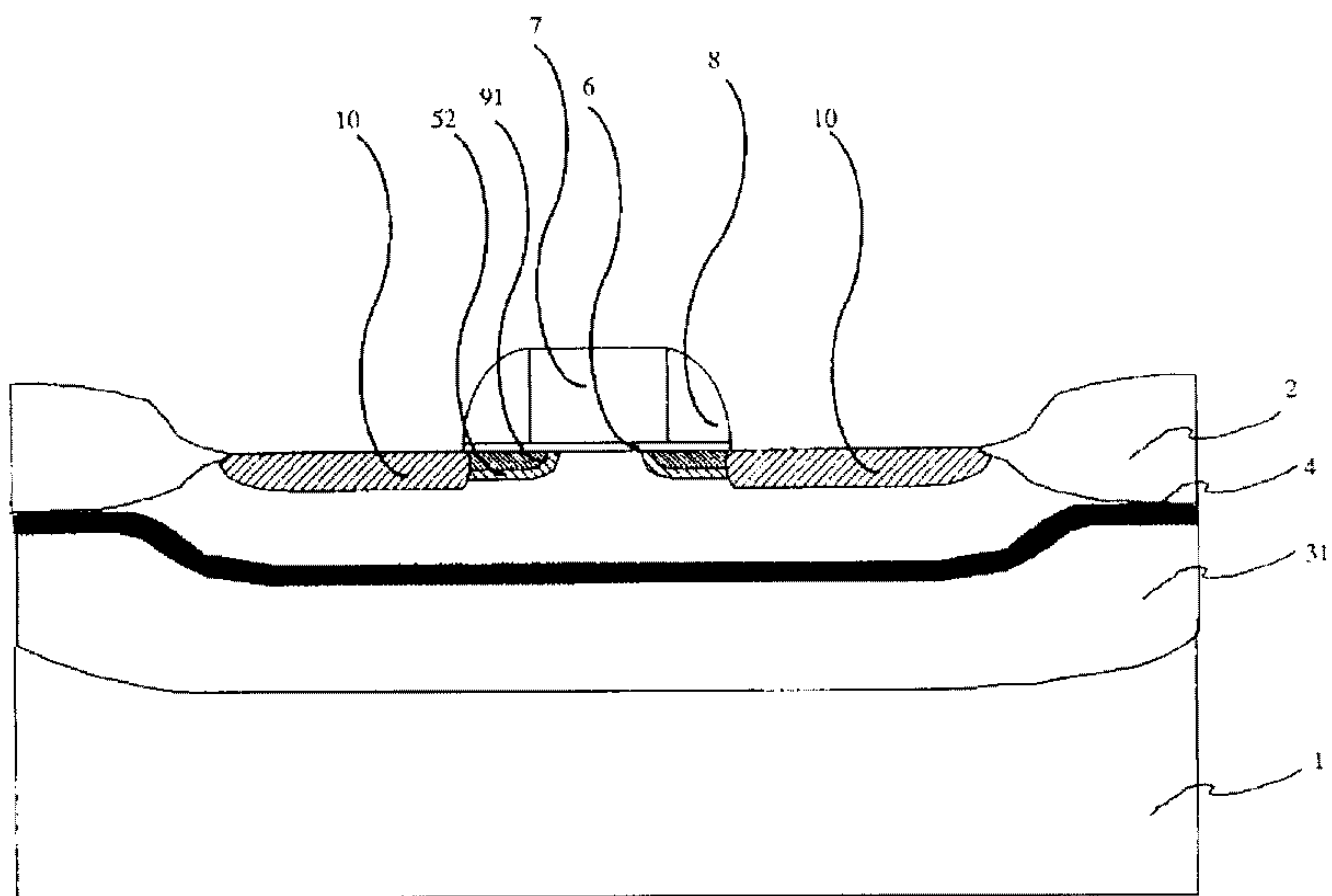
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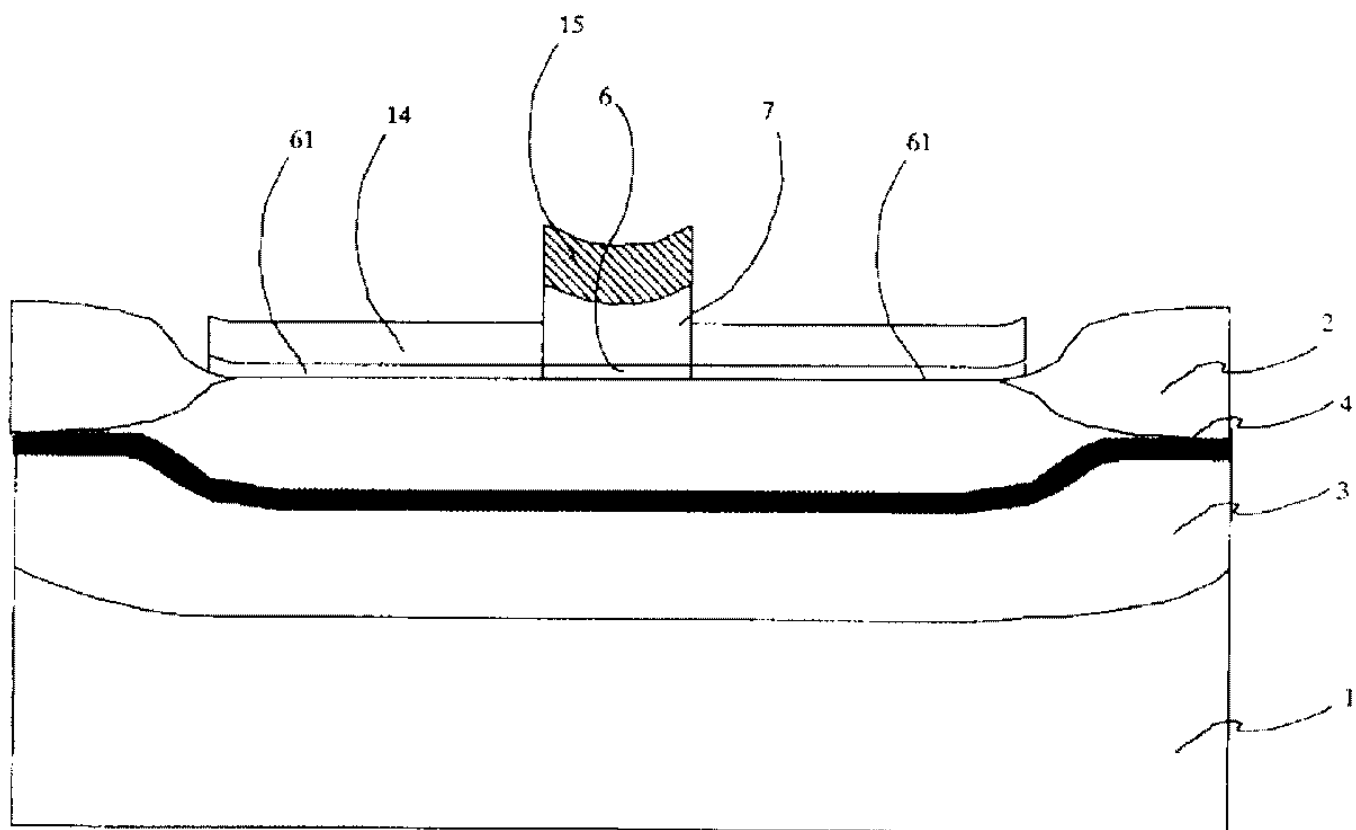
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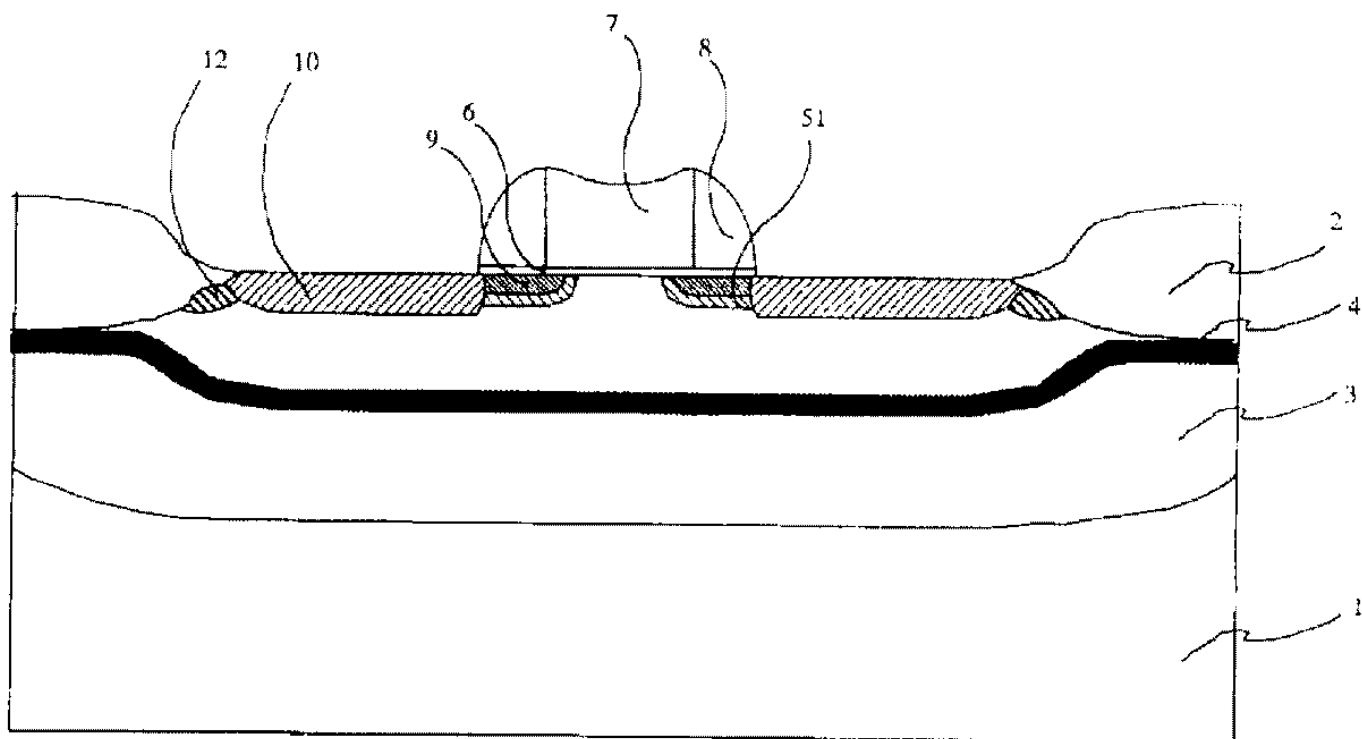
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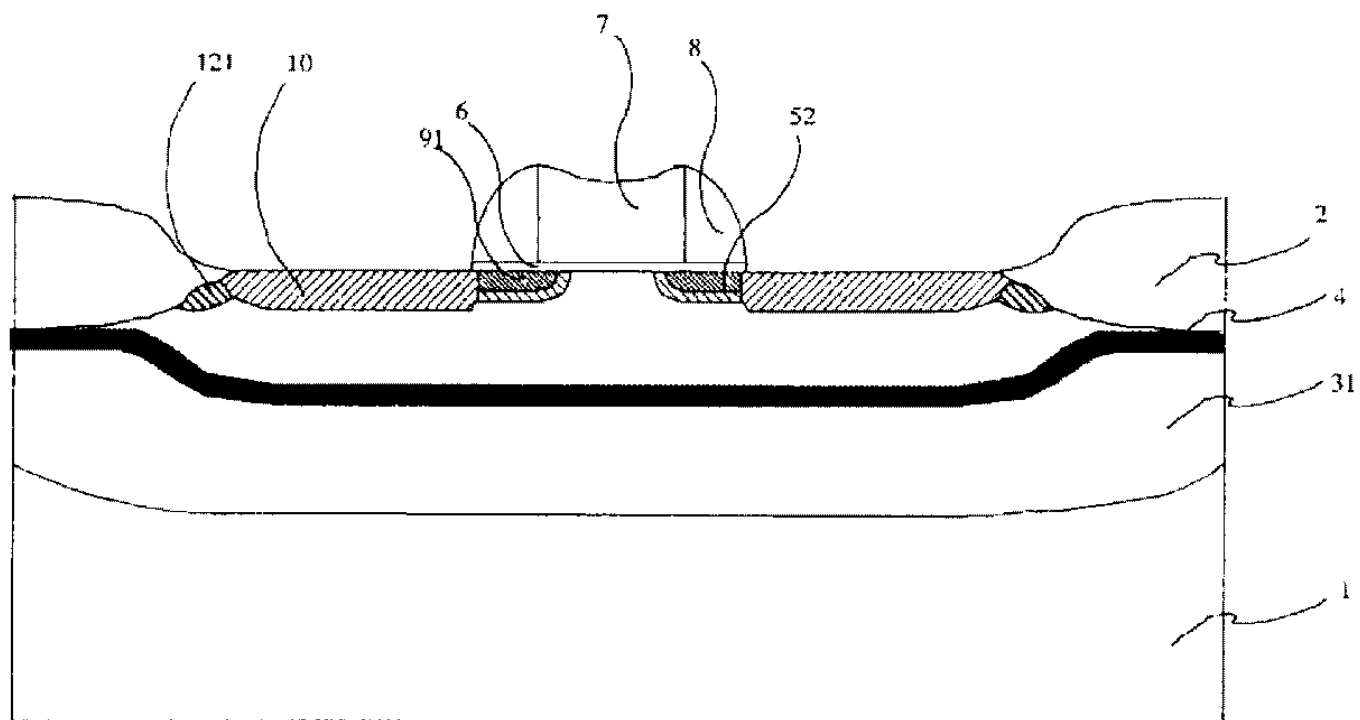
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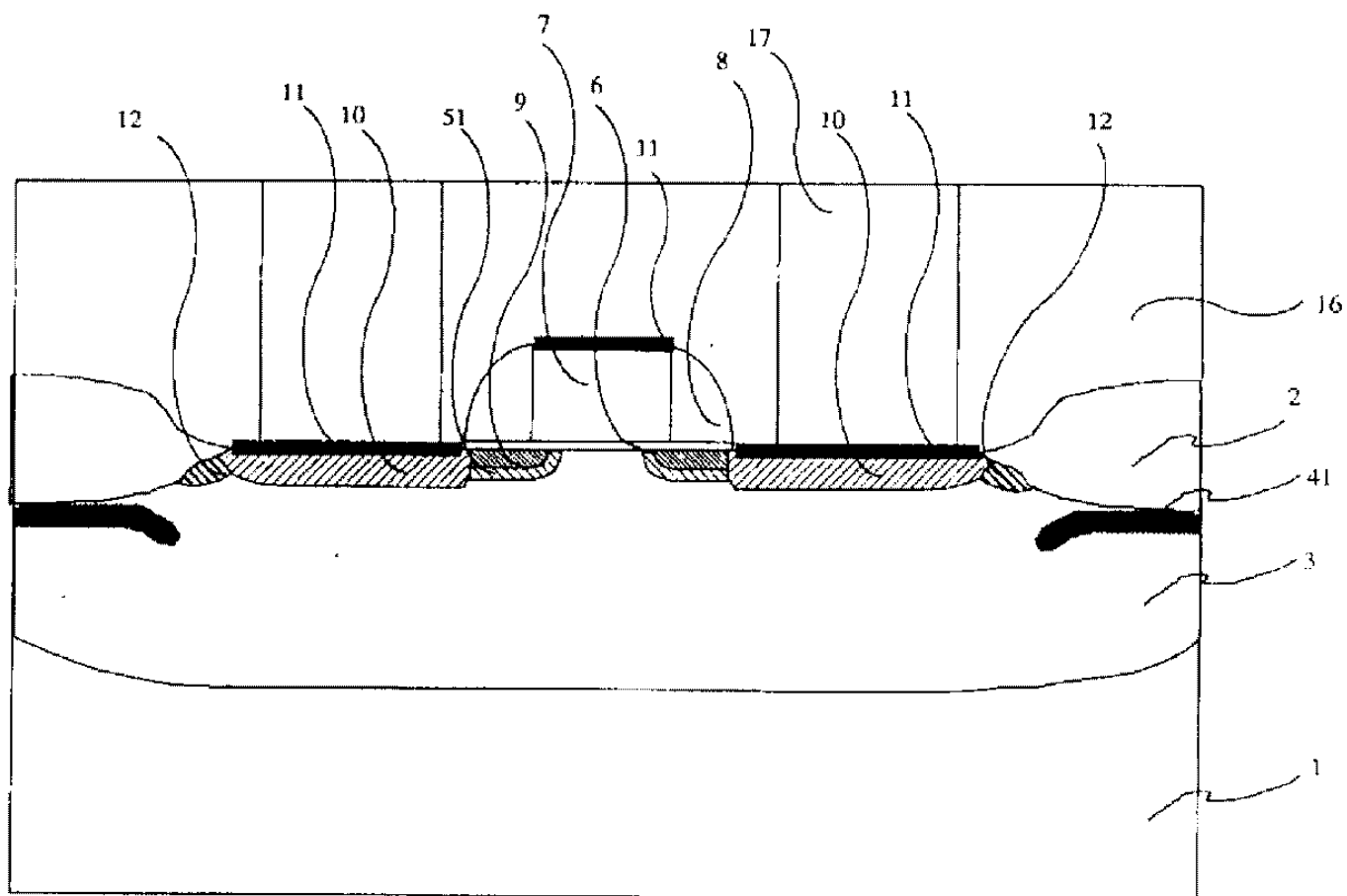
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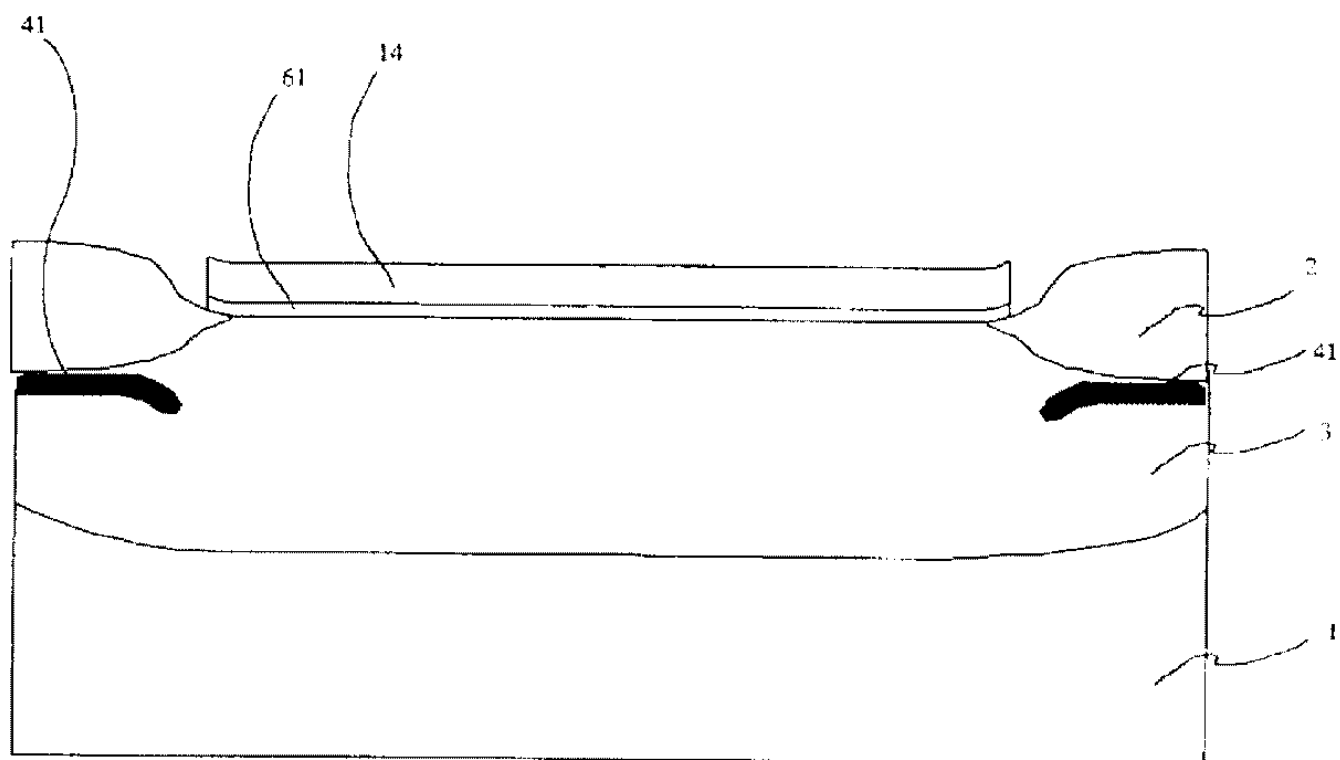
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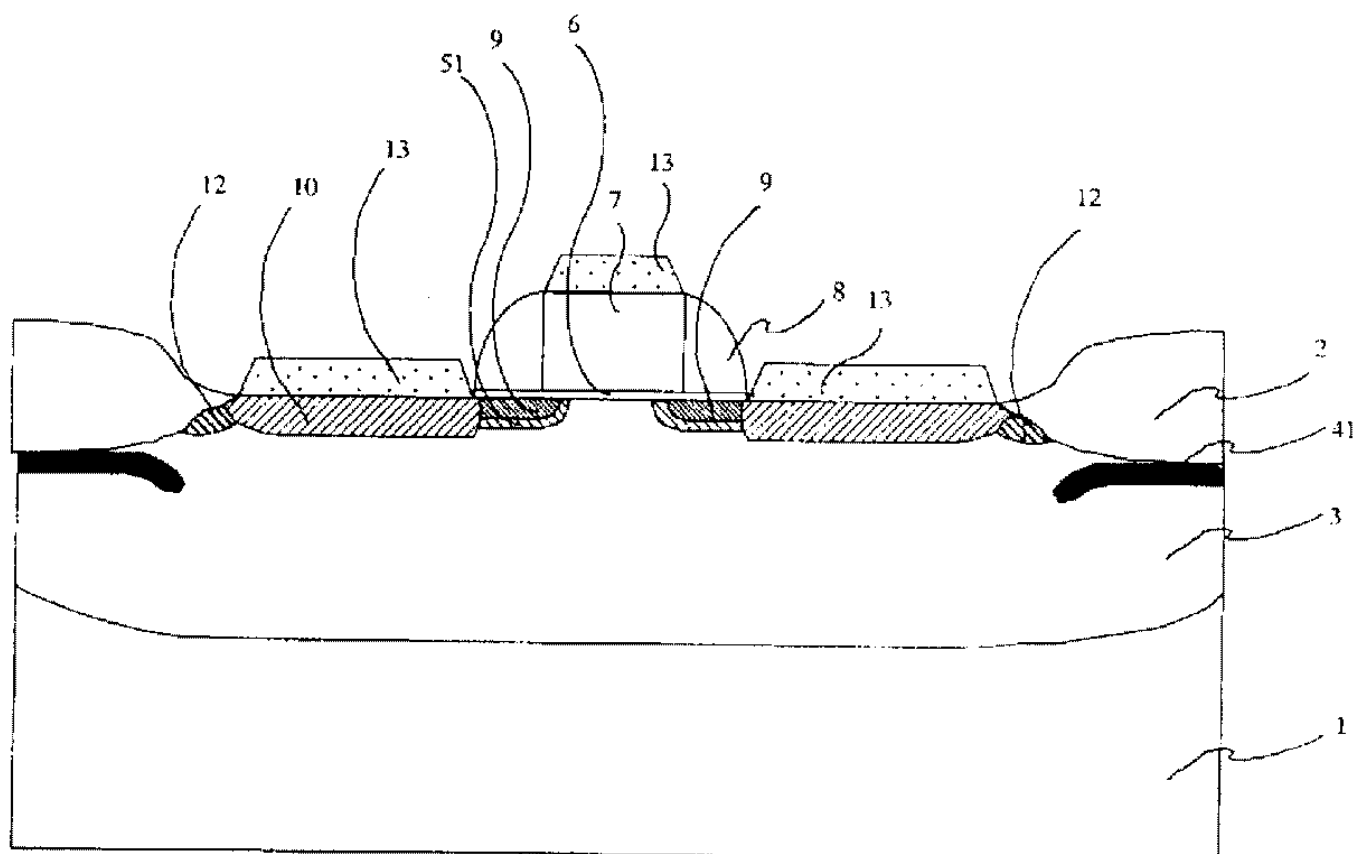
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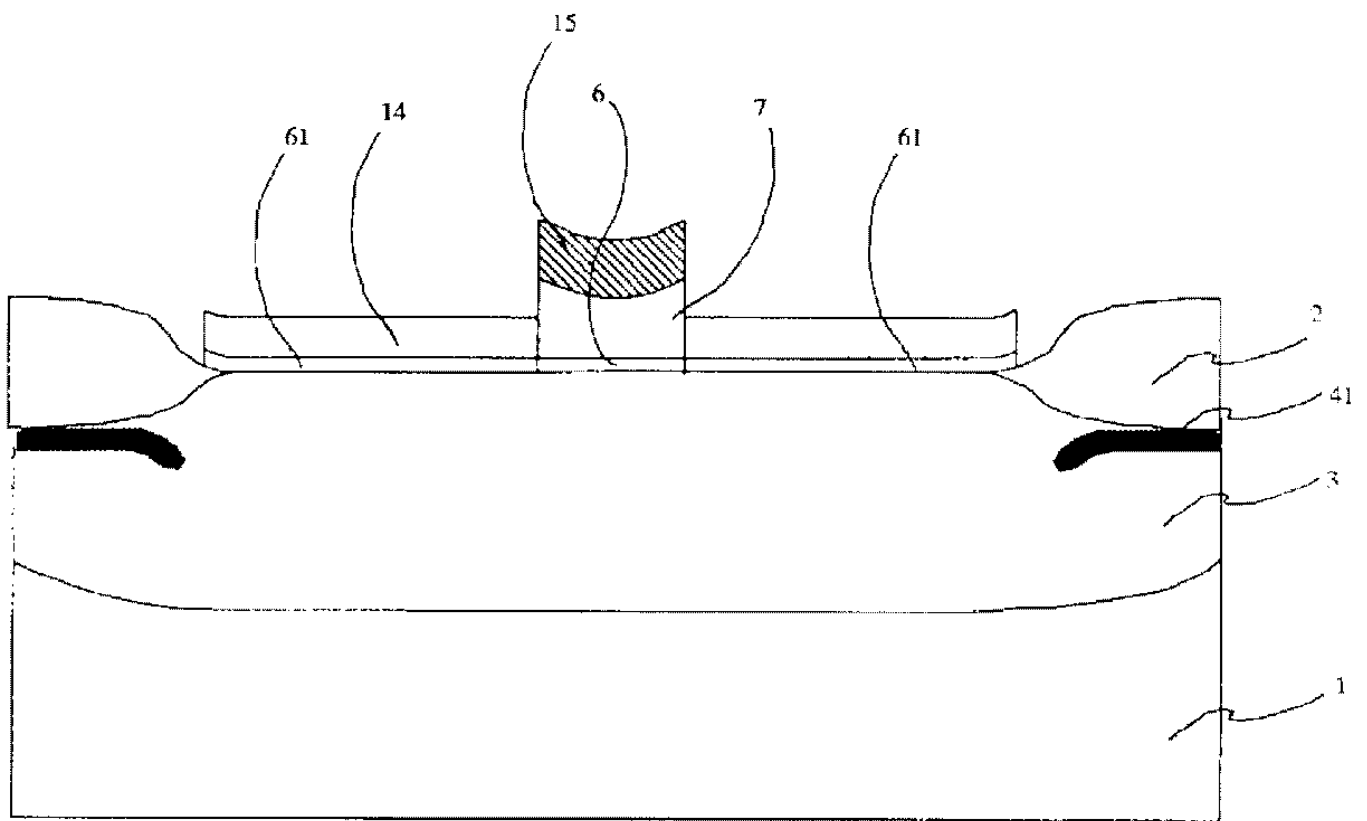
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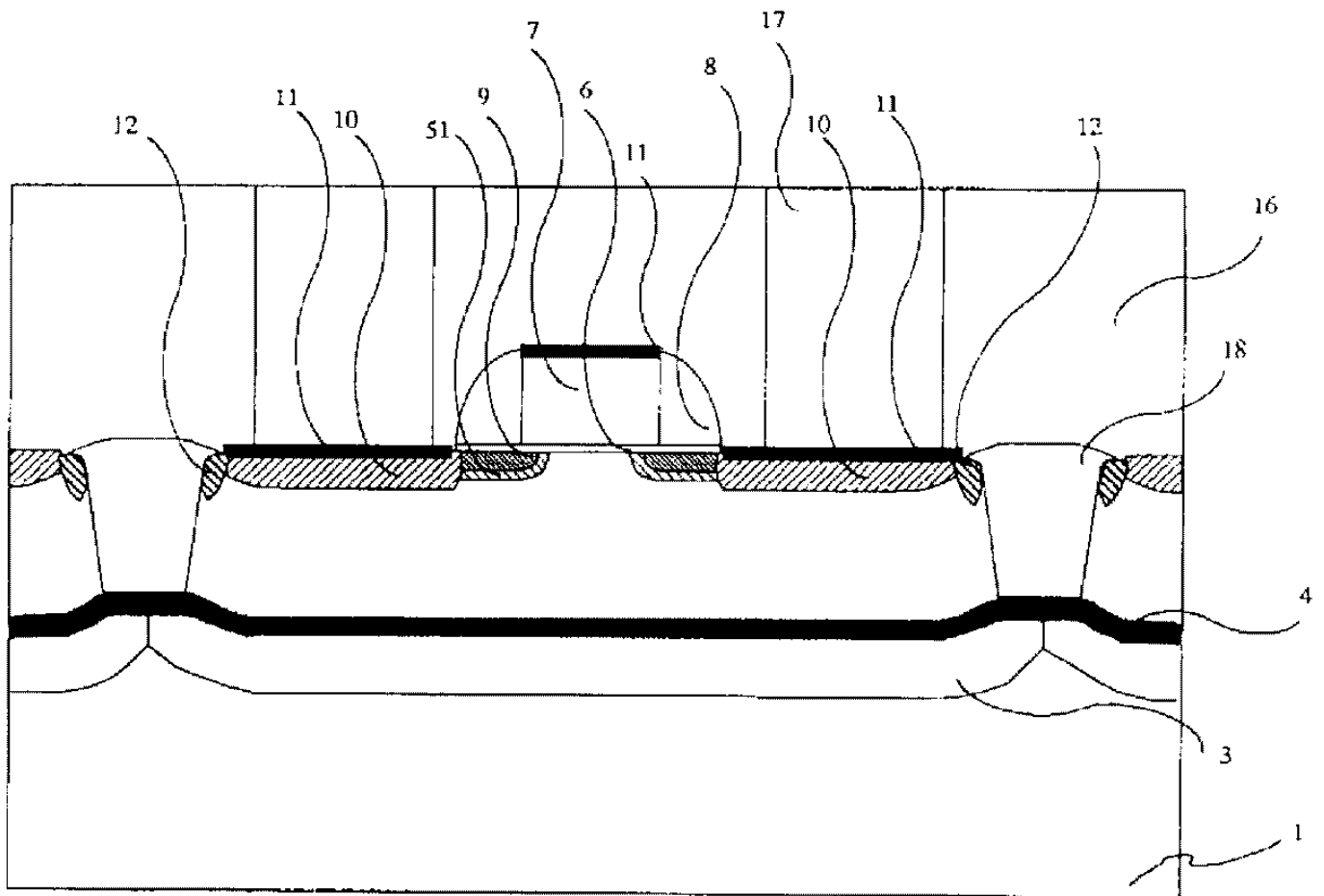
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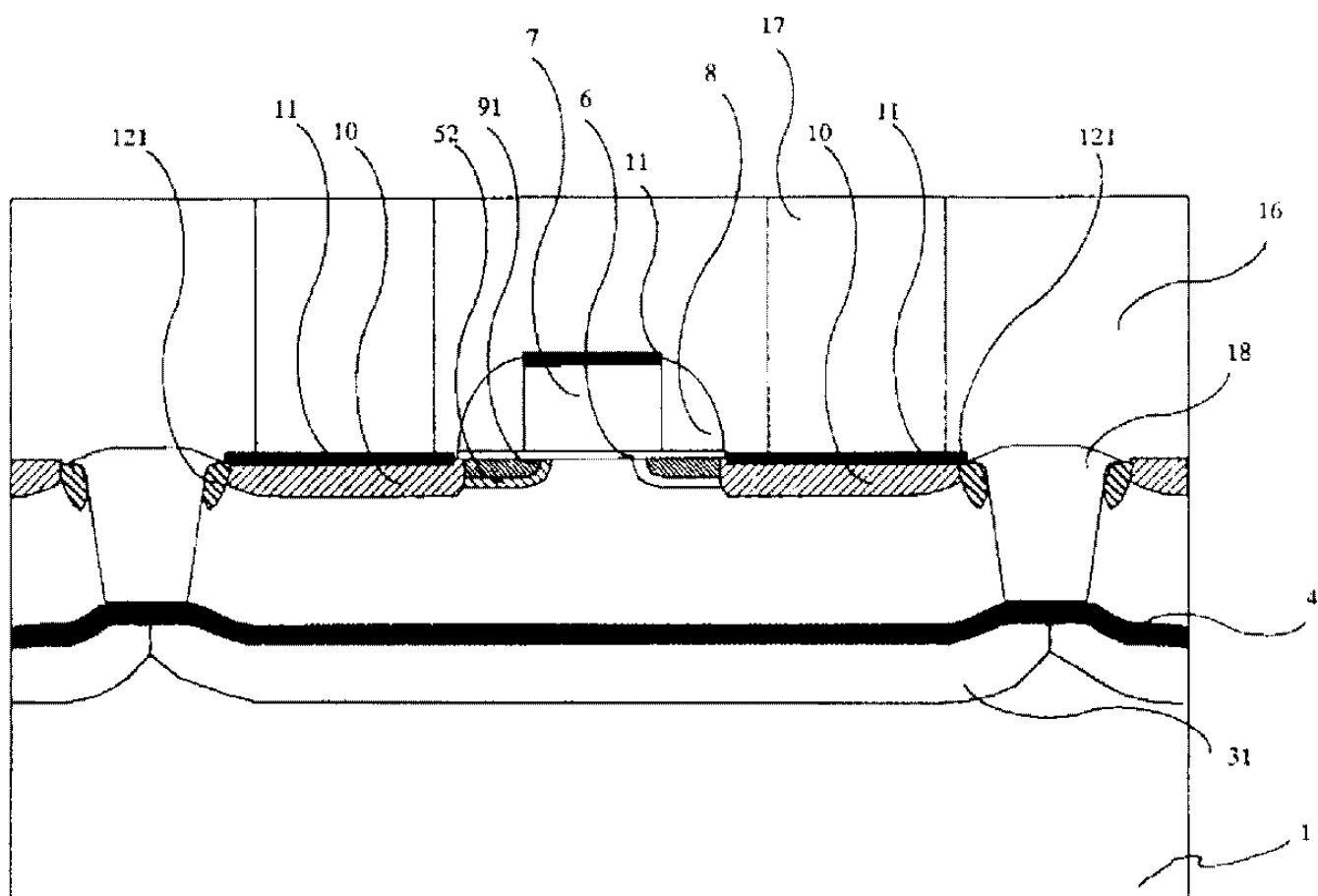
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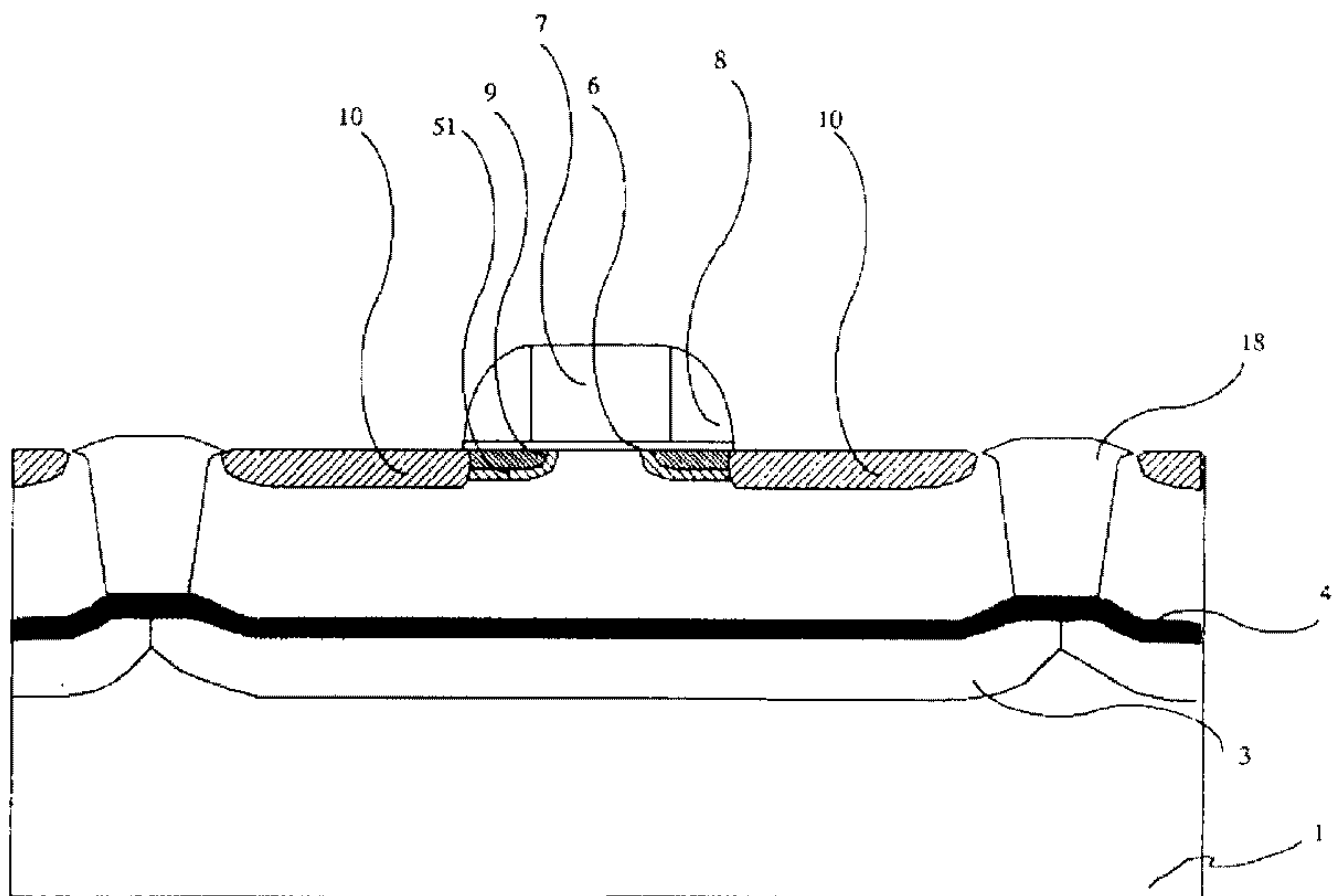
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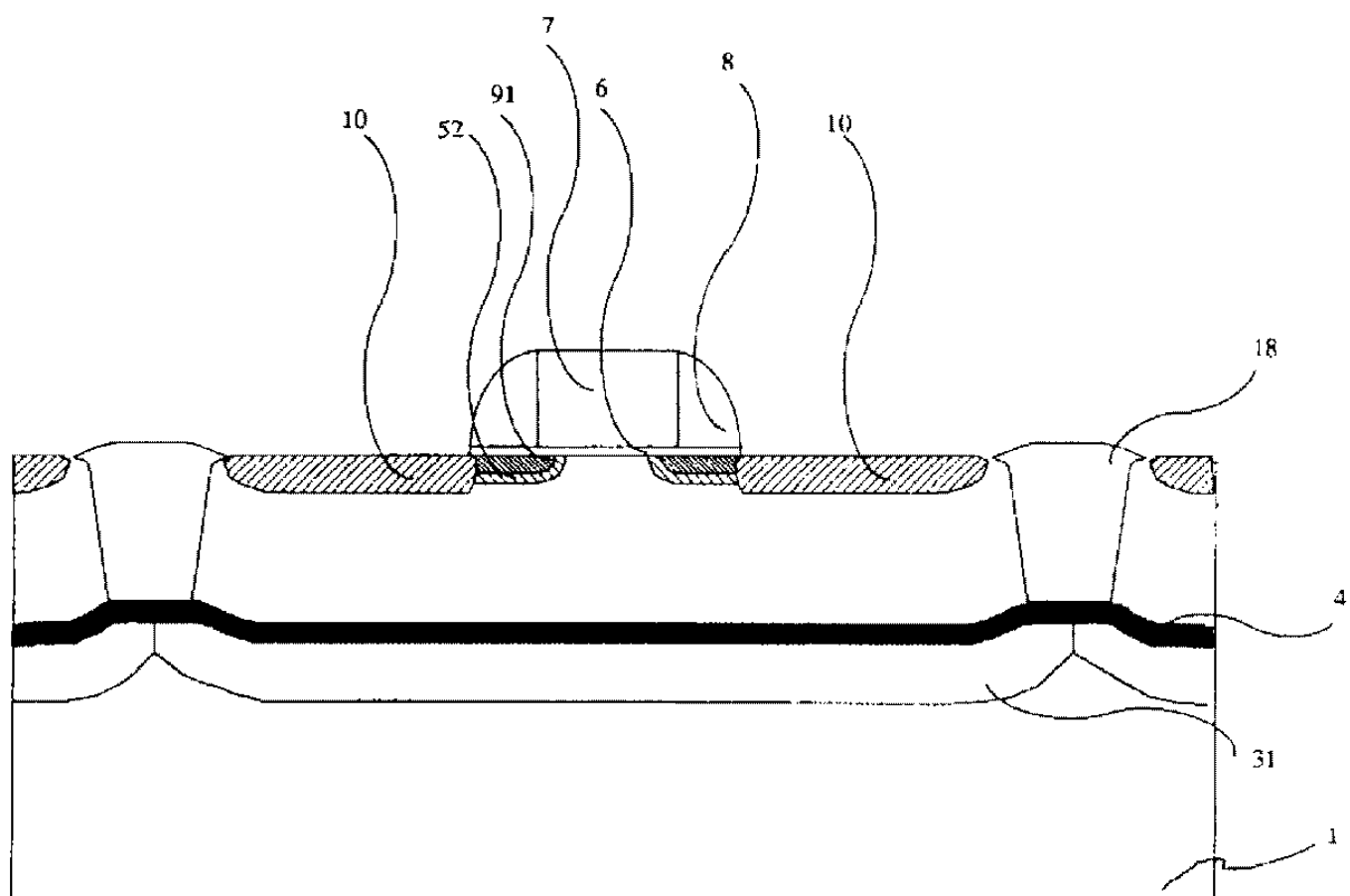
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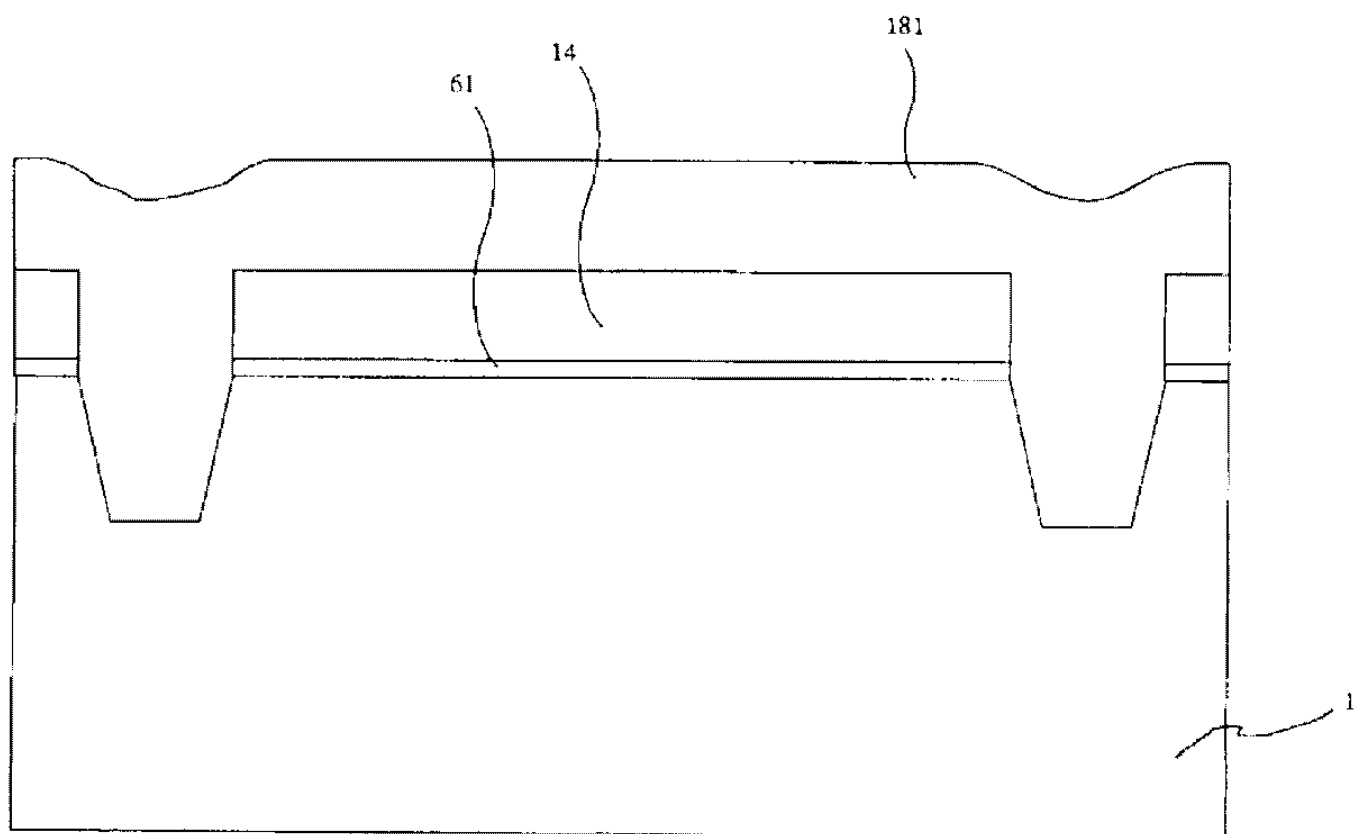
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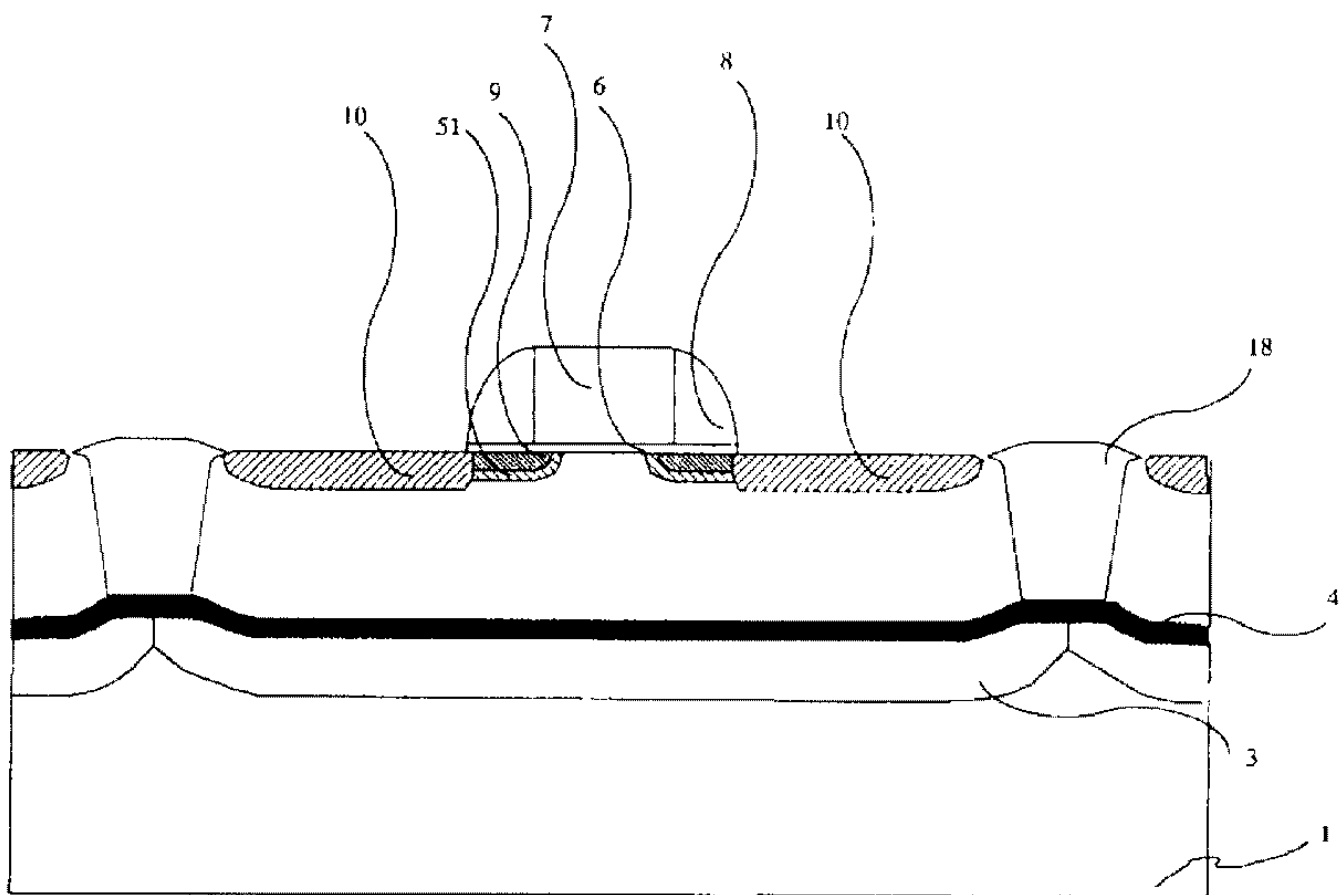
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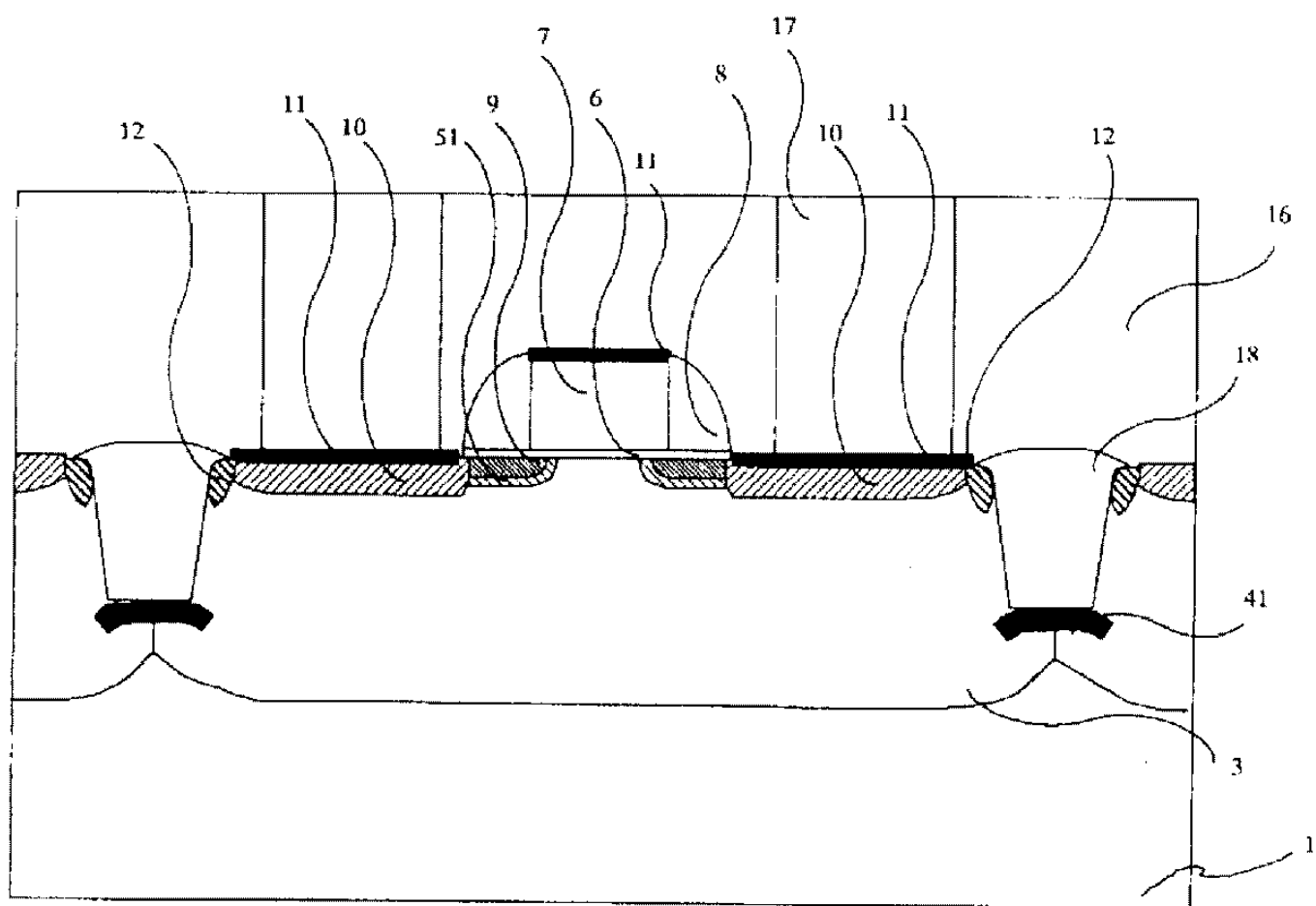
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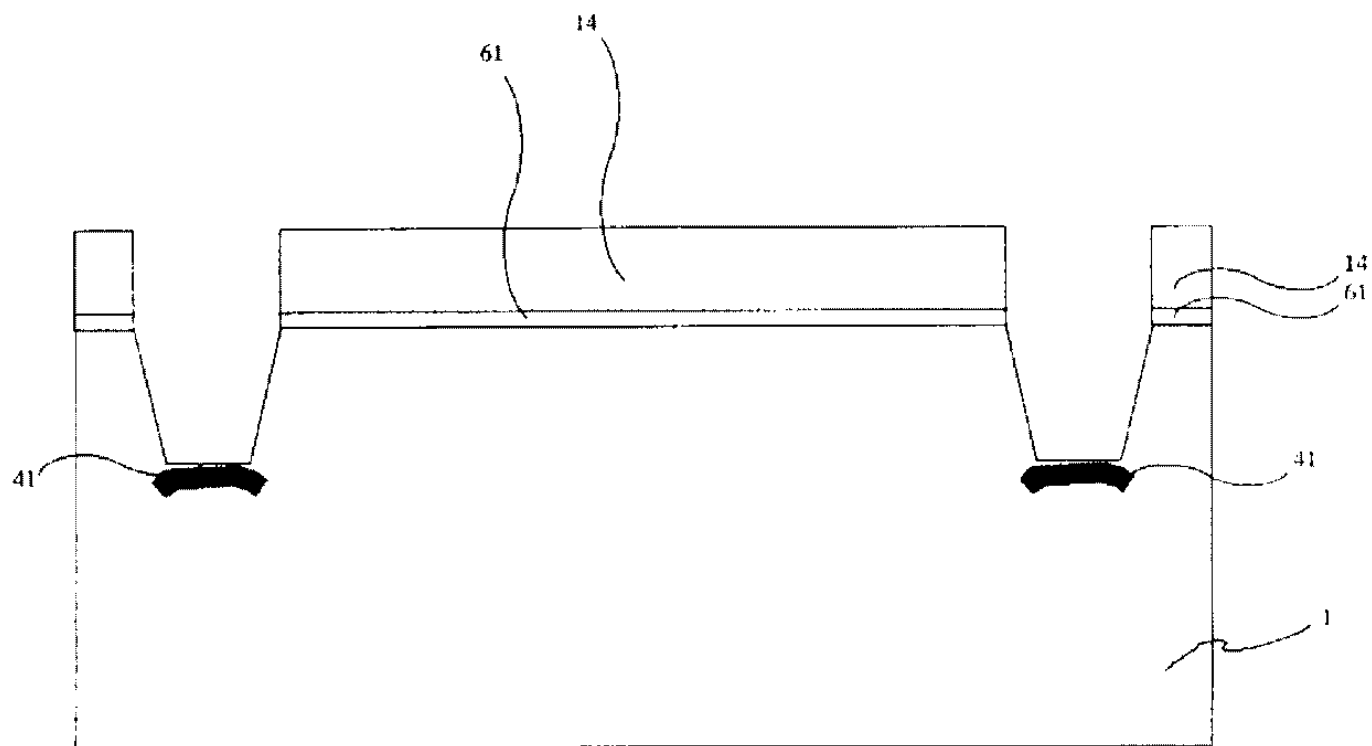
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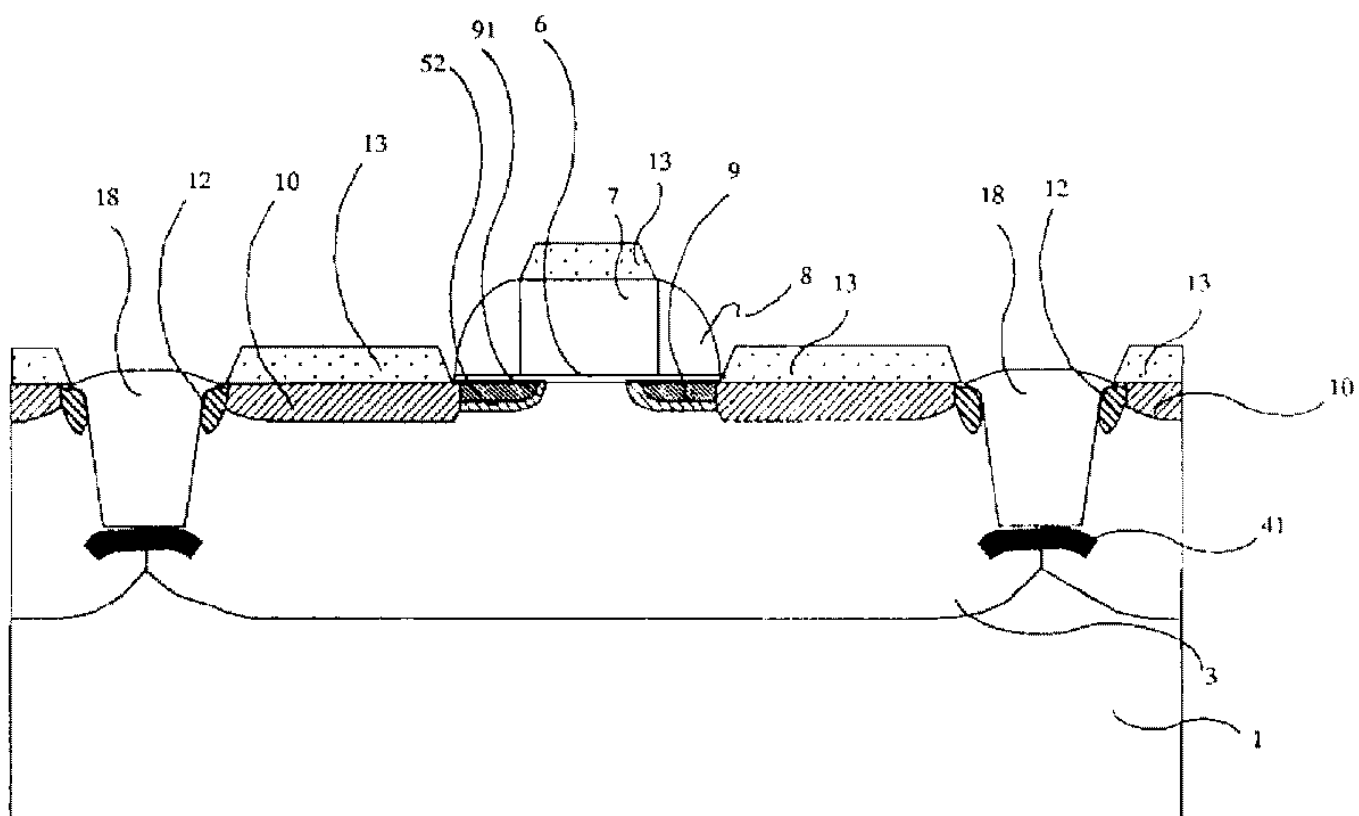
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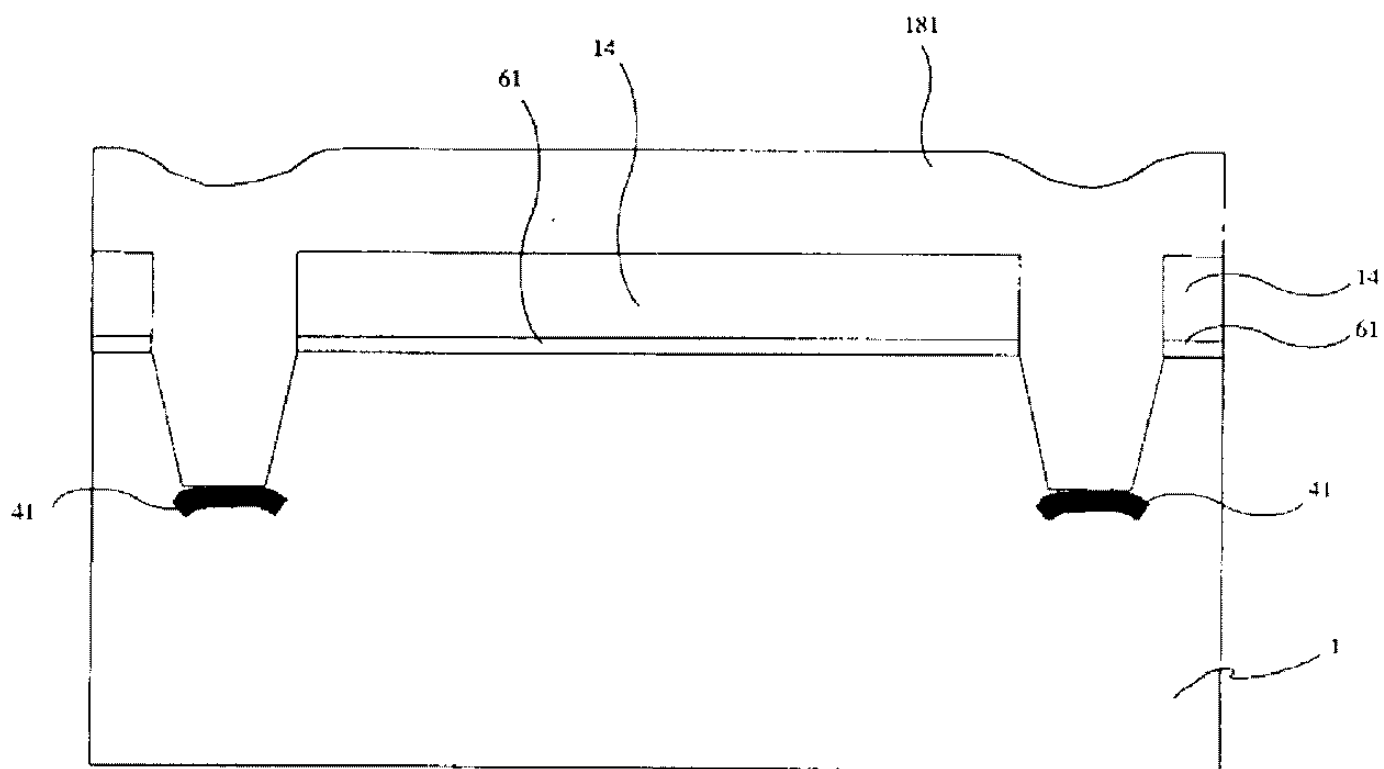
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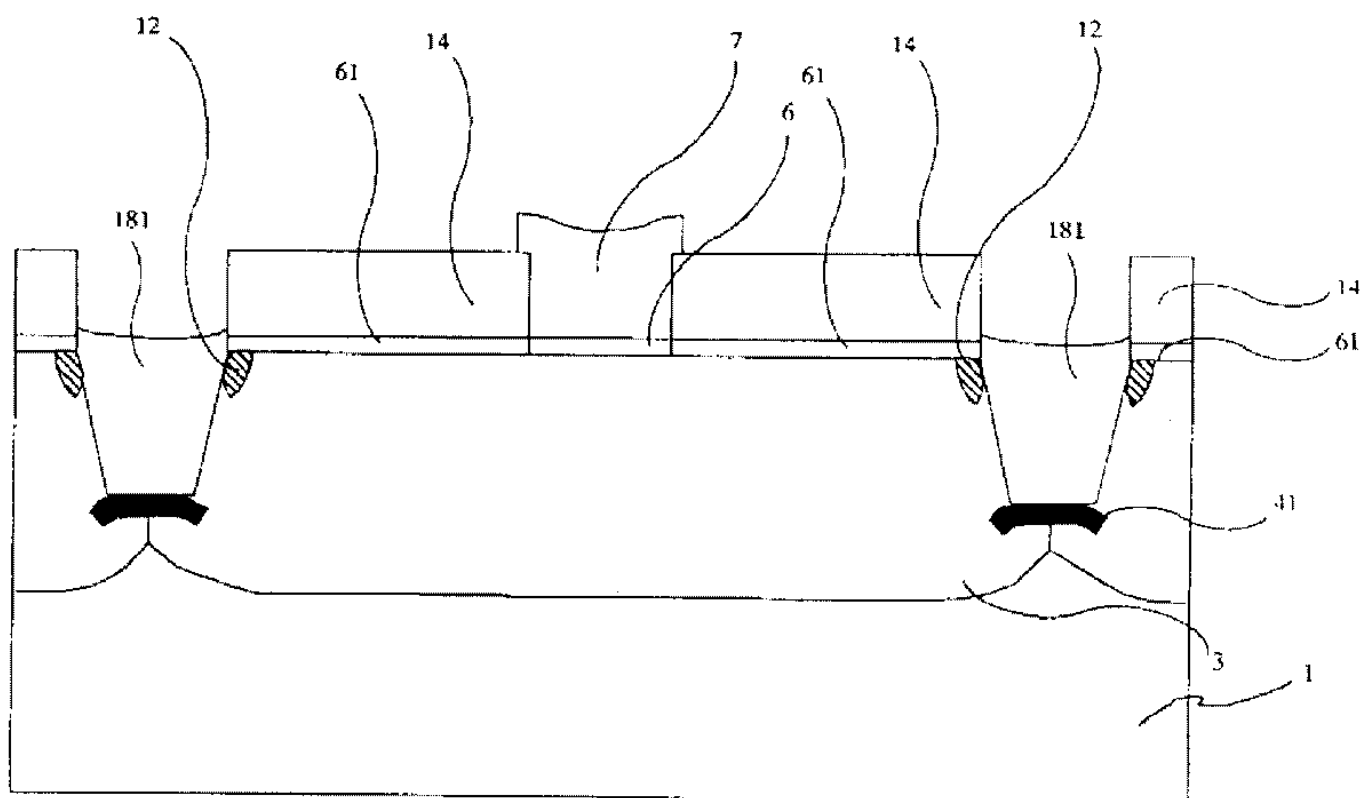
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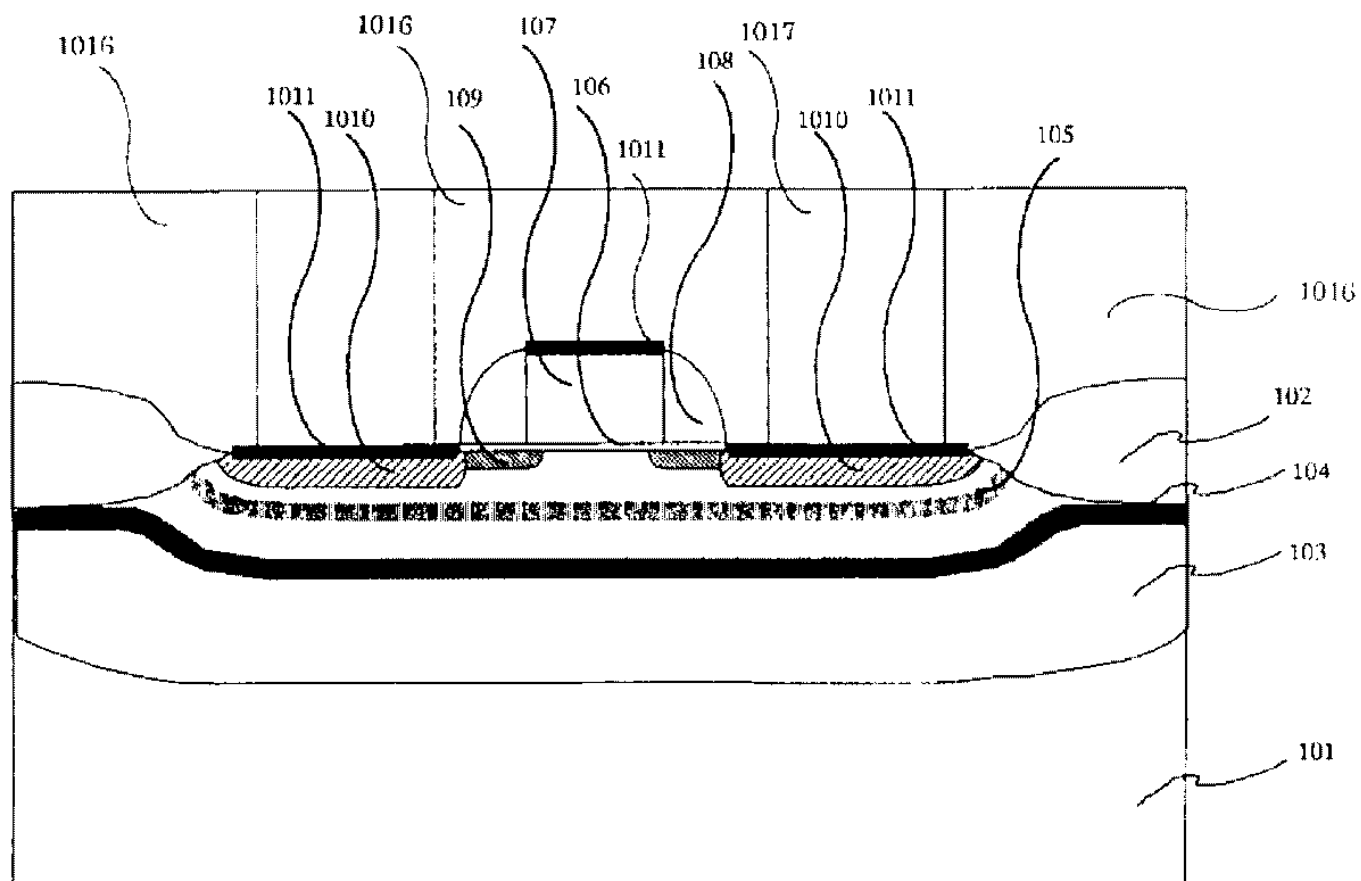
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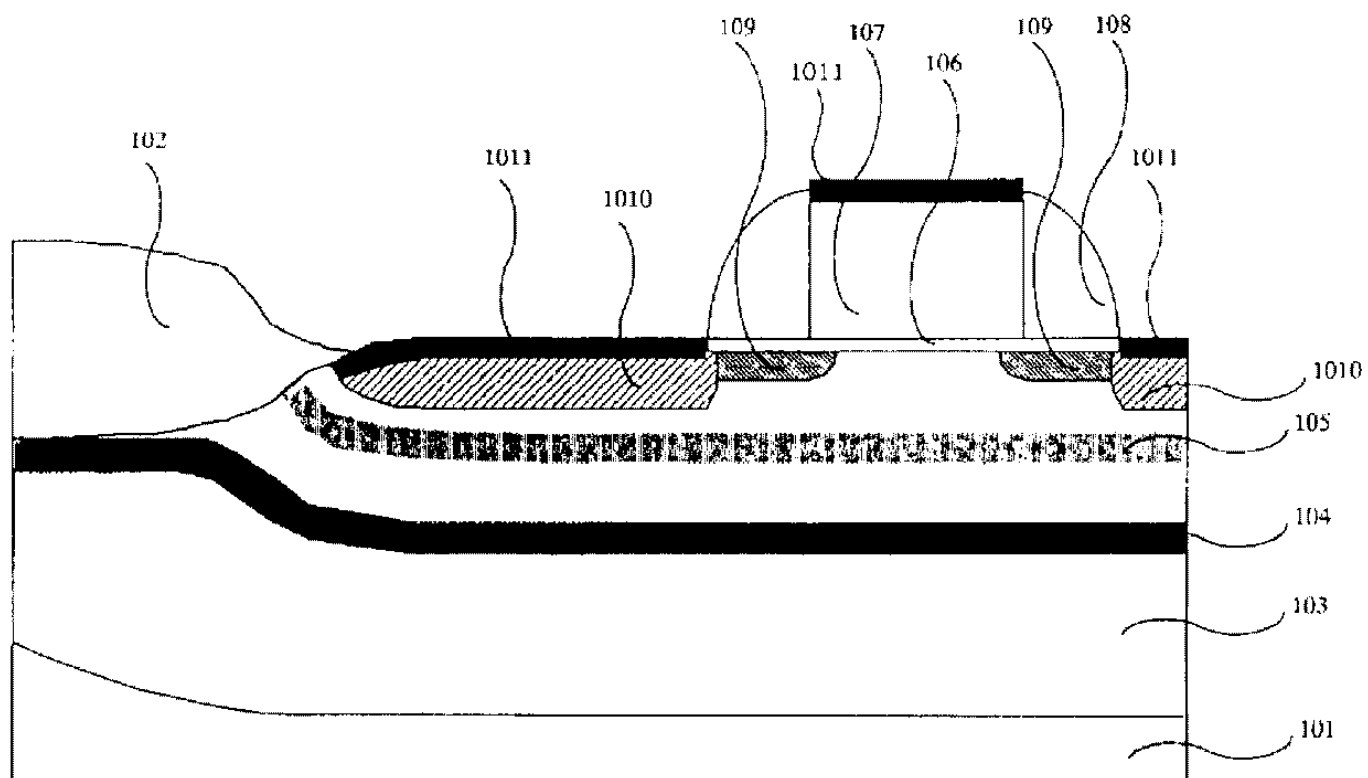
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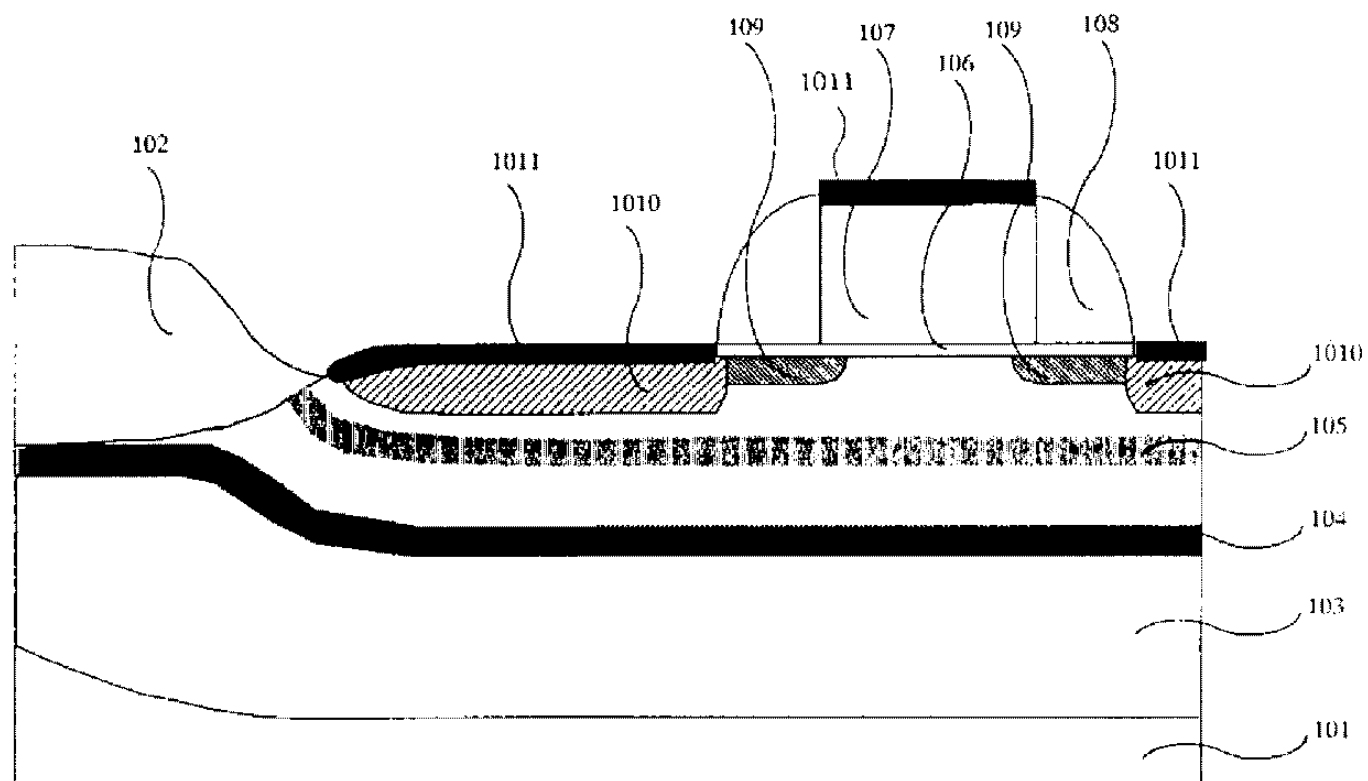
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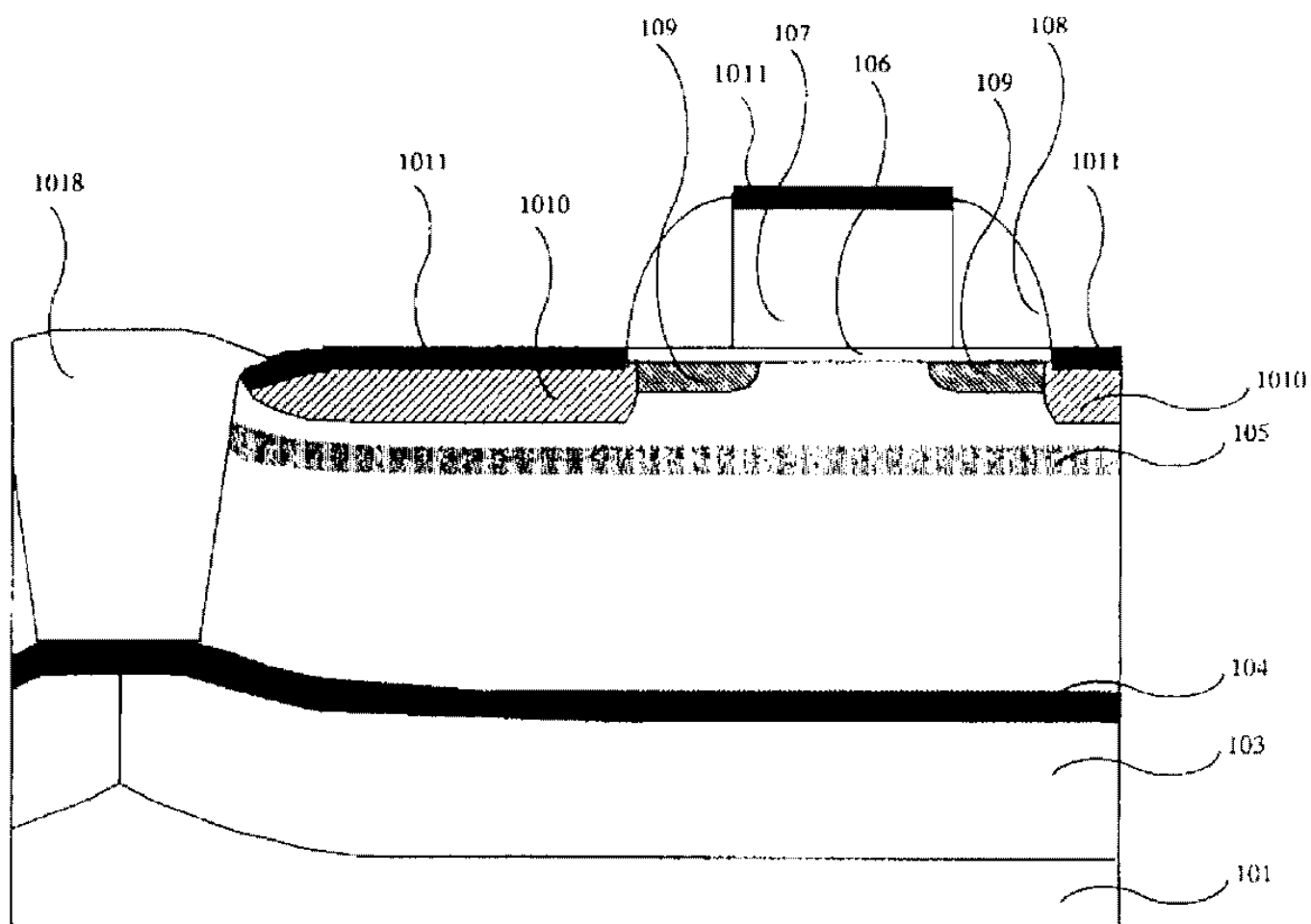
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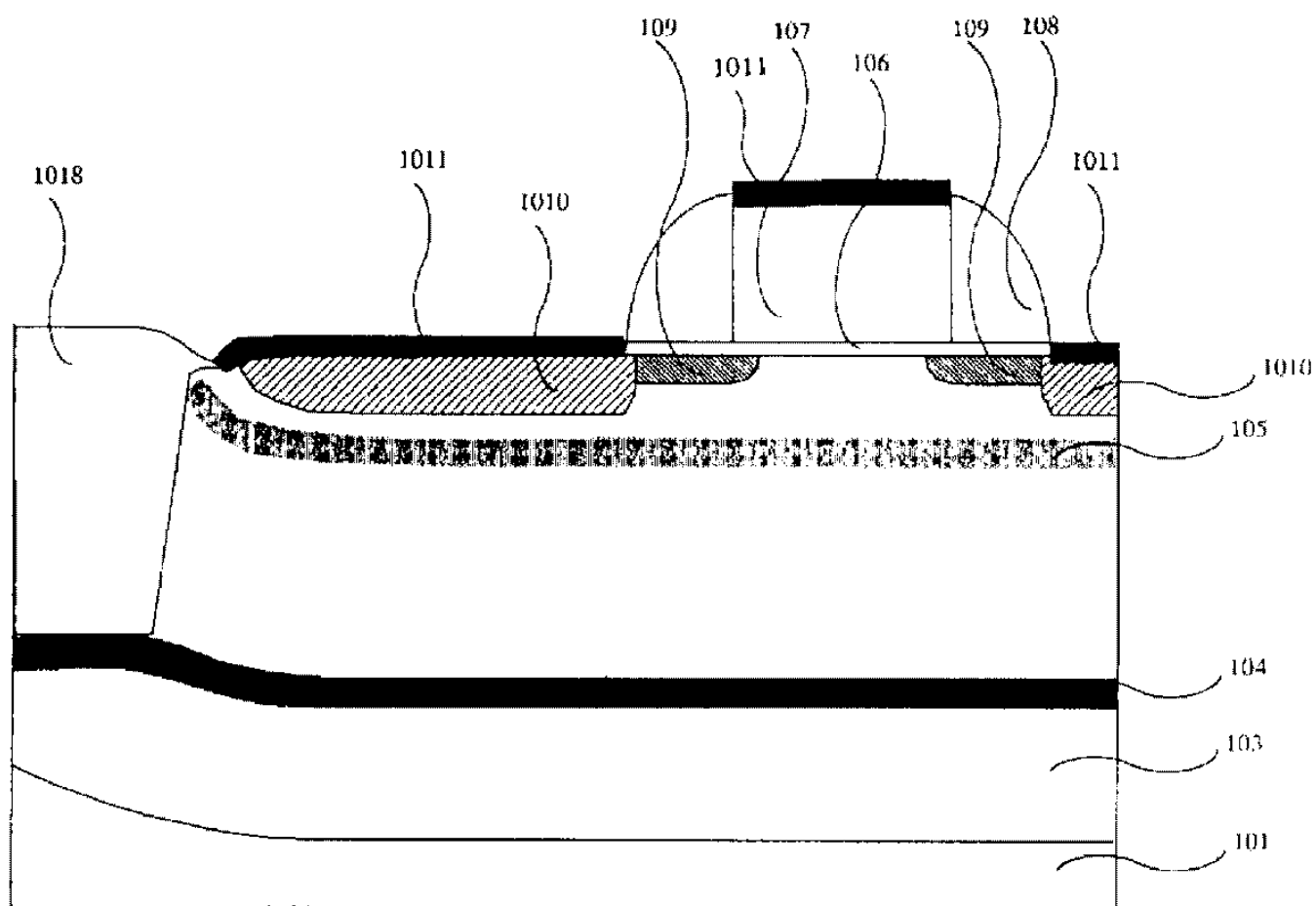
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