



(72)

- 4174 17

- 8600 7

602 00 25

621 00 32

(74)

:

(54)

1mm) 가 ( 100V/cm) 가  
 / , ( )  
 , 가 ( )  
 , ( )

3

- , , ,

(quasi - ballistic)

가 , 가

( )

( 100V/cm )

가 가 / 가

QB - Sem

1.

2.

가 (E) ( 가 (E) )

(John Wiley),

(Van Nostrand Reinhold) .)

(K.W.Boer) " (S.M.Sze) " ; 1981  
2 ; 1992

1.

( 100V/cm)

4가

A: ( ) p - n, p - i - n , 가 MIS( ) (US5  
627 429 EP672 257 B1), , CCD( ), MIS , MIS  
, IMPATT( ) BARITT)

B: - / 가 LED's( )

C: -

) , MESFETs( / , FETs( ), JFETs( ), MOSFETs( )

, TEDs( ) ( ) / .

D: / / , . , 2D- / , 2D-

1981 (John Wiley), p184, (S.M.Sze) " " ; (K.W.Boer) " , 2 ; 1992 (Van Nostrand Reinhold), p1265 1247 ), , ( ) .

2.

" " , " "

( ) ( 3 - 5eV ) ,

:

- (" " ) 가
- ( - (" " " )
- (" " / " - " ) 가
- (" " )
- - (" " ) ,
- 가 - , 가 , / .
- 가 .

US5,703,435 (1997 12 ) US 5,534,859 (1996 9 )

1

1 , - , - .

(I<sub>em</sub>) 가 / .

가 ( ) , ( 가 )

(quasi - ballistic trajectories) . ,

(way) ( ) , 가

(E) ( ) , (E)

(L<sub>sam</sub> )( 2)가 ( )

(I<sub>bai</sub> ) , (I<sub>em</sub> )( 2)

1 , .

US5,536,193 , ,

US5,463,275 .

US4,801,994 3 - , 가 ,

EP 504 603 B1 , 가 .

US5,554,859, US4,303,930 GB 1 303 659 EP 504 603 B1 .

( 76 , 17(1996), 320 ) ,

(US5,631,196, US5,703,435

2

) , 1 / ( , , /

2

US5,229,682  
t layer)

(interjacen

US5,712,490

1 (3<sup>rd</sup>, 11 )

가

US5,229,682

US5,528,103

가

ridges)  
col. 27 ).

(focusing

US5,229,682

US 5,212,426

( ) (integral control)

US4,823,004

US5,444,328

가

US5,229,682

US5,631,196

US4,683,339 , EP 150 885 B1 , EP 601 637 A1 , US5,340,997

가

US5,703,435  
(crystallites)

가

가  
" 가 " 가  
가

가- , " (luminophor)" " 가 "

x - ( , 2 /EM ),

(IC) (PEBL) (IC) (writing to  
ol)" ( , ) , IC

ICs 가 IC

8 (1), (24), (19) (14)  
(FS) (24) (S4) 가

(6) (H. Ahmed) (Proceedings of the Conference on Microlithog

raphy)" (1989) ) ,  
가

가 , ( )  
가 ,

가 ( )

( ) -

$k)(2)$  ,  $(I_{em})(2)$   $(I_{bac}$   
 , 가  
 ,  
 ,  
 ) (   
 , ( 가 ) -  
 , -  
 , 가  
 IC's  
 (30 ) ,  
 , -  
 ,  
 100V/cm) , 가 ( (   
 S2, EH 3) ( S4) , (S4) (   
 가 가 . ( , - " QB - Sem " )  
 , - QB - Sem  
 QB - Sem , - -  
 QB - Sem , - ( ) 가  
 , 가 QB - Sem  
 , QB - Sem

, (100 ) QB - Sem

, QB - Sem , QB - Sem ,

, QB - Sem -

, QB - Sem (ICs)

, ICs QB - QB -  
가 QB - Sem

" " , QB - Sem

, QB - Sem

QB - Sem

QB - Sem

, QB - Sem

QB - Sem

가

QB - Sem

( )

QB - Sem

, QB - , 가

/ /

가 ( 100V/cm)

QB - Sem

( S2, 3)

( S4)

( - ) 가 , (S4)

가 /

( 1cm)

( 3)

QB - 800cm2 ( QB - )

가 , 가 , 2 ( )

1 , 1,2 , 1 1 2 , 2 2 , 1 2 , 가 , 1 1 , 2 2 1 2



- 1 1 , 2 2 ,  
 1 2 ,

- 1 2 ;

- 1 1 ;

- 2 2 , 2  
 1 2 1

.  
 , 1 가 가 , 2  
 - .

1,2 , 가 .

- , 1,2 2V 가 가 .  
 1,2 ,  $1 \times 10^{17} \text{ cm}^{-3}$

. , , , , , , .

4 , :  
 - 1,2 , 2 1  
 ; 1 2

- 1,2 1,2 ;

- ;

- 1,2 1 , 1 , 1  
 , 2 1 ;

- 2 1,2 2 , 2 ,  
 2 1,2 , 1 2 .

1,2 , -  
 , 가 .

< 111> , < 110> < 100> ,  
 , 가 / .  
 / .

$1 \times 10^{14} \text{ cm}^{-3}$ , 가  $1 \times 10^{13} \text{ cm}^{-3}$ , 가  $1 \times 10^{12} \text{ cm}^{-3}$ , 가  $1 \times 10^{18} \text{ cm}^{-3}$ , 가  $1 \times 10^{16} \text{ cm}^{-3}$ , 가

1, 2,  $1 \times 10^{17} \text{ cm}^{-3}$

5, :

- 1, :

- , 2, 1, 2

- 2, .

1 2, 가

, 가

2, 1 2, 가

6, 1, :

- 1, 2 1, ,

- 1 1, 2 2, ,

- 1 2 ; ,

- 2 ; , 2 1

- ; 1

- 1 1 1 ;



12 11

13 10

14

15 2

3D

16 15

3D

17 2

18

19 - -

20

(MESFET)

21 2 /

22 /

23

가

24

(ECEM)

1, 2

(PEE)

1, 2

가

1  
가  
)가  
) 가

( $E_c$   $E_v$ )

( $E_g$ )

$E_v$ (가  
(S2 S3)

가  
)  $E_c$ (  
1( ) 4(



$(E_g)(1)$ , (QB - Sem), (가  
 GaAs )  
 ( ) , ( ) , 가  $SiO_2, Al_2O_3$ ,  
 1 (S1 S2) -  
 3 (S2) (S2)  
 Q , (1) , 가 / 가 가  
 QB- ( 2 2) Q가 가 (QB - Sem 가) ( $\mu_{M^{ch}}$ )(  
 ( 3 ) (S2) /  
 2 ) (S2) /  
 4 (S3 S4) -  
 (S3) (S3) (S3) 가  
 (PEE) 가 Q가 (S3)  
 ( ) (4) ( $\mu_{M^{ch}}$ ) 가 , 가  
 ( $I_h$ )( 2 ) (  $I_h$  ) 가 가  
 - 2 ). / (S3) - (4) (S2)  
 가 , (S3) / 가 .  
 (4) , ( 가 (7) - 8 ) (S3) ( 3)  
 (S3) (FS)( 3)  
 , (2) (S3)  
 (FS) 가 (2) - 가 (S3)  
 , (S3) (S3) ( / ) 가

(S3) ( ) , 8  
 ( 가 (7) )  
 (S3) / 가 .  
 (S3)( (4) (S4)) 가  
 가 .

QB - Sem

4V (0.5mm 가 4V - , 80.  
 0V/cm ) ,  
 ( $I_{em}$ )가 ( $I_{em}$ ) 30%  
 가, (S4) - (FS)( 3 ) 가  
 , ( $E_c$ )( 2 ) 4eV( 4.0V)  
 , 가 3  
 (PEE)

(1)( ) (S2) (2)( - ) , (ECP)  
 / (8)( ) ( ) (S2)  
 Q ( ) , Q (4)( )  
 (S3) (2) , ECP / (8)  
 , (8) (S3) , (S2 S3)  
 (E) , ( $I_{tot}$ )가 (2) 2  
 , ( $I_{tot}$ )  $I_e, I_h, I_{em}$   
 ( $I_{back}$ ) , ( $I_{em}$ )가 ( - )  
 , (E) (V="E.t1 " (S2 S3)  
 ), (FS)( 3)

( (2) - QB - Sem ) , (S2 S3)  
 , (1 2) , ( $I_{em}$ )( ) ( $I_{back}$ )

QB 가 , ( (S2 S3) ) ,  
 -  $I_{em}$  100V/cm ( ) ,  
 (L2) ( ) . 30cm ( ) ,  
 ) (L1)( ) 가 3 ,  
 TV , 가 가 .

3 (" " -  
 2 ) (1)( ) Q ,  
 , QB - ,  
 가 ( (1) - 3 ) ,  
 - QB - (S2) ( (S2) QB - ) -  
 QB - (PEE) -



(i)( ) (j)( ) 가 (9 10) ,  
3, 4, 5, 6 7 FE - FPD TV a/c  
(d1, d2, d3 d4) , FE - FPD

4, 5, 6 7 " " FE - FPD (L1, L2) 20cm 20cm ,  
Si 30.0cm 가 (d2)  
(d4) " "  
4, 5, 6 7 FE - FPD (L3) 1mm , QB -

6 , (3 4) FE - FPD 가 , (S5) , ( - )  
(3) (FS)

, 4, 5, 6 7 (5, 6 11) - - - /  
(3) 4 (1( ), 2(QB- ) , / / (5,  
18,11) 4( )) (CLEd) FE - FPD  
가 , 5, 6 7

, , / - /  
가 ) , TV ( 10 20kV /  
, 7 가

, 4, 5 6 (3) (1( ), 2(QB-  
) 4( )) ( ) (13) , (13)  
(14 12) FE - FPD (3) 가 (7)  
(FS)( ) (S4) 가 TV (5, 6 11)

7 FE - FPD (Dim 2) 1 2 cm , (Dim 1) F  
E - FPD

2.

가  
9 14

8

(4) 8 (10) (24) 10 (S2) 가 10 (QB - Sem)(2) 8 (QB - (19) (S3) (19) (FS) 가 (FS) 가 (7) (6) (7)

(i) (" MinS" ) 0.15 1:1 가 (i) ( 10) (6) (j) (19) 가 가 10

10 가 가 9 9 10 가 (7) (17) 가 가 (1, 2, 19, 4) (6) (17, 12 14) (17) " Min"

(H. Ahmed) " (Proceedings of the Confere nce on Microlithography)" (1989) ) 11, 12, 13 14 11 (1, 2, 10 4) - QB - Sem - 22 , 6 , 12 x, y - QB - Sem - 가 가 (20) - 1:1 (6)( 10 )

14 1:1 ( 8 ) " Min" ) 0.15 13 0.15 12, 13, 14 , 0.1 가 , 가 ( 13 14 ). (

3.2

, 2 ( ) , , 2

가 (1), QB- (2) (4)) ( 15 16 가 ) (FS) 가 (3) ( 14 12 ) 가 (7) 가 (13)(

가 , 가 (3) , (FS) 가 / 가 " Dim 1" - 1cm 가 , " Dim 2" 16 가

가 , 가 17 ( ) , (1), QB- (2) (4) (3) QB (FS) , 가 (7) 가 (3) ( ) (13) 가

4.

가 , , / (A D)

(FS)( 2 ) ( , QB- ) " " " " QB-

4a

A: ( )

S( - - ) / , CCD( p-n, p-i-n ), MIS , MIS , 가 MI  
 TT( ) BARITT( ) , MIS , IMPA

: -

18 , , 가 R, C  
 6) QB- (36 37) (US5,627,479 EP 672 257 B1 ), (37) (3

18 , (I<sub>diode</sub>) (W<sub>d</sub>) (R<sub>d</sub>)  
 ( ) (W<sub>d</sub>) 가 (V<sub>SQ</sub>)  
 V<sub>SQ</sub> W<sub>d</sub> (I<sub>diode</sub>)  
 ) Rd  
 (L), (L<sub>so</sub>)  
 L<sub>qb</sub> ( - ) R<sub>qb</sub> 가 , 18 37

4b

B: - -

/ LED's( ), ,

: -

19 가 ( ) (A- ), - (B- ) / /  
 1 가 ( ) (C- ) ,

- ( 19 A)

( ) ( 19 (S1 S2) ) , (S2) 가  
 QB- ( 19 " Exc  
 1" ) (AMR) (I<sub>bal</sub>) , 가 (S5)  
 (AM) (AM) (I<sub>e</sub> I<sub>h</sub>)  
 (AMR) , - (" Exc1" )  
 가

( ) 가 2 - , 가 , 2  
 - - ( 19 B)  
 - ) QB - (QB - Sem) 가 ( - ) ( ( 19 " Exc2" ).  
 QB - Sem , 가 , ( 19 I<sub>bal</sub> ) (S5)  
 (LER) 가 , (E<sub>g</sub>) 가 ( 2  
 19 B ). ( - 가 Q(t)가 )  
 (FS) 가 .  
 (" Exc2" ) 가 , (LER)( )  
 , 가 , -

( 19 C)  
 (I<sub>bal</sub> ) , - (" Exc1" ) / (" Exc2" ) -  
 - / (QB - Sem) . , (S5 S3) 19 -  
 4d (I<sub>em</sub> ) (S4) (FS) .

4c

C:

/ , FETs( ), JFETs(  
 ), MESFETs( ), MOSFETs(  
 ) ,  
 , TEDs( - ) ( ) / .

: -

20 - (MESFET)  
 (I<sub>d</sub>) (W<sub>d</sub>)(V<sub>d</sub>) (V<sub>g</sub>) . " a"  
 (SEM) , " L" , " Z"  
 , (< 1.5 ) , (V<sub>ds</sub>)  
 ( ) ( ) ,

20 MESFET  
 , MESFET 가 , ( QB -  
 ) . 20 가 , -  
 Sem (Sem)( 20 ) .

20 ( ) , MESFET - ( $I_d$ )가 - ,  
 , 20 MESFET / 가 가  
 ( , (K.W.  
 Boer) , p.1237 ).

4d

D:

2 , , 가가 .  
 :  
 ( ) 2 / ( - -  
 - 1 ) .  
 - 2 ( - ) .  
 - 2 , , 2<sup>2</sup> , 2<sup>2</sup> 가

2  
 :

a) - (2 / )

b) 2 / / .

, QB- / 가 2 가  
 / .  
 0 3 . , /  
 / .

a) -  
 21 2 / , QB  
 - (1) (4) . 5 x,y , QB  
 , QB- ( 2 i,j- ) . 5

(S2) , R( ), Y( ) B( )  
 21 가 , -QB- QB-

가 "i" "j" ( 21 "Y" )  
 em)( 21) 가 (i,j) " - " , (AMR)( 2) QB- (QB-S  
 " " , , 21 (i, j)

(QB - ) (Dim2) mm ,  
 Dim1) 30cm ,

b) /  
 (가 , 가 / ) , /  
 / 가 가 가 2 , /  
 . , (A) 2 / 가 22 , (B) 2  
 / .

(25) 22 ,  
 (S2) QB- ( )  
 (S4) QB- (QB - Sem) 가 ( ) ,  
 ( , QB- )

가 ( - ) ( QB - Sem 가  
 ) , (S4) - ( )  
 ) 가 ( ) ,  
 ( - ) .

2 가 - , (17)  
 2 (26) (A) / 29  
 (29) (28)( CCD) ( A B)  
 ≅ (27) ,

(A)

(FS)

5.

가 23

QB - 가 (1) (2) QB - QB - (2) (p - QB - Sem

) E(x) 23

( ) ( 23),

(D) QB - (E) QB - QB - S

em ) (F) QB - QB - (W<sub>d</sub>)

, QB - / 가 ( )

6.

(ECEM) " (virgin)"

/ 24

가

가

가 ( 50 ) ( )

(S2) QB - (S3) ( 24 QB - Sem )

( ) (1, 2 / 3 ) /

가 가 24

( , QB - , - 1, 2 ) , 가  
 , QB - (S2) , (S2)  
 QB - 가 , QB - (S2 S3) ,  
 , / 가  
 QB - (S3) , (S2) (S3) -  
 ( ) .

(S4) (32) (34) , -  
 (30) (32) ( ) - (33) .  
 x, y QB - 10 50

7.

( ) , (가<sup>2</sup> , /  
 ) , ,  
 "old Schottky Cathodes)" , (CRT) ; x - ; , , (C  
 가 ,

(57)

1.

- 1, 2 ,  
 - 1 1 2 2 ,  
 1 2 ,  
 - 1 2 ,  
 - 가 , ,  
 - 1 1 ,  
 - 2 2 , 2  
 1 2 1 .

2.









- 2

35.

34 ,

36.

34 35 ,

37.

36 ,

38.

34 37 , , , ,

39.

34 38 , -

40.

34 39 , , 1 2  
, 가 2 , ,

41.

1 ,

- 1, 2 1 ,

- 1 1 , 2 2 ,

- 1 2 ; ,

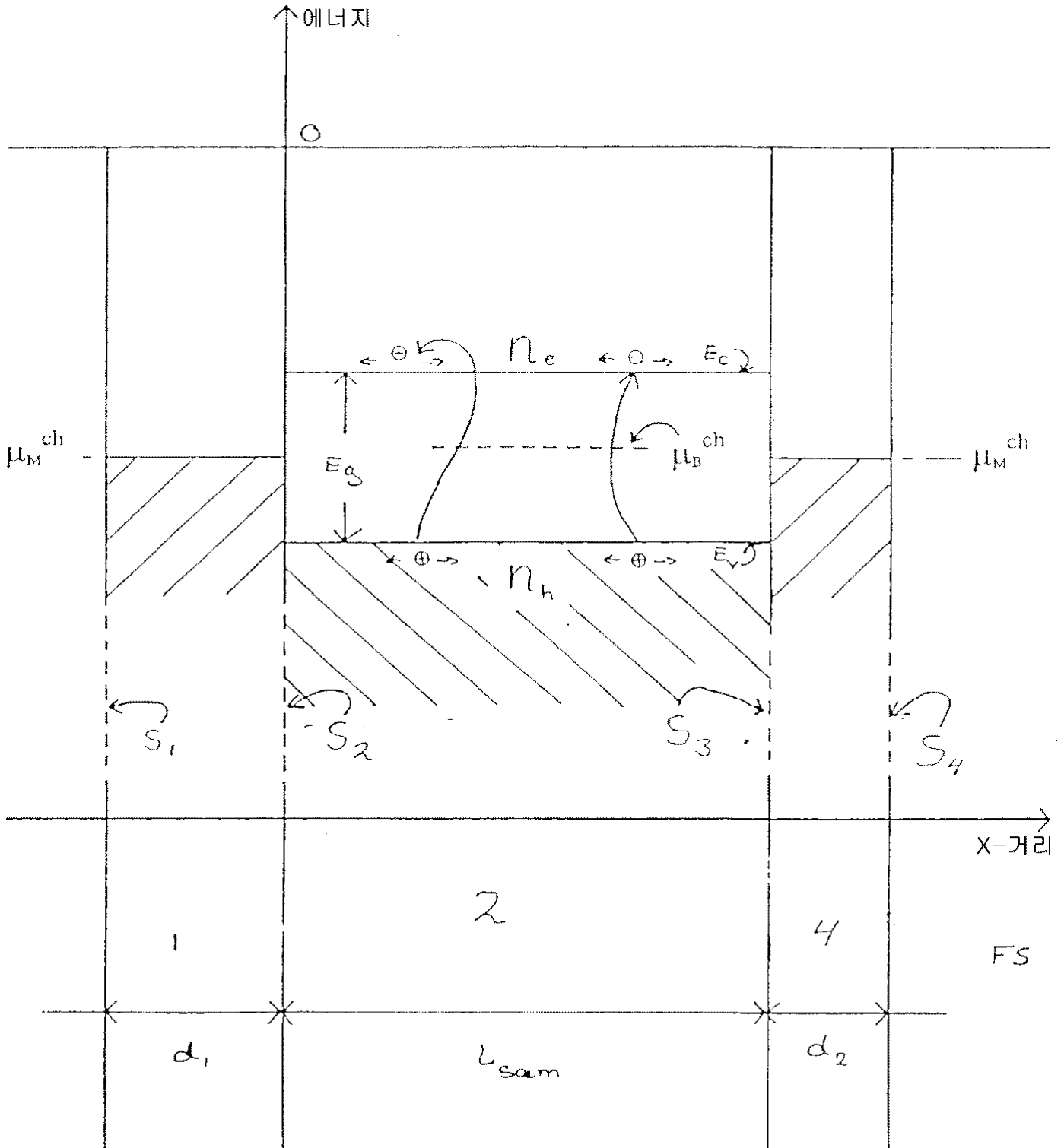
- 2 , 2 1 ;



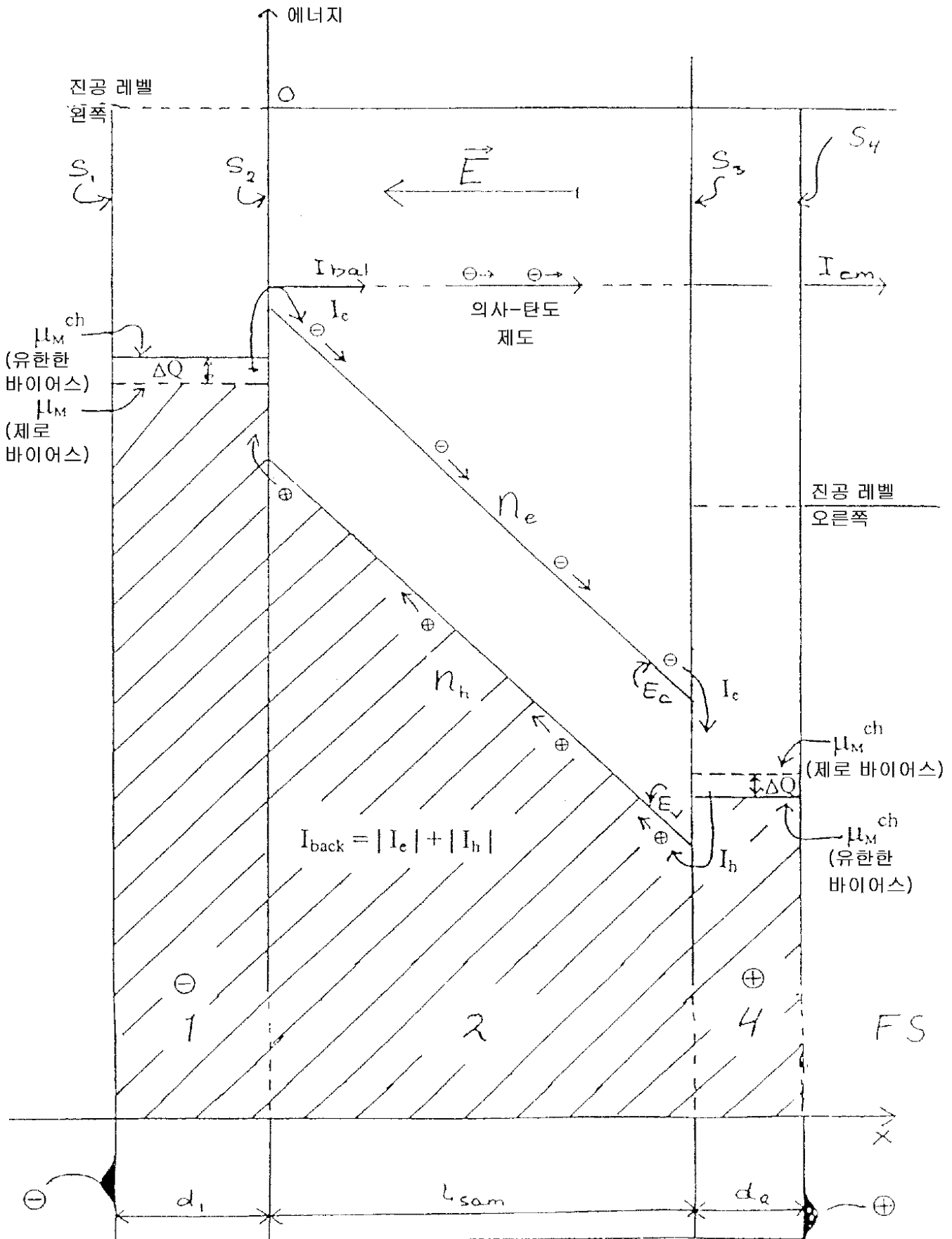




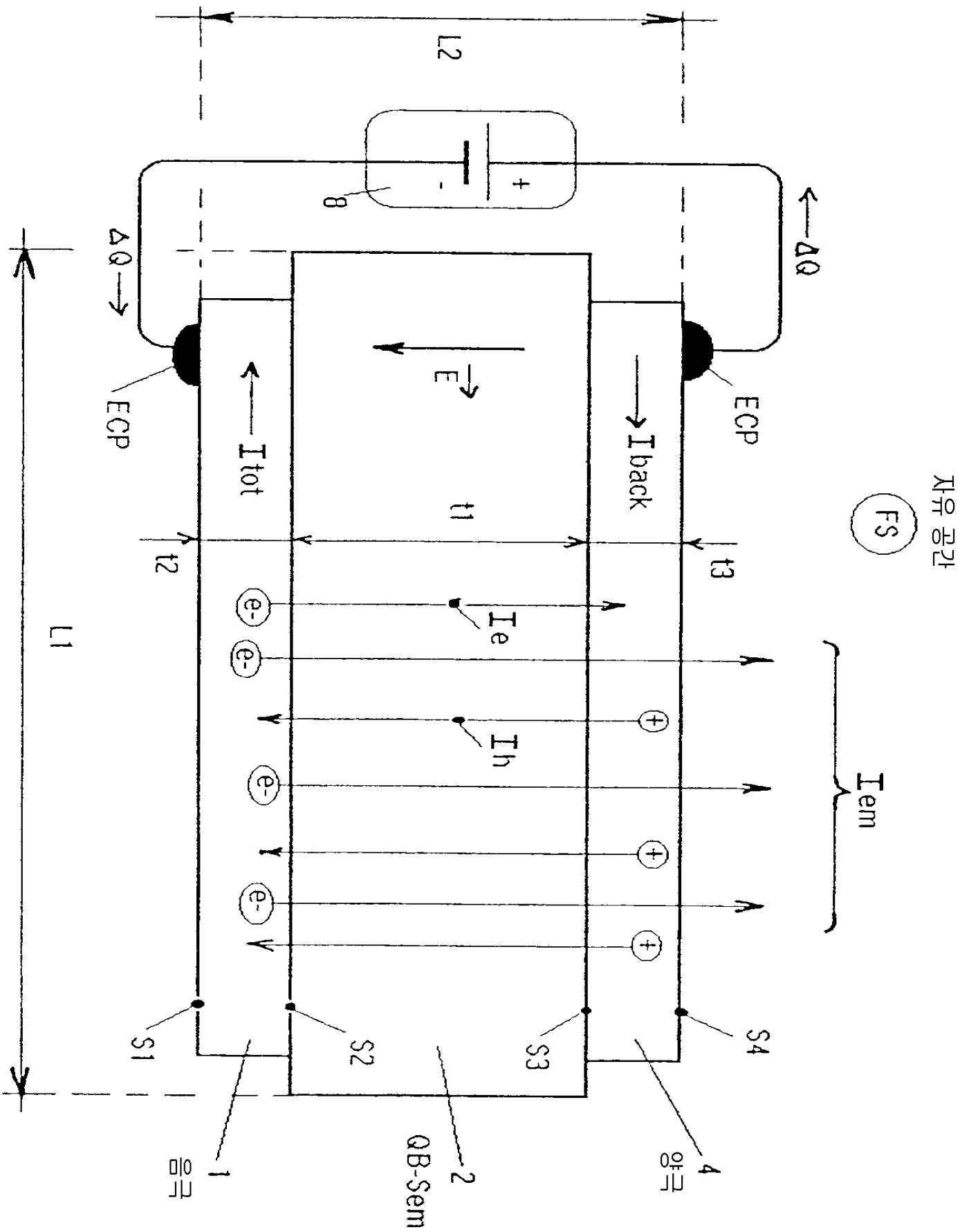
1



2



3

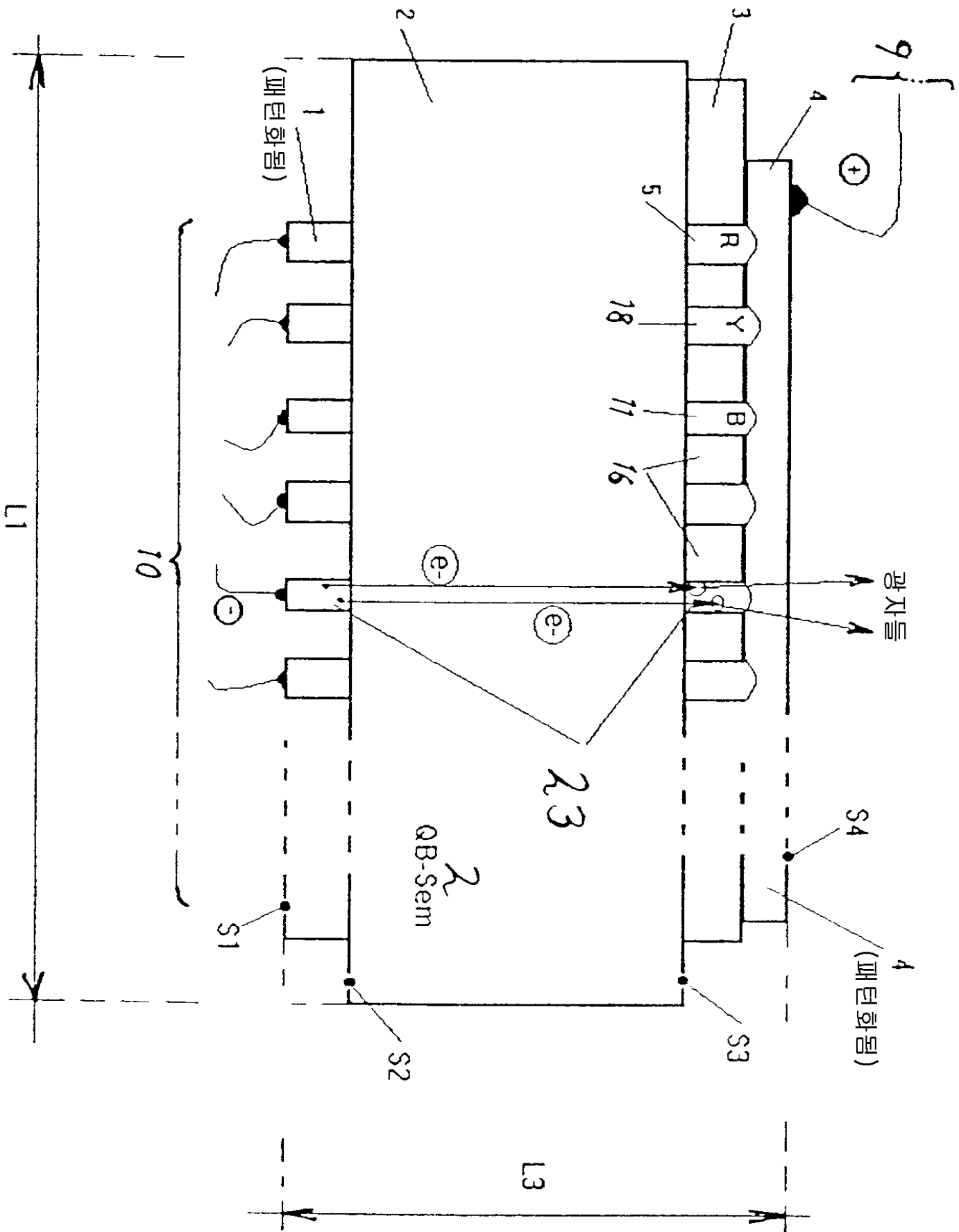


자유 공간

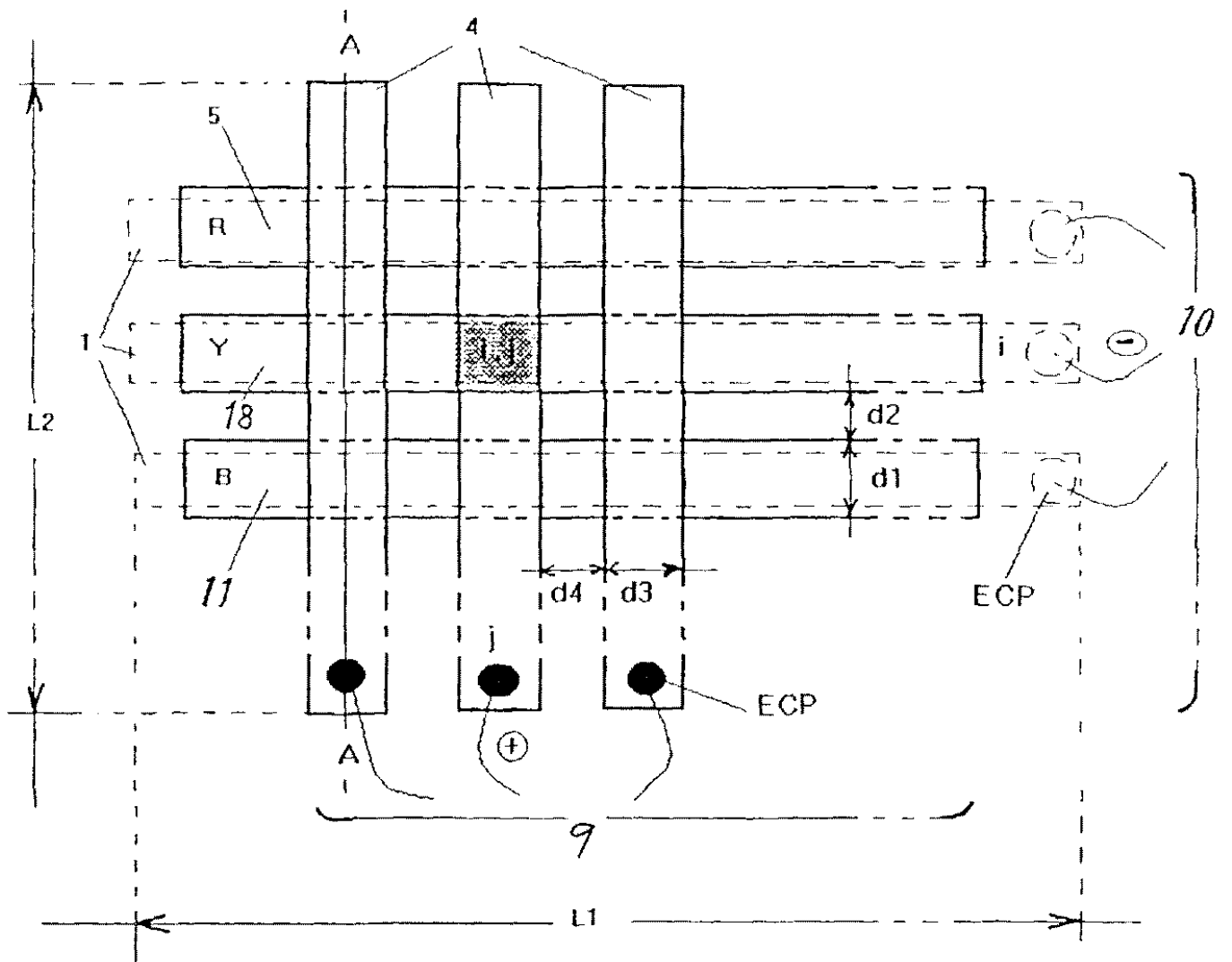
FS

$I_{em}$

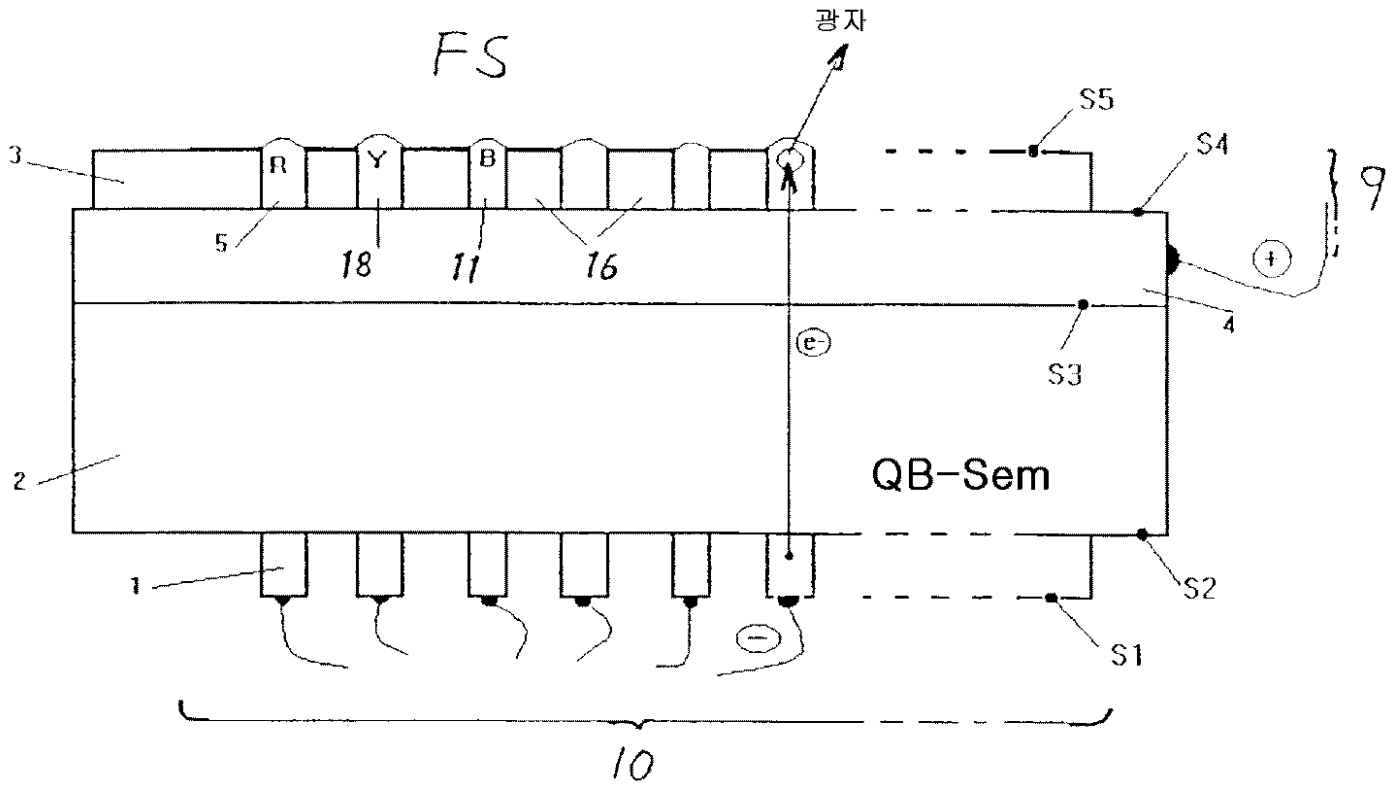
4



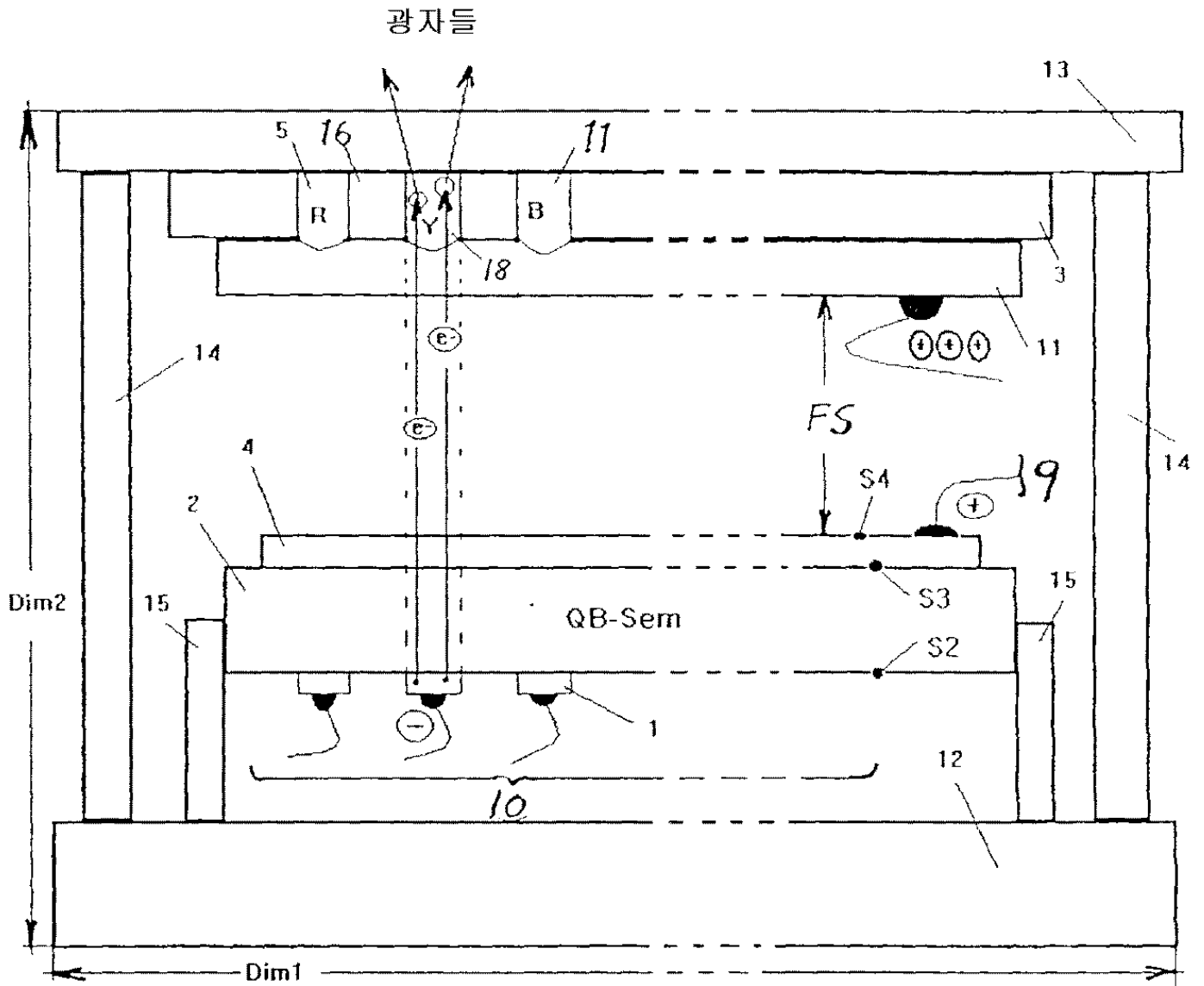
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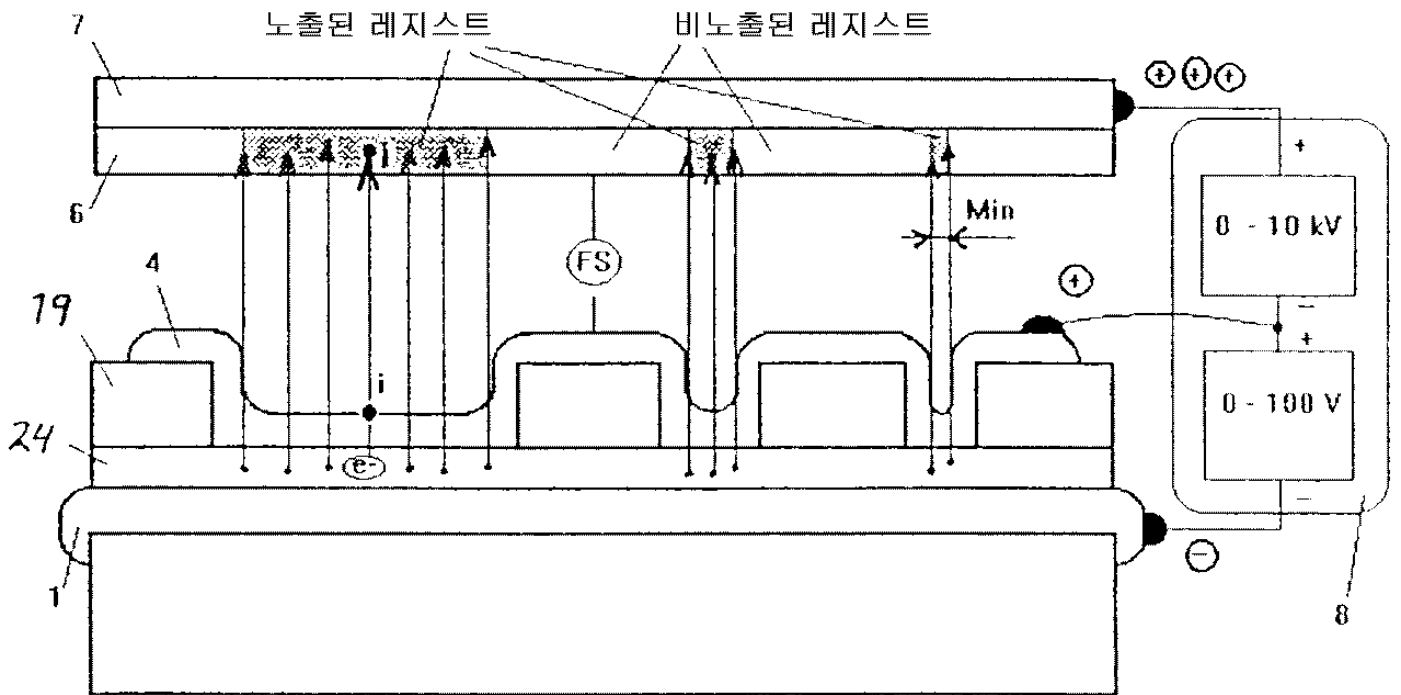
6



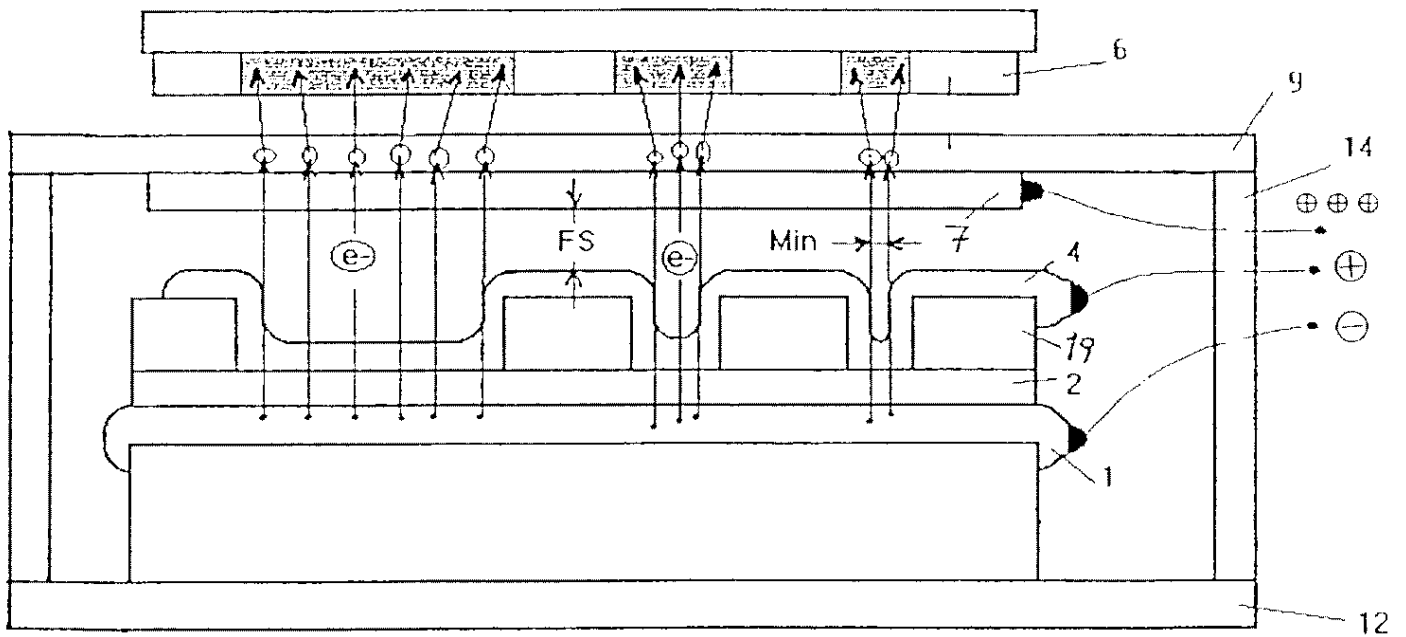
7



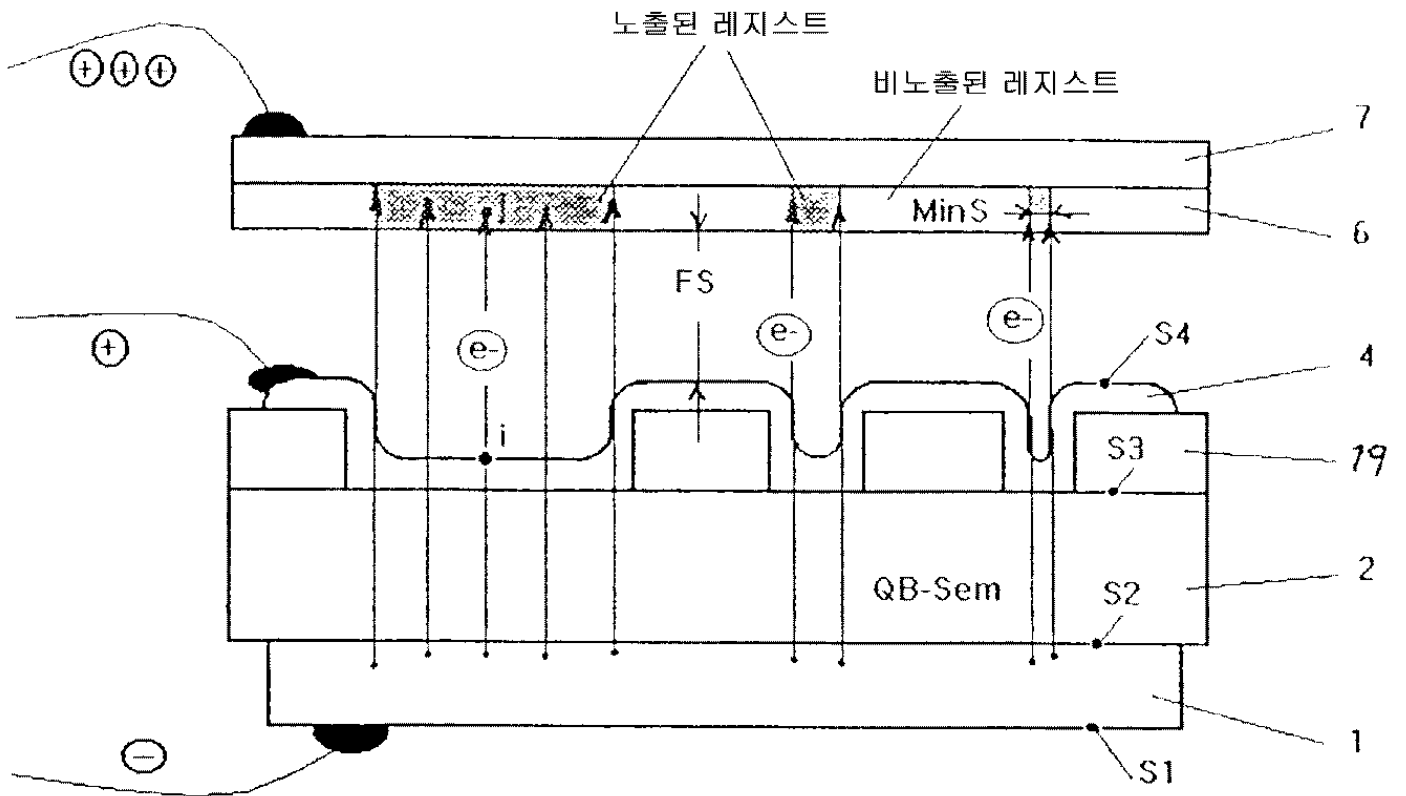
8



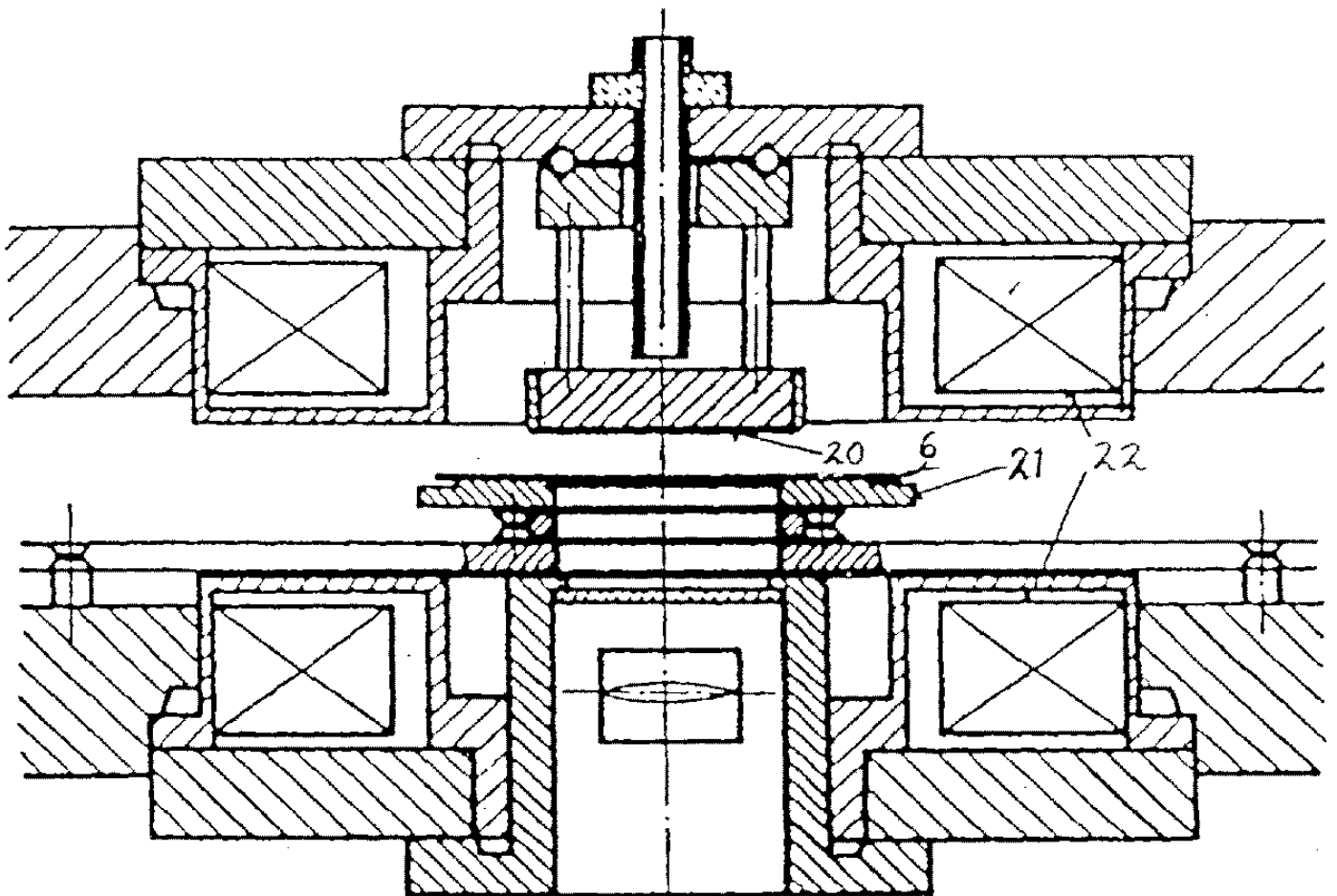
9

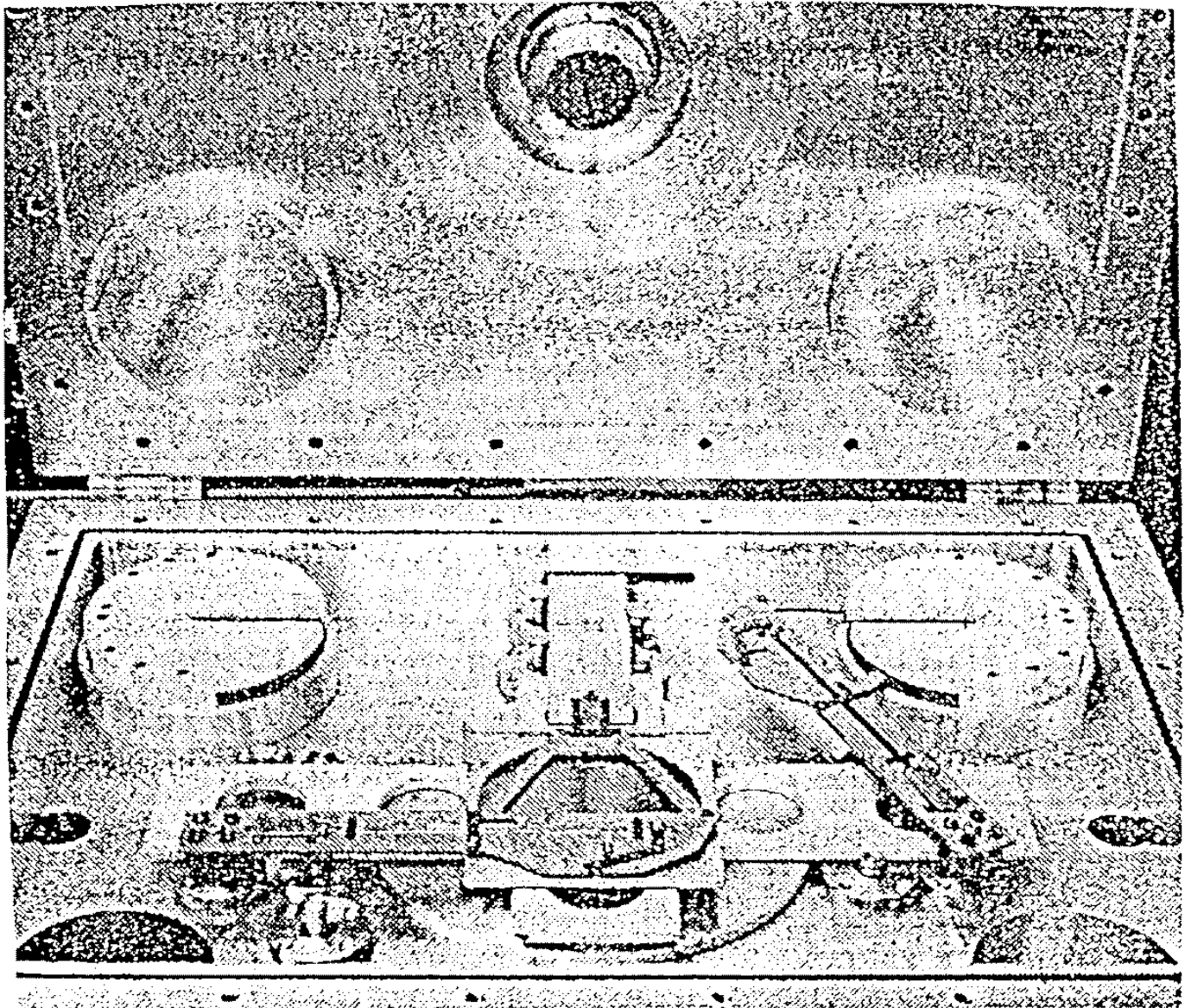


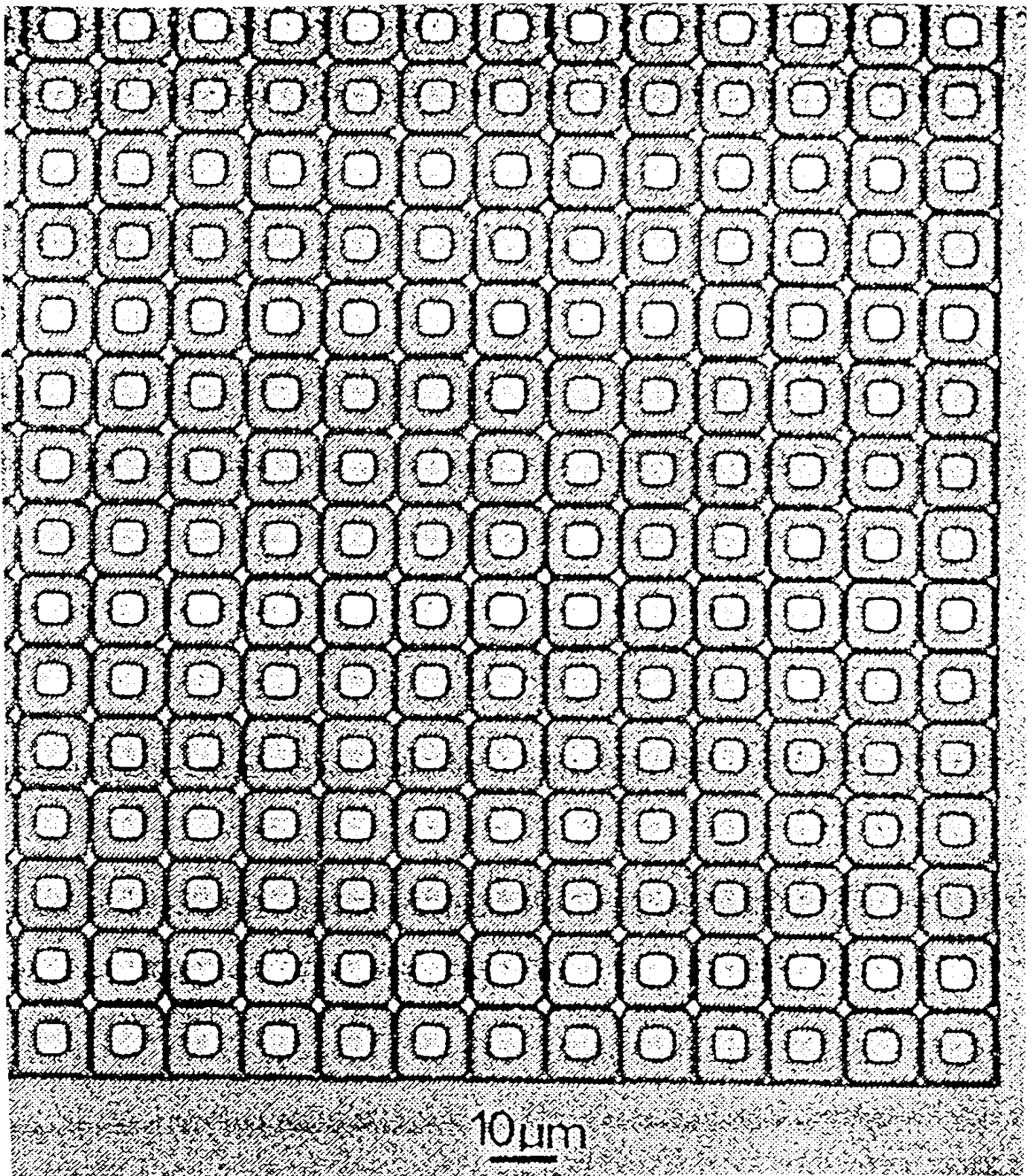
10

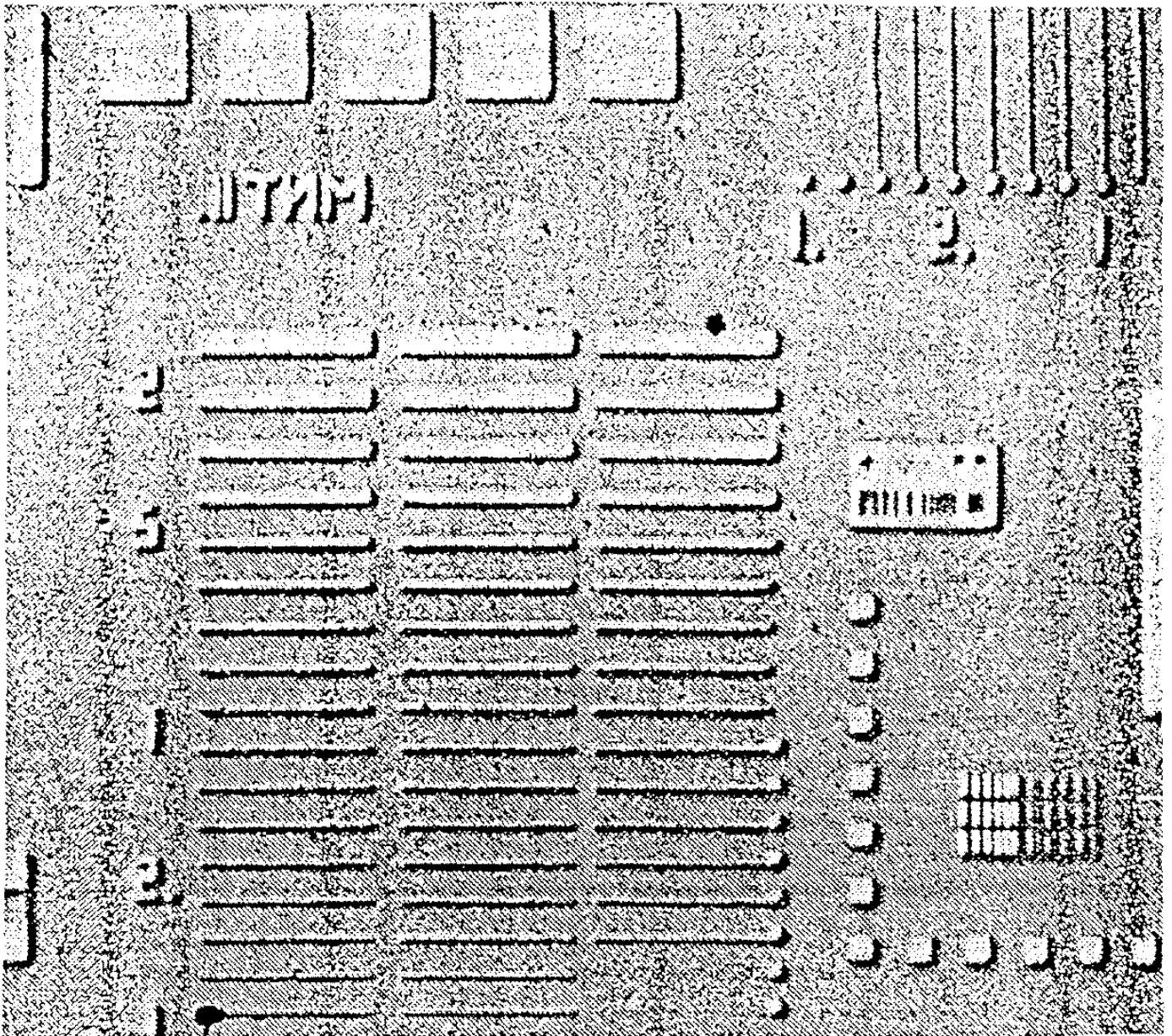


11



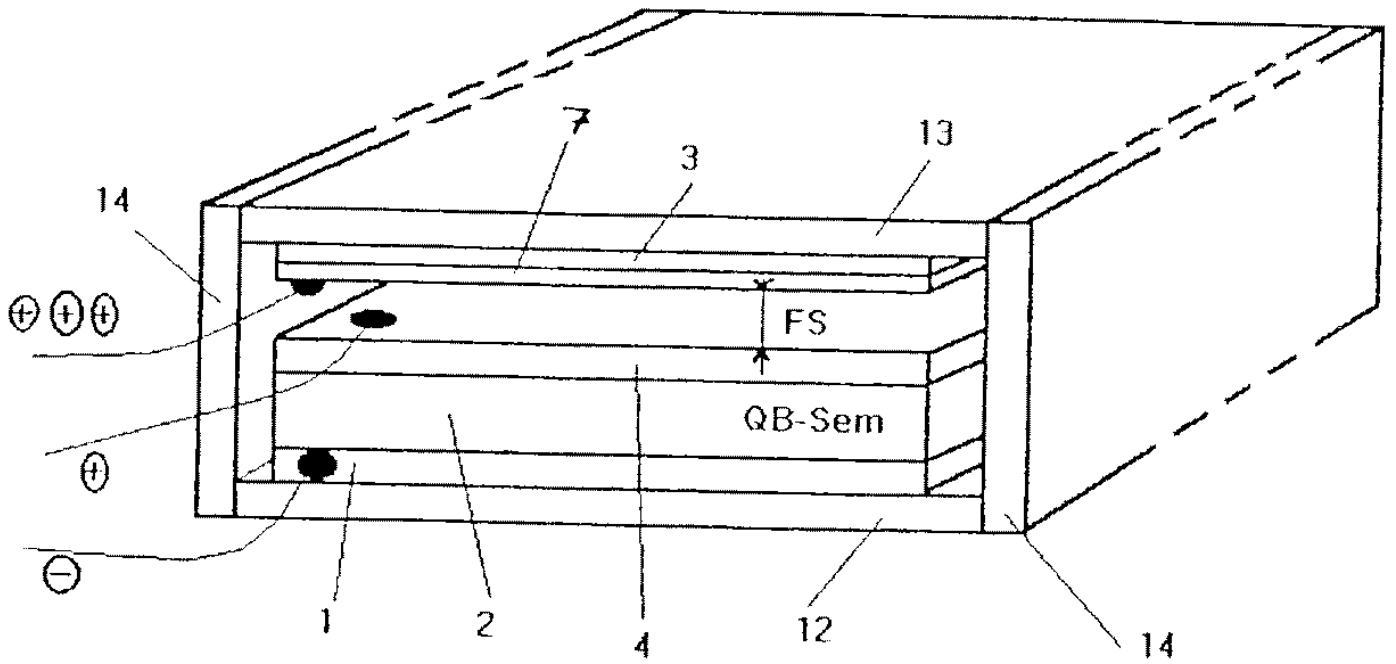




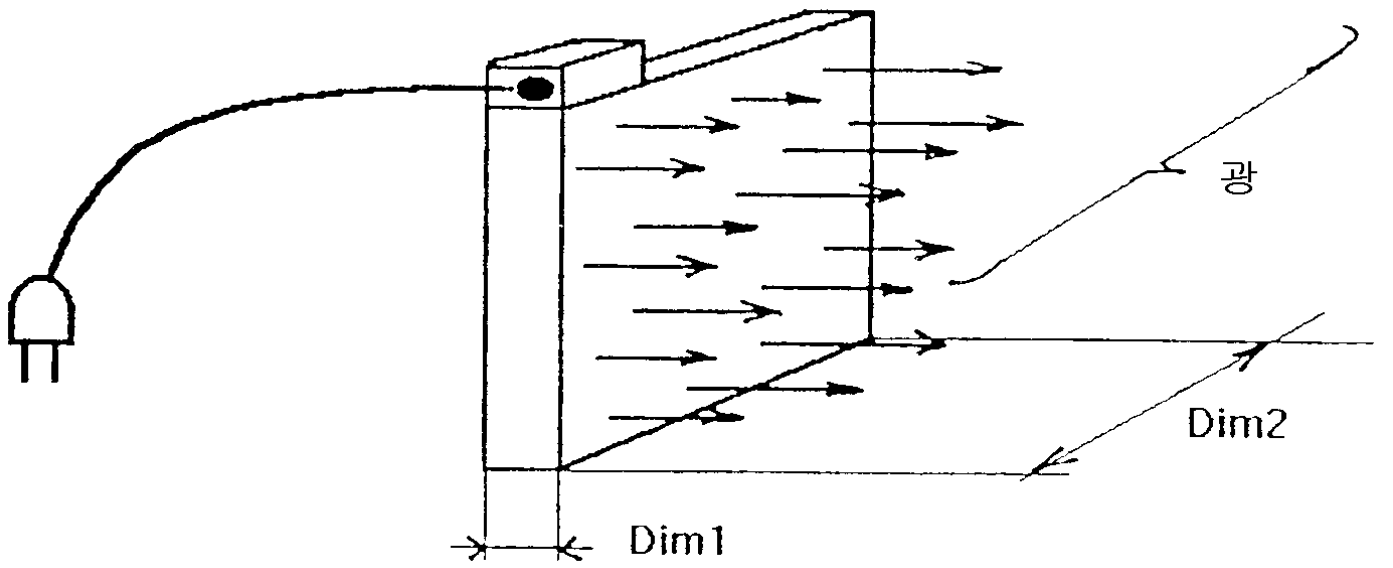


0.15 $\mu$ m 특성 영역

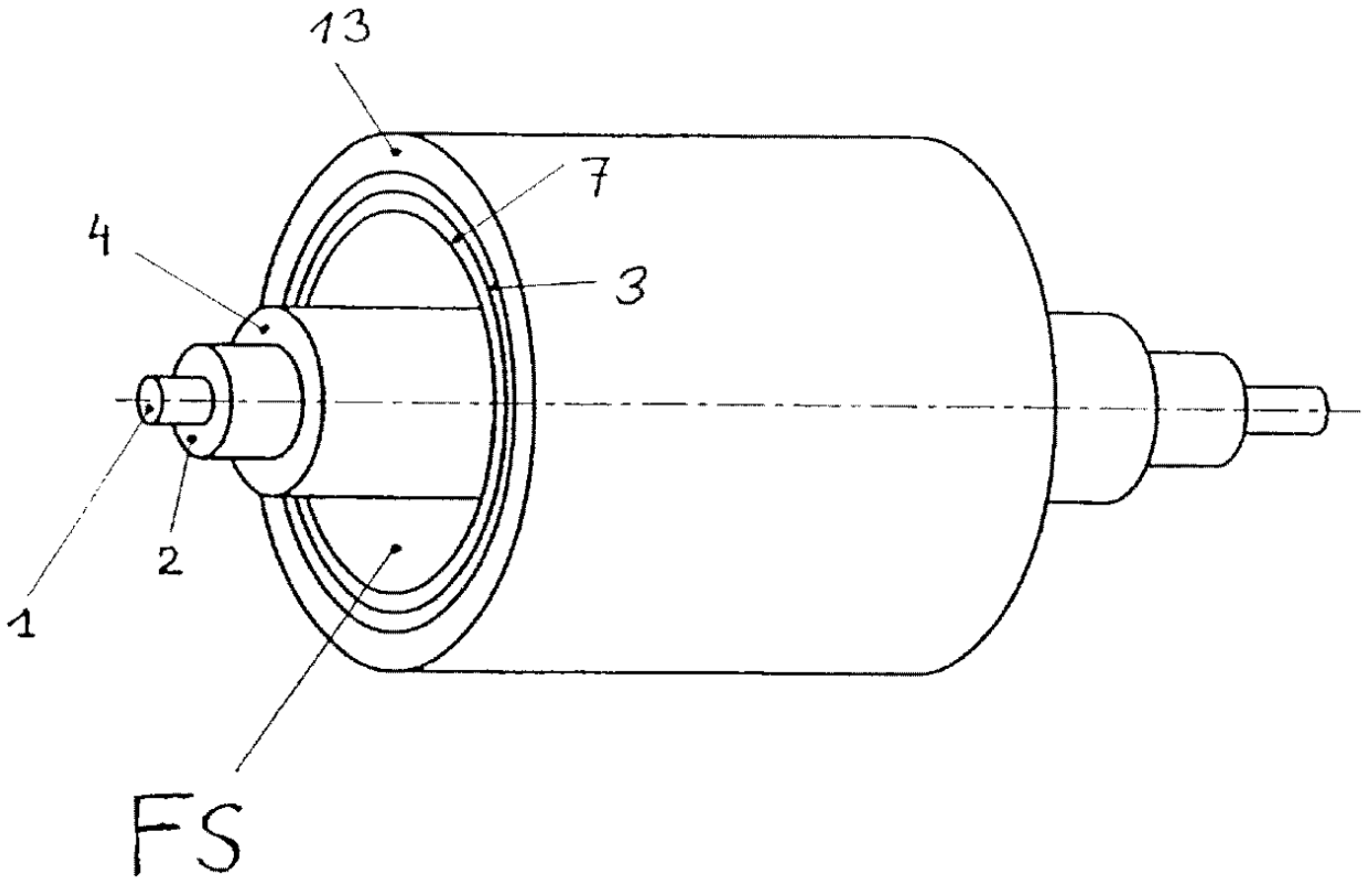
15



16

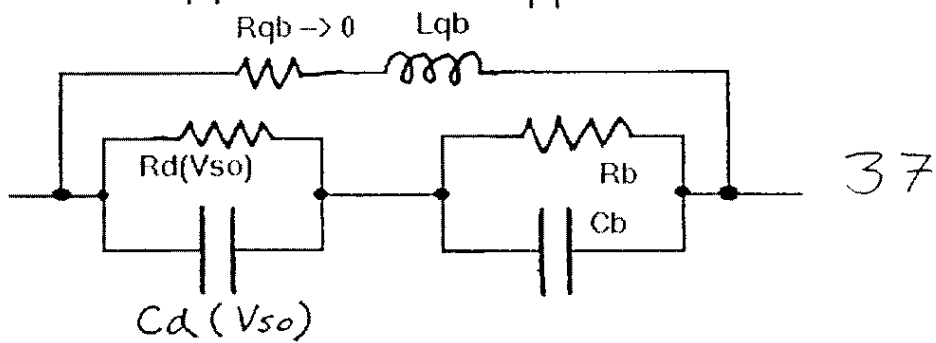
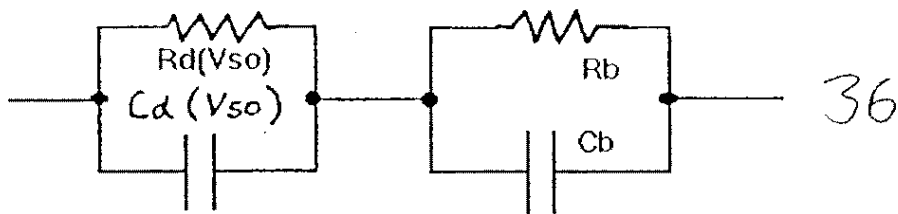
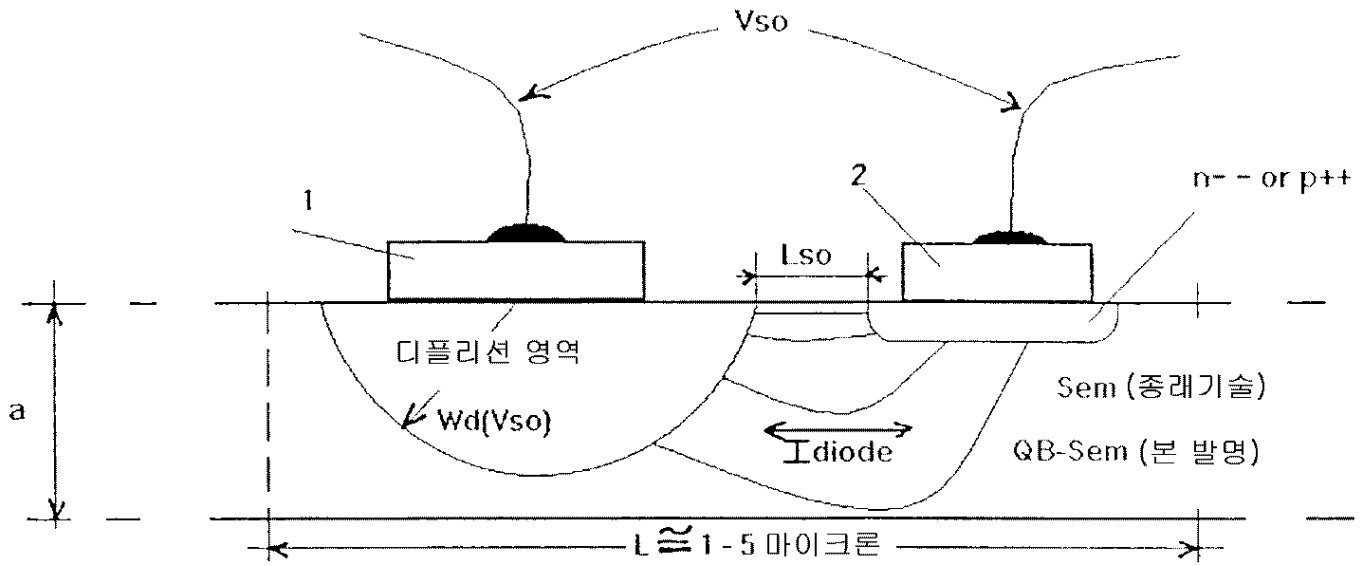


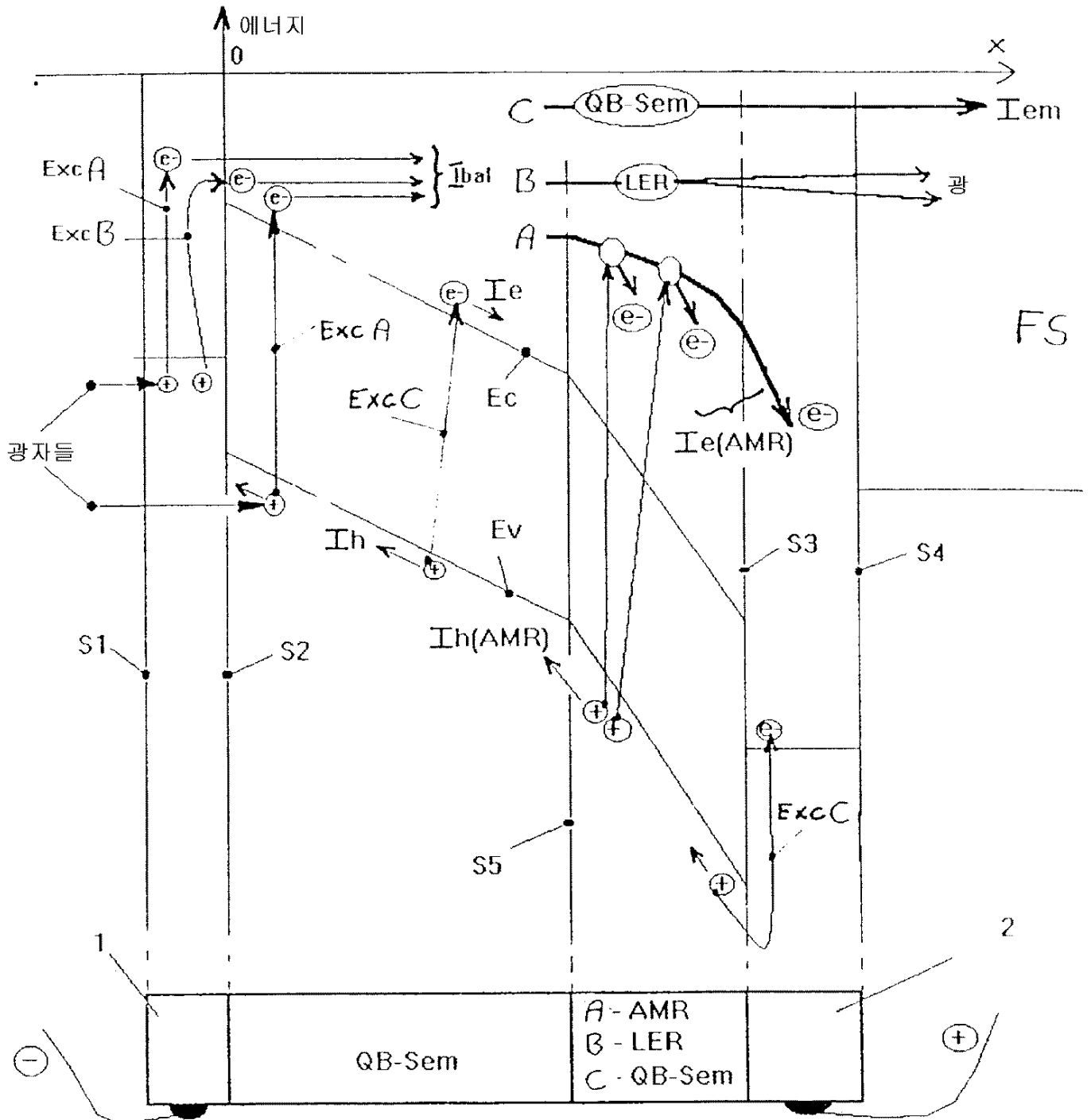
17

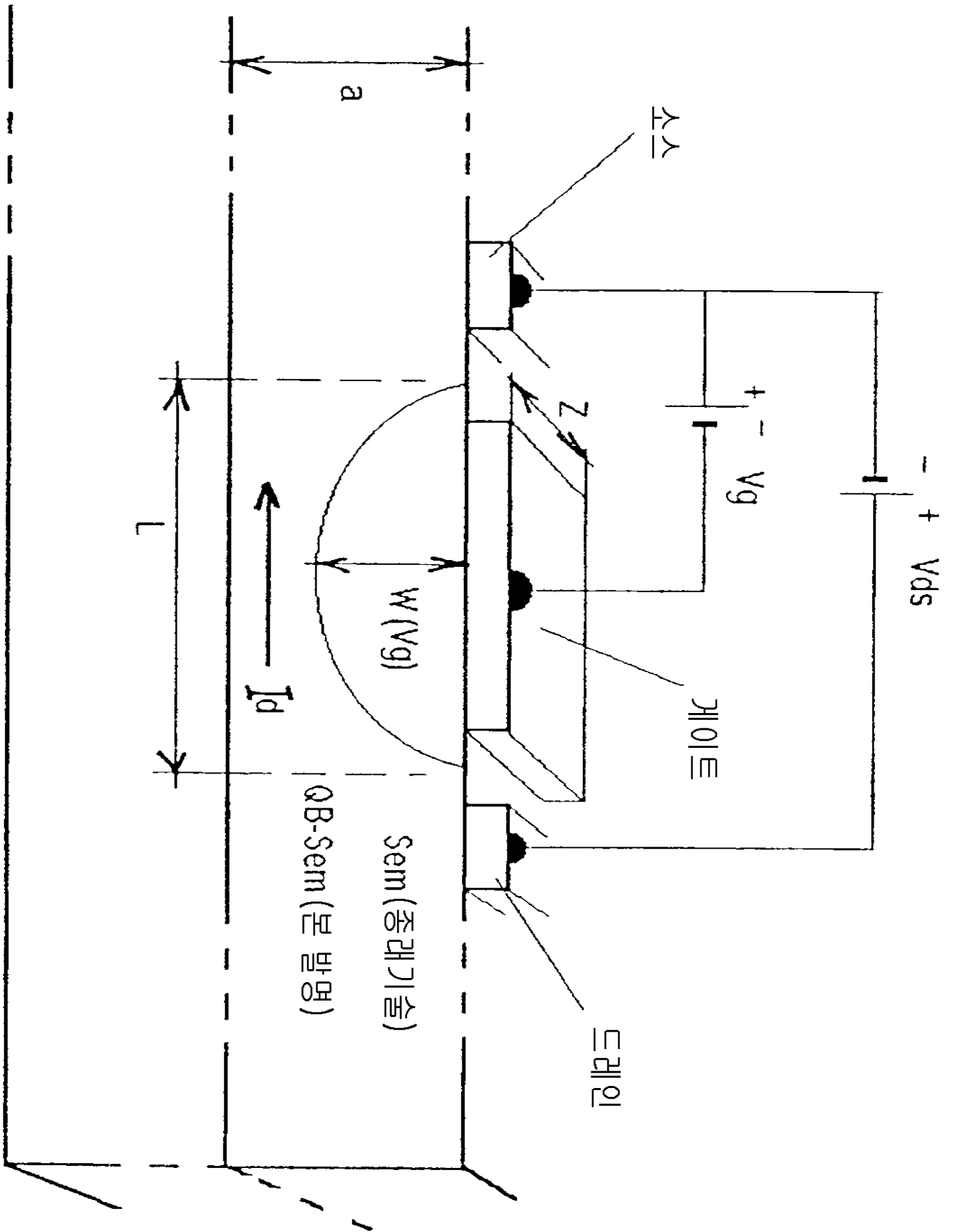


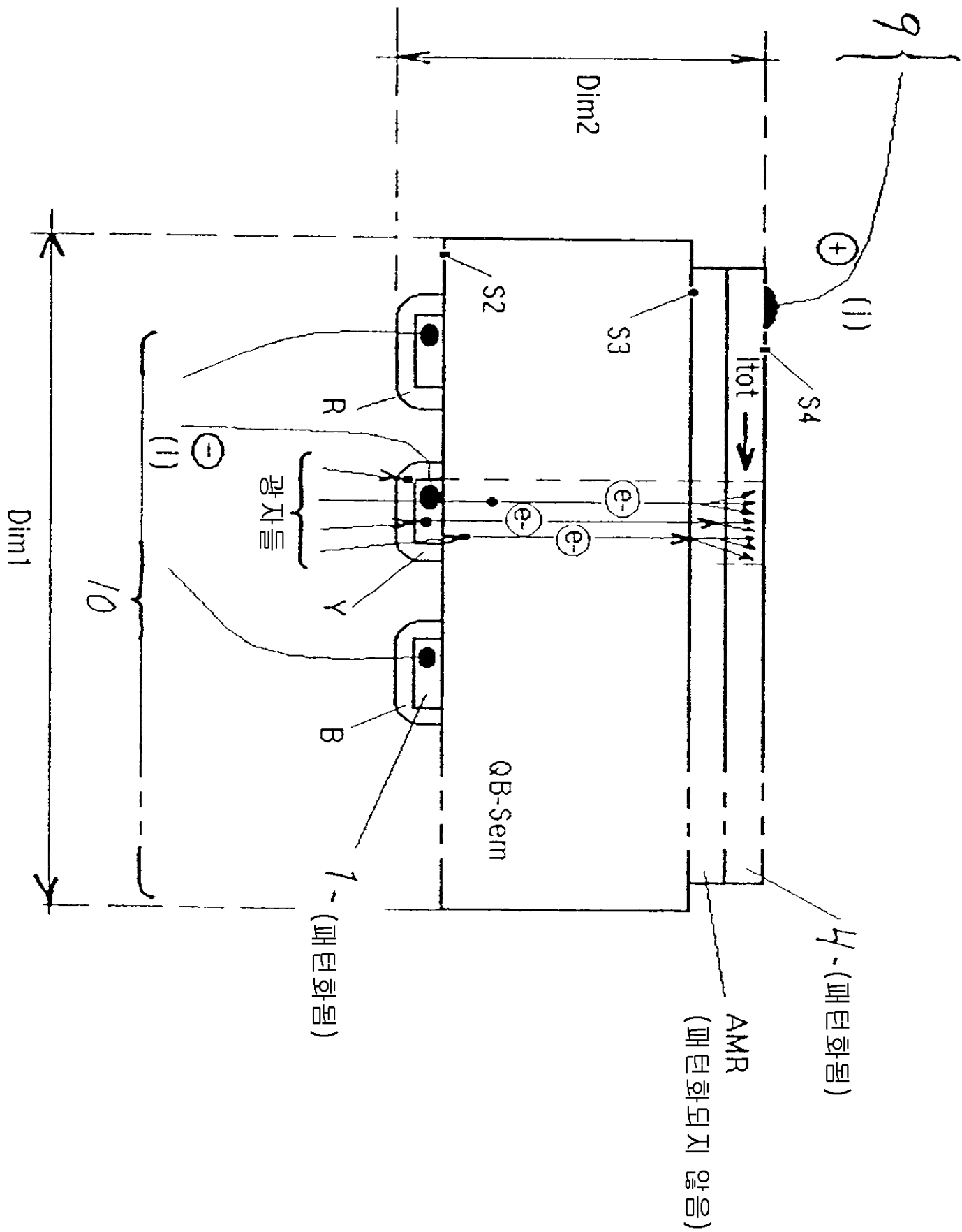
쇼키 콘택

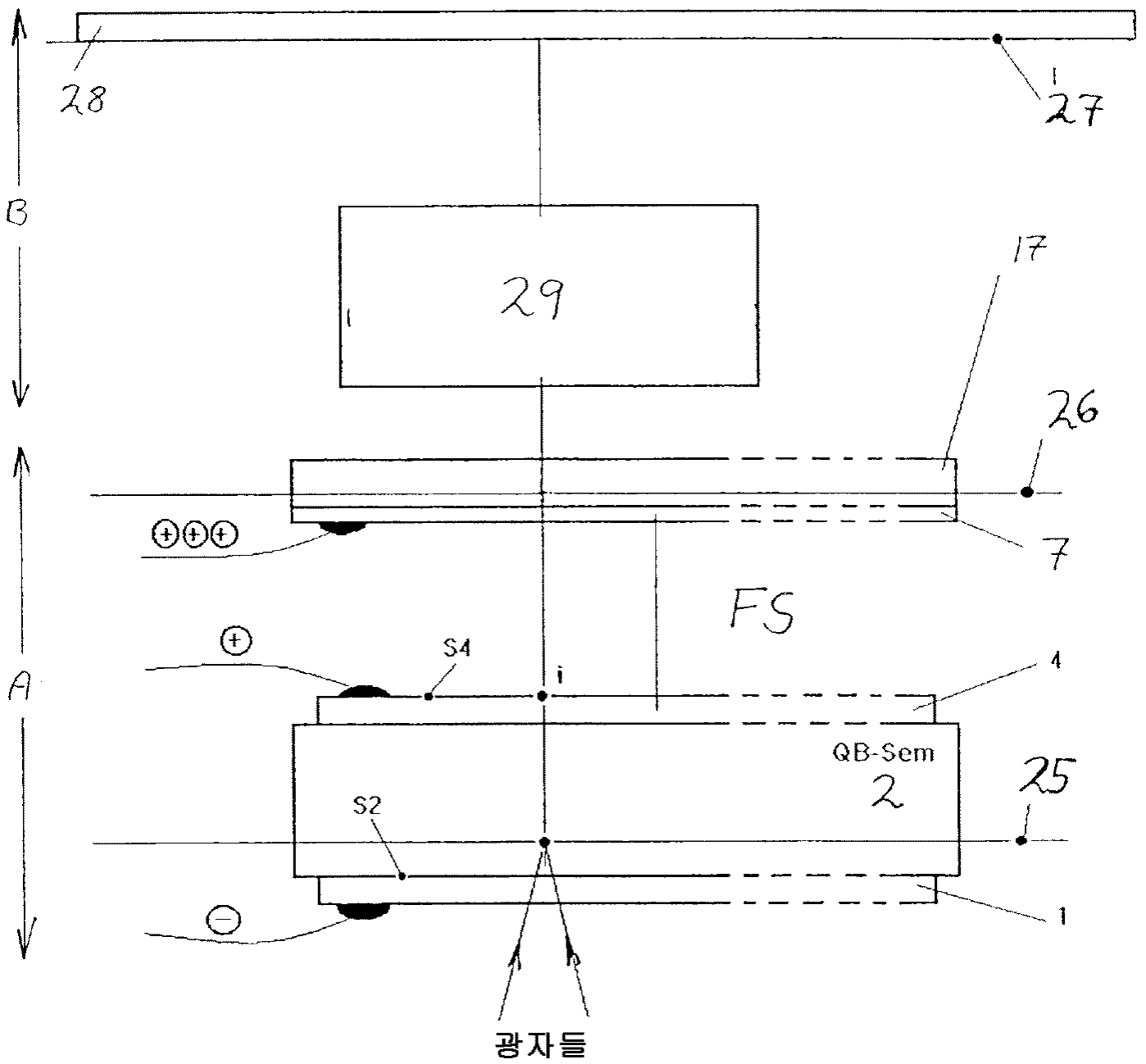
오믹 콘택

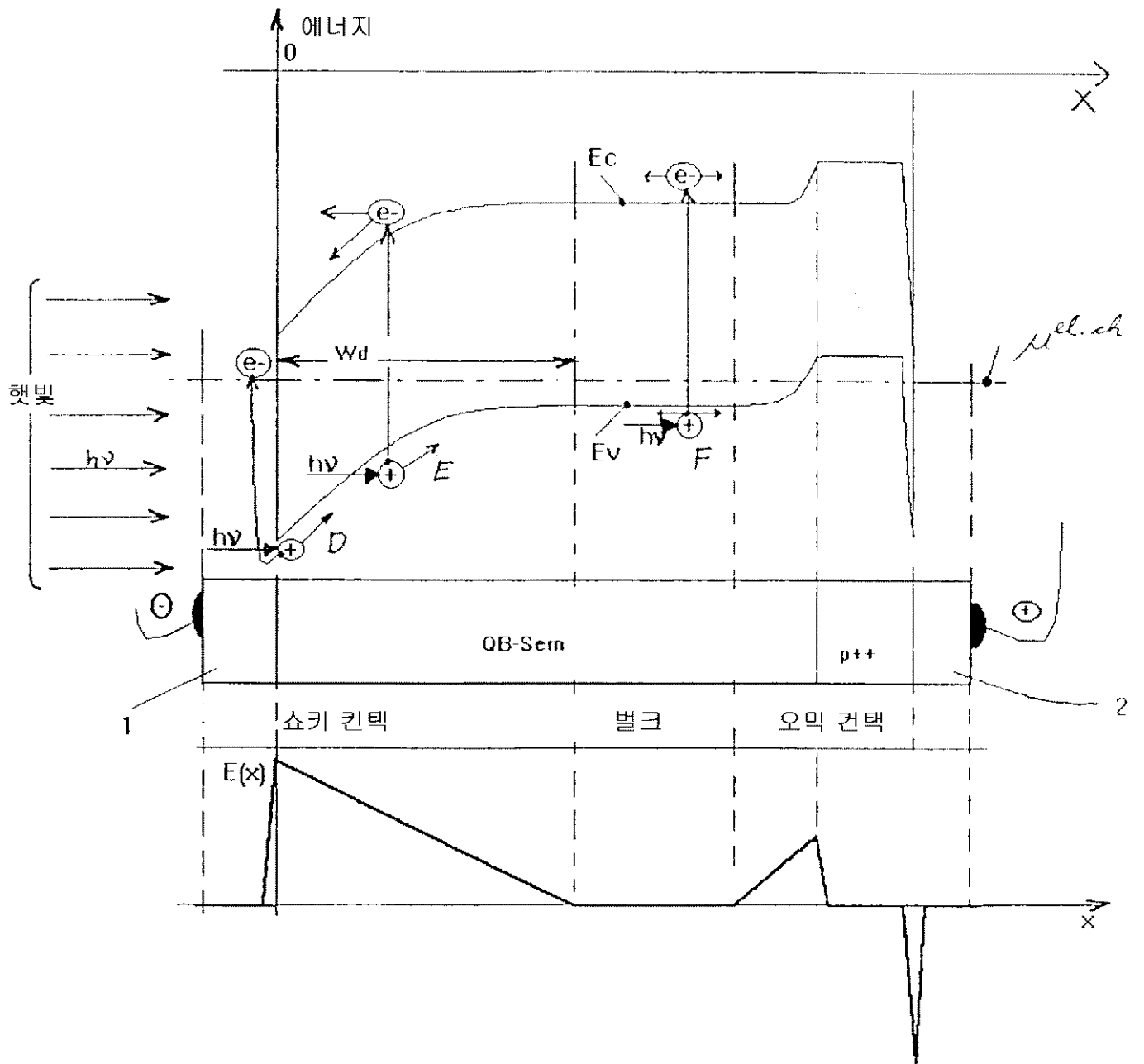












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