

(19)
(12)

(KR)
(B1)

(51) 。 Int. Cl. 7
G11B 5/31

(45)
(11)
(24)

2003 02 26
10 - 0373672
2003 02 12

(21) 10 - 2000 - 0055971
(22) 2000 09 23

(65)
(43)

2001 - 0030480
2001 04 16

(30) 99 - 271365 1999 09 24 (JP)

(73) 가 가 1 1 1

(72) 가 가 가 297 - 203

4 - 5 - 15 405

2 - 1 - 108

(74)

:

(54) ,

, , , 가 가 ,

.

, 가 , , , ,

,

.

,

1a

, , DLC ,

1a 1c , 1a
가

2 (a) (e)

3 (a) (d)

4 가

5 (a), (b) 1

6 (a) (c) 2 , 3 , 4

7

8

9 (a), (b) , 「
」

10

11

12

<

10A, 100A :

11, 111 :

12, 112 :

13, 113 :

14, 114A :

18, 118 :

20A, 100B :

30 : DLC

114B :

153A :

155 :

200 :

215 :

216 :

(Hard Disk Drive)

100 Gbps [가 / ()²]가 가 () 가 40

(Ku) (V) 가 (V) Ku 가

Ku 가

Ku 가

12 A) (100B)가 (200) (100)

(216) (100A) (111), (112), (113), (200) (114A)

(100B) (111), (112), (113), (200)
 (216) (114B)

B) (100A) (113) (S) (S) (100)
 (113)
 (200) (118) DLC(Diamond Like Carbon) (117)

(100A) (114A) (112) (215)
 (111) (200) (218)
 12 (100B) (114B)

(100A) (111) (112) (112) (111) (111)
 가 (200) (112) 가 (200) 가
 가 (111) (112) (200) (가) L
) (가) 가

(113) 가

(111) 가
 (111) 가 (111)
 가 (200) 가 (112) (113) (111)
 (114A) (215)
 (111)

4A) (111) (200) (112), (113), (11)
 (100B) 가 가
 12 (100A, 100B)

(100A)

(S) (113), (114A), (111), (112)
 , DLC (117) (100A)가 가 (118)

(118) 가 $\pm 0.15 \mu\text{m}$ 가
 (112) (200) 0.3 μm (111) 0.15 μm
 70 %
 (113), (114A 114B), (111), (112) 가
 ($\pm 0.1 \mu\text{m}$) ($\pm 0.2 \mu\text{m}$) $\pm 0.3 \mu\text{m}$ 0.1
 (113)가 (113)가 (118)
 90 % 0.9 μm 가 (118)
 (200) 80 % 가 (114A)
 가 가 가 $0.7 \times 0.9 \times 0.8 = 0.5$ 가
 가

가 0.05 0.1 μm
 가 가

GMR

(pole tip)

(yoke tip)

1

가

가

0.01 μm

GMR/TMR

DLC

가

DLC

가

DLC

가

FIB(Focused Ion Beam Etching) EB(Electron Beam)

가

DLC

1/10000

FIB(Focused Ion Beam Etching) EB(Electron Beam)

가

1a

(10A)

(20A)가 (200)

(218)

(216)

(215)

(200)

(218) PtMn,

(216) NiFe,

CoCrPt

(11), (10A) (30) (11 14) (216),
 (12), (13) (200) (14)
 (32)

(30) (200) (18) (18) ,
 (30) , (18) DLC(Diamond Like Carbon)
 (11 14) (200)
 (11 14) DLC (30) [(30H)가
 (18)] , DLC (30) (30H)가 ,
 (11) (10T) (30H) , (30)
 (10T) (12) (30H) (10T) , (30)
 (10T) DLC (30) (0.1 μm)
 (12) (10T) (30)

(12), (13) (14) DLC(Diamond Like Carbon)
 (30) , (200) DLC (30)

(10A) 가 (200)
 (12) , (13) DLC (30)
 (14) 0.01 μm 가
 (12), (13), (14) 가 , 가

(12) (13) (E) (E) 가
 가

1b 1a
 (10T) (A) (W1) (W2)

(155) (10) (158) 1c ((200) (A) (15
 가 (T) (T) , , (200) , (2
 8) (10) , (200) . 1c , (1
 (T10) (10T) , 가 (())
 00) (10T) , (Br) ()
 0T)

(10T) , (10T) () 가 , 가
 (10T) 1c Te (10T) (Tw)
 (10T) (Tw)
 가 , (T10) (W1) (W1) (W2) 1/10
 , (20A) , (21), (22),
 (23), (24) (216) GMR(Giant Magneto Resistive) TMR(Tunneling Magneto Resistive)
 (23) (23) (5)
 0, 50)가 ,
 (30H) (20) (21) (20T) DLC (30) ()
 22) (30H) (30) (20T) , (30) , ,
 (22) (24) (30) , , (20
 T) (30) , (22)
 (24) (30) (10A)
 , (10A, 20A)
 2 (a) 3 (d)
 , 2 (a) (Si) (41) (Cu)
 (42) , DLC (30)
 , 2 (b) DLC (30) (30H) , FIB(Focused Ion Bea
 m Etching) EB(Electron Beam)
 , 0.15 μm × 0.15 μm (30H)
 , 2 (c) , FeCo, NiFe
 (11, 21) (30H)
 , 2 (d) DLC (30) NiFe
 (12), (13), (22, 24) , Cu
 (14)
 , 2 (e) AlOx() (32A) , CMP(Chemo Mechani
 cal Polishing)
 , 3 (a) (10) (12) (13)
 , NiFe

(32B) TMR, 3 (b) CMP (20A) (23) AlOx (32B) AlOx GMR

P, 3 (c) , AlOx (32C) CM

, 3 (e) (41) (10A, 20A) Cu (42)

(11), 가 (12), (13)

(13) (20A) DLC (10A) (30) (12), (0.1 μm) (14), (22, 24), GMR/TMR (23) (41)

, 1a (10A, 20A) (10T), (20T) DLC (30) (10T), (20T)

(30)

4 (30a) (10T) (10T) (10T)

(10T) (42), 2 (b) (30) DLC (30) (30H)

, 3 (d) (41) DLC (30a) (10T), (20T) 4 (30)

a) DLC (30b) (相性) DLC

가

, DLC (30)

가

5 (a), (b) 1 1a 4

5 (a) (10B) (10T) (14) (14) (200) (12) (13)

가

, DLC (30) (off - set) ,
가 .

5 (b)

, (10C) 4 (30a 30d) (10T) (
30b 30d) (14) (30c, 30d) ,
(13) (30d) (12) (30d) ,
(30a)

, (10C) (30a 30d) ,
(18)

,
가 .

, 5 (b) , (30a 30d)
(30a) DLC
(30b 30d) ,

2 (a) 3 (d) 가 , (30b 30d)
(11) , (30b)
(30c, 30d) 가
(14) (30b 30d) 가
가 .

, (30c) 가 (30d) 가 (30d)
(13) .

, 가 , 5 (b)

6 (a) 2 . 1a 5 (b)
(20B) (20T) (26, 26) (26, 26)

, (20T) (20T)
(26, 26) (30) , (20T)

가 .

6 (b) 3 . 1a 6 (a)

. (G) (20C) (22, 24)가 (G) (23),
(24) , (23) (22), (23),

6 (c) 4 . 1a 6 (b)

(24) (G) (20D) (22, 24)가 (G) (23),

(23) (23) (50, 50)가 (23) 가

가

7 (150)

(200) (200) (152)

(153) (154)

(153)

(200)가 (153) (ABS) (200)

(154) (155) (155) (155) (156)가

(156) (155) (155)

(155) (157)

(156)

8 (155)

(160) (155)

(155) (154)

(154) (154) (164) (164) (153)가 (153)

(154) (164) 165 (160)

(153) (ABS) (200)

9 (a) (153) (200) (10)

(153) (200)

(200)

가

가

(200) 가

가

, 1

30 G(가)

(10)

(200)

(10)

(200)

9 (b)

「
DLC

(153)

(200)

, 9 (b)

「

가

10

(153)

(10)

(153)

(T)()

(L)()

(153A)

(153A)

(153A)

, 2 (a)

(e)

(41)

(153A)

11

(41)

(41)

4

(153S)

(153S)

(10S) ,

(153i)가

(41)

2 (a)

3 (d)

(41)

, 3 (c)

(63)

(41)

, 3 (d)

(41)

(153)

(153A)

가

가

가

, 1/3

가

가

가

가

「

(removable)」

가

가 가 ,

(57)

1.

2.

가 ,

3.

2 ,

4.

3 ,

5.

3 ,

6.

5 ,

7.

3 ,

2

8.

9.

가

1

1

10.

9 ,

11.

10 ,

1

2 ,

1 2

2

12.

10 ,

1

2 ,

1 2

2

13.

12 , 1 2

14.

10 , 2

15.

16.

17.

18.

17 ,

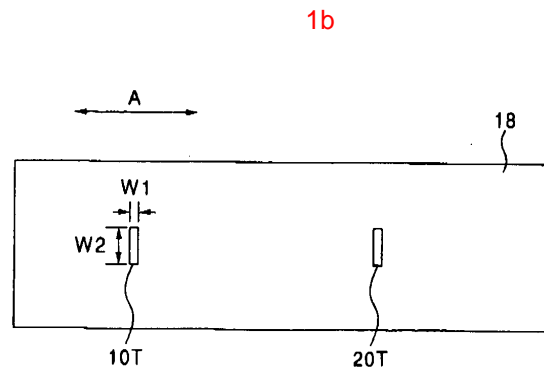
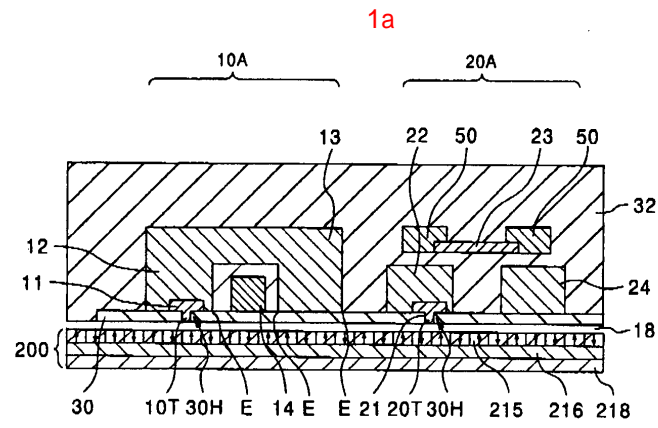
19.

17 , 1 ,

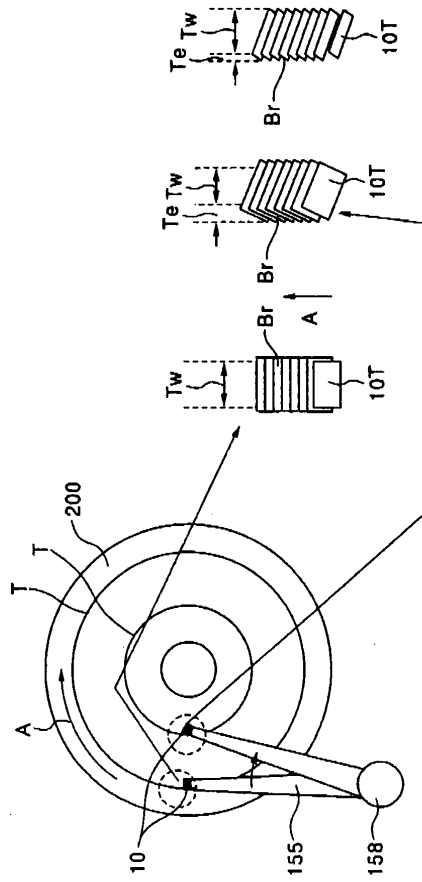
2

20.

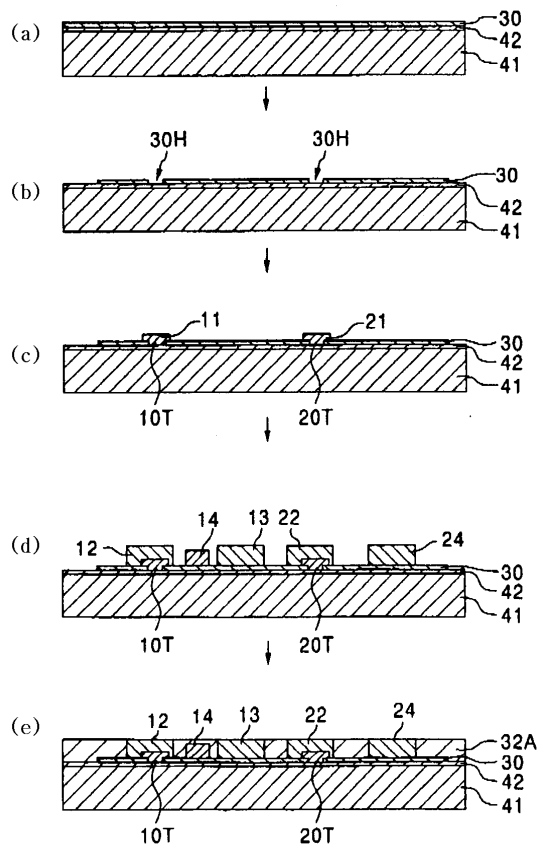
17 ,



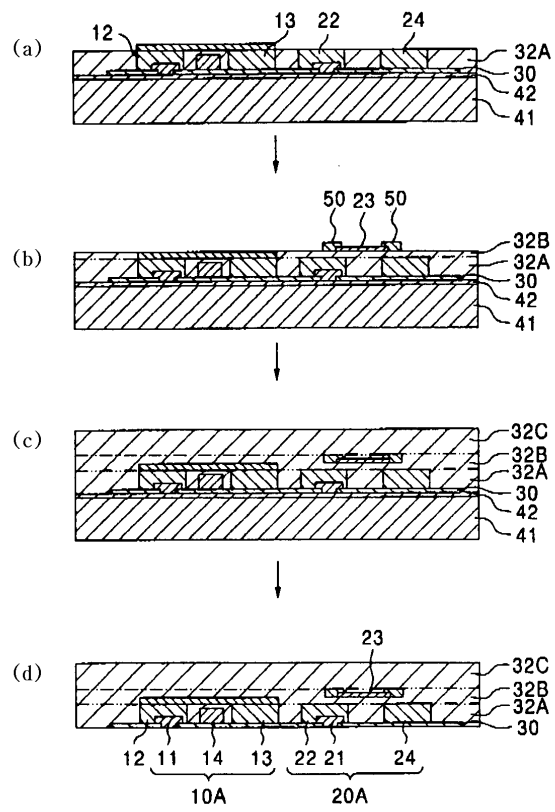
1c



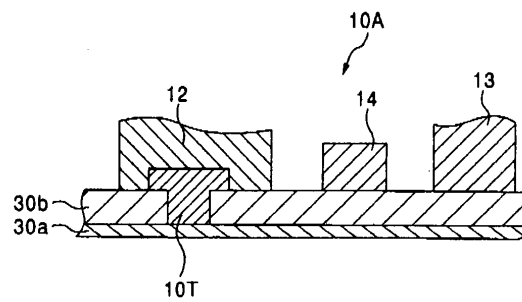
2



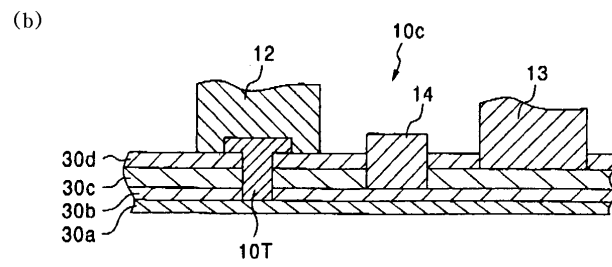
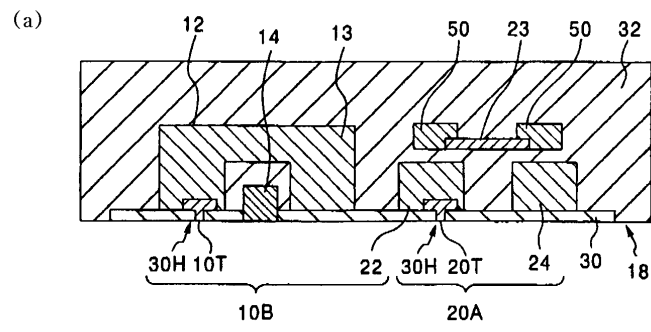
3



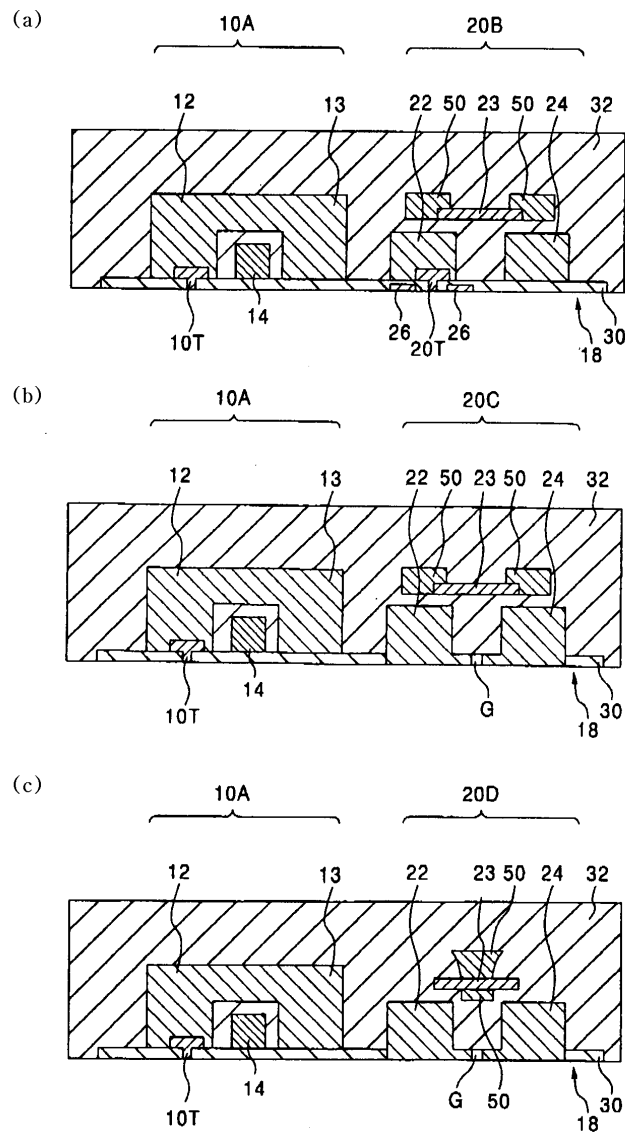
4



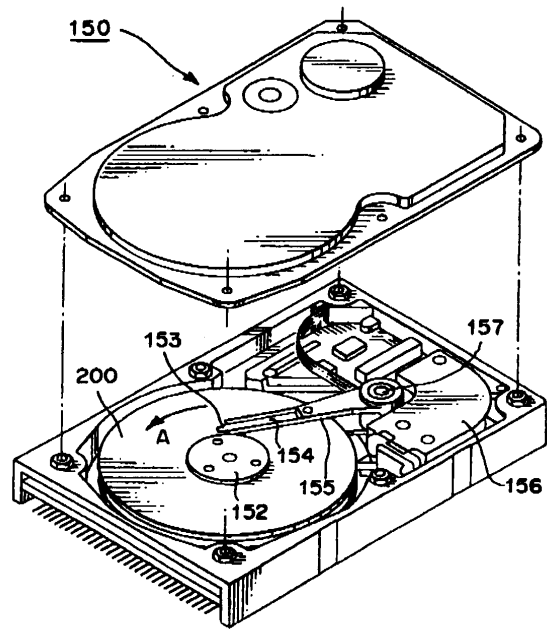
5



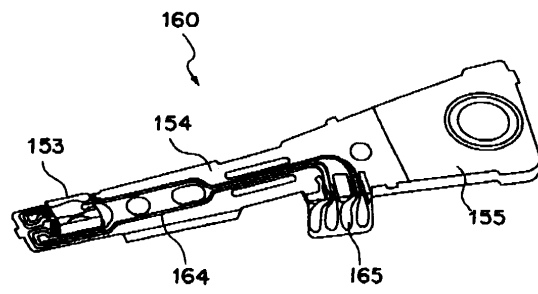
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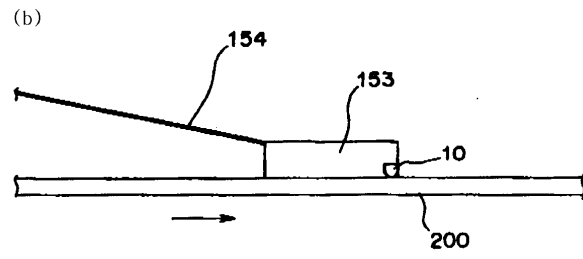
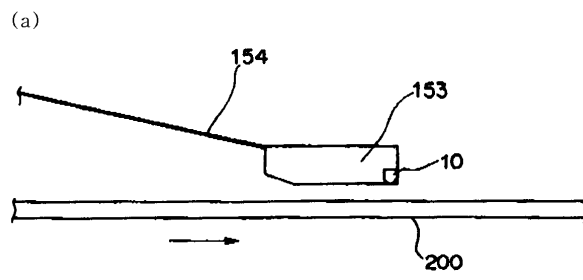
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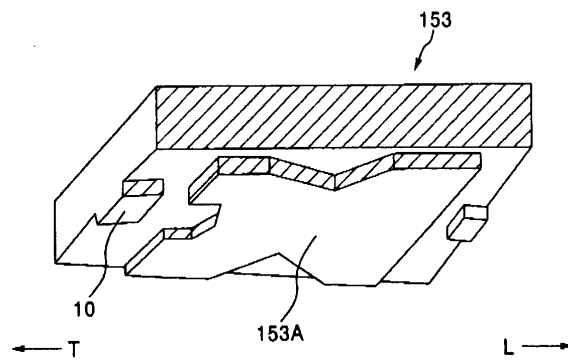
8



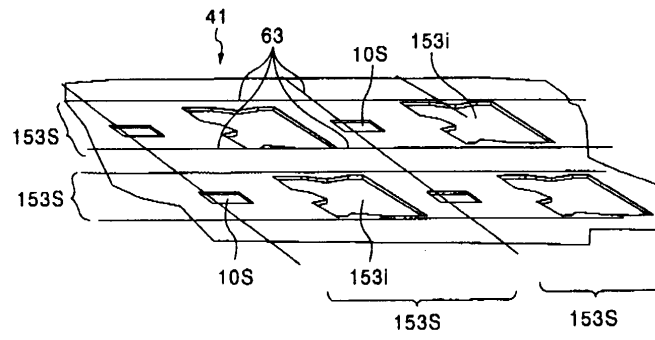
9



10



11



12

