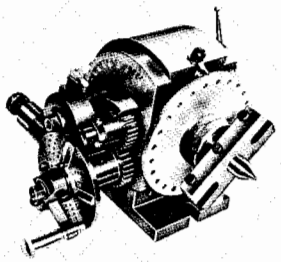
OPERATION AND SERVICE MANUAL



For Dividing Head

OPERATION INSTRUCTIONS

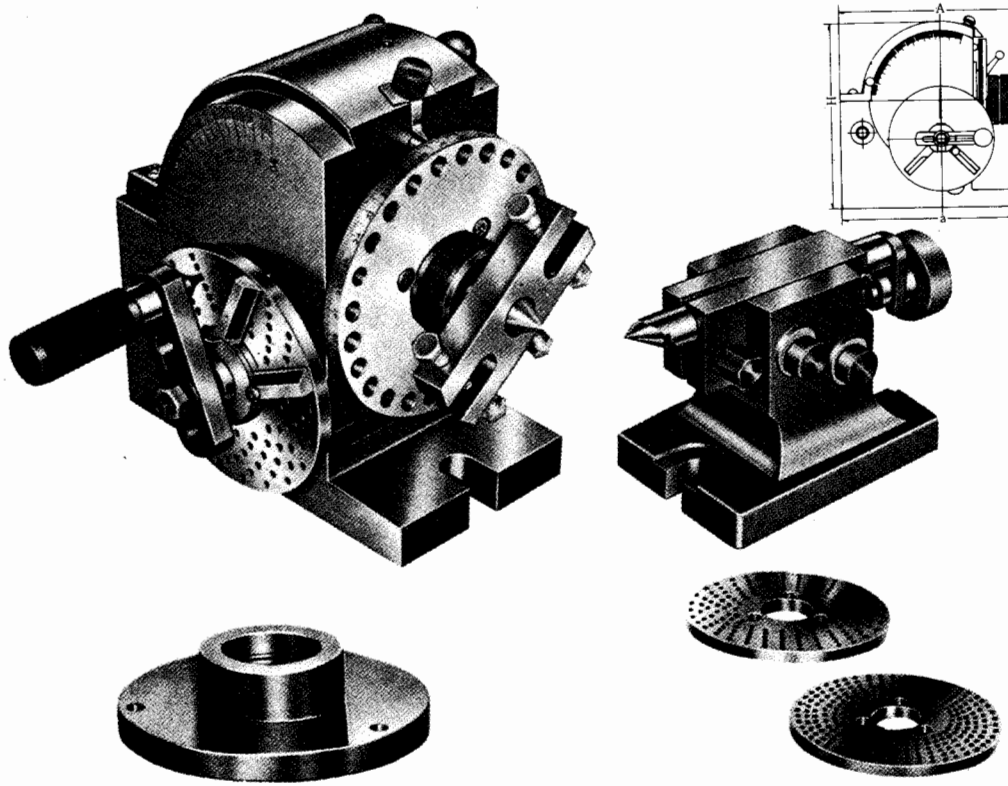
DIVIDING HEAD B & S Type

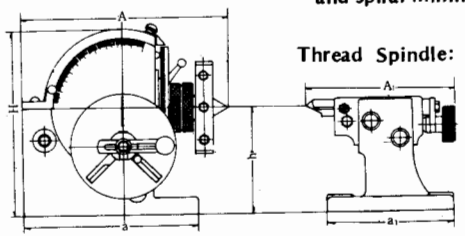
These heads are suitable for milling grinding and drilling work. A plain dividing plate with 24 notches gives direct divisions of 2, 3, 4, 6, 8, 12 and 24. By indirect indexing (worm gear ratio 1:40) all divisions up to 50 and many above 50 can be carried out (see indexing chart). Divisions beyond the indirect indexing range are obtained by using the differential system which gives all divisions up to 1000. The indexing chart supplied with each head lists all divisions up to 380. Spiral milling work can also be carried out with BS-2 dividing heads.

Construction: These attachments combine rigidity with accuracy. The indexing spindle runs in precision taper roller bearings virtually free of play. In contrast to conventional designs the direct indexing plate is mounted at the tapered front indexing spindle. Dividing head and indexing spindle can be swivelled from horizontal to vertical. Indexing spindle, worm, direct indexing pin are hardened and ground, as well as centers and indirect indexing pin. The wormwheel is made of a special hard phosphor-bronze. Worm and wormwheel as well as most of the other revolving parts rotate in oil.

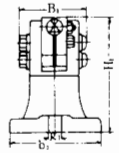
ENCLOSURE:

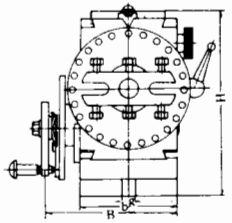
1. Fixed tailstock
2. Carrier
3. Center for head and tailstock
4. Direct indexing plate with 24 notches
5. Indirect indexing plate with 18 circles of holes 15-49.
   - A 15, 16, 17, 18, 19, 20
   - B 21, 23, 27, 29, 31, 33
   - C 37, 39, 41, 43, 47, 49
6. 12 change gears for differential and spiral milling. (only BS-2)
7. Change gear quadrant and 2 bolts (only BS-2)
8. Flange plate,
9. Test certificate
10. Operating instructions
11. Indirect dividing table
12. Differential dividing table (only fitting BS-2)
13. Table for spiral milling (only fitting BS-2)





Thread Spindle: BS-0.1. 1½ – 8TPI





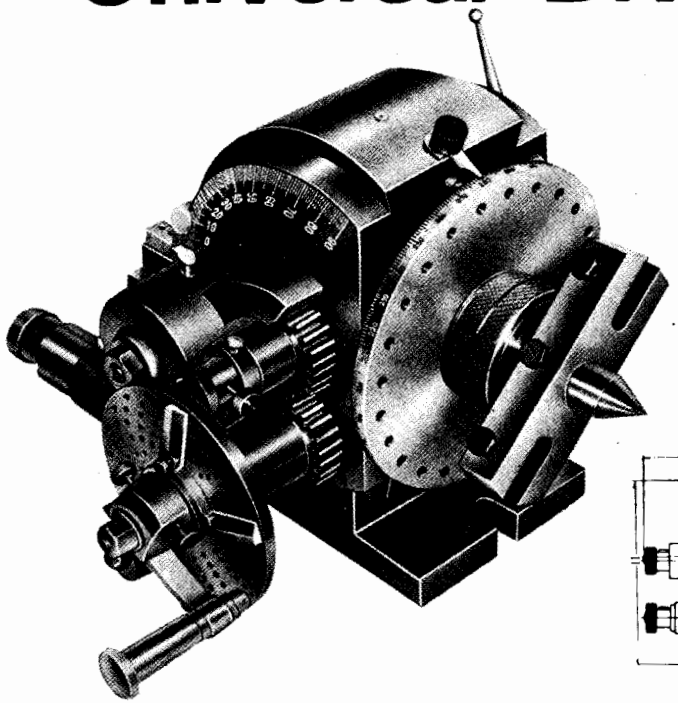
Semi-Universal Index B & S Type No. 0 No. 1 (Head-stock)

No. \ mm / in	A	B	H	h	a	b	g	Taper of center	Diameter of spindle hole
BS-0	189 7 7/16	140 5 23/64	173 6 13/16	100 3 15/16	160 6 19/64	91 3 37/64	13 33/64	B & S No.7	18
BS-1	293 11 17/32	156 6 9/64	220 8 21/32	128 5 3/64	207 8 5/32	114 4 31/64	16 5/8	B & S No.9	20

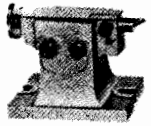
Semi-Universal Index B & S type No.0 No.1 (Tail-stock)

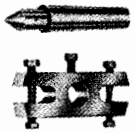
No. \ mm / in	A_1	B_1	H_1	h	a_1	b_1	g
BS-0	167 6 37/64	80 3 5/32	107.5 4 15/64	100 3 15/16	130 5 1/8	92 3 2/8	13 33/64
BS-1	191 7 33/64	88 3 15/32	137 5 25/64	128 5 3/64	150 5 29/32	108 4 1/4	16 5/8

Universal Dividing Head

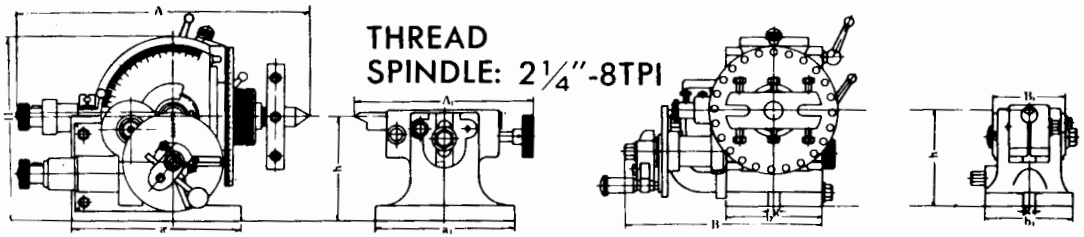


ACCESSORIES:





THREAD
SPINDLE: 2¼"-8TPI



Operation

The indexing attachment is a precision instrument and should, therefore, be handled with care. After unpacking, remove anti-rust compound.
Before setting up the head on the machine table, both the table surface and the base of the dividing head must be free of dirt and chips in order to obtain maximum accuracy.

Maintanance

A continuous maintanance i.e. lubrication is necessary. Special care should be taken in direct indexing operations, that the holes of the direct indexing plate and the direct dividing index are absolutely clean, as even a slight contamination of these parts results in indexing faults. Just two lubrication point has to be oiled.

Universal Index B & S type No.2 (Head-stock)

mm / in — No.	A	B	H	h	a	b	g	Taper of center	Diameter of Spindle hole
BS-2	365 14 13/32	272 10 45/64	236 9 19/64	132.7 5 15/64	213 8 25/64	134 5 9/32	16 5/8	B & S No.10	25.4 1

BS-2 (Tail-stock)

mm / in — No.	A_1	B_1	H_1	h	a_1	b_1	g_1
BS-2	205-255 8 5/64 ~ 10 3/64	88 3 15/32	139 5 15/32	132.7 5 15/64	175 6 57/64	124 4 7/8	16 5/8

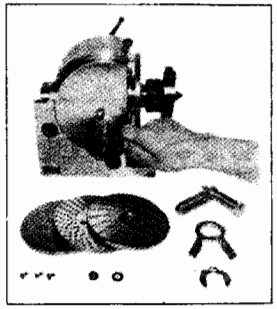
Adjustment of worm backlash

Any backlash between worm and worm wheel encountered after extensive operation is removed as follows:

1. Loosen locking bolt and turn the stop screw so far until worm backlash has been taken out. In this respect however, a free turning of the hand crank should still be possible.
2. Tighten locking bolt.

The worm backlash has been removed when no more play can be observed on the index head spindle.

BS-2



BS-0.1.

Direct indexing

Swivel out the worm. For further indexing, loosen the spindle locking and lift out the direct dividing index with the respective lever. The indexing spindle can then be turned by the desired number of noles, after which the direct dividing index is engaged again. In the case of relatively heavy work tighten the spindle locking as well. The standard equipment includes a holes plate with 24 holes.

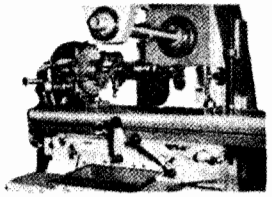
Rule: Divide 24 by the number of divisions required and the result equals the number of holes to move in the 24-hole rapid index plate. Thus, number of holes to move = $24/D$, where D is the number of divisions.

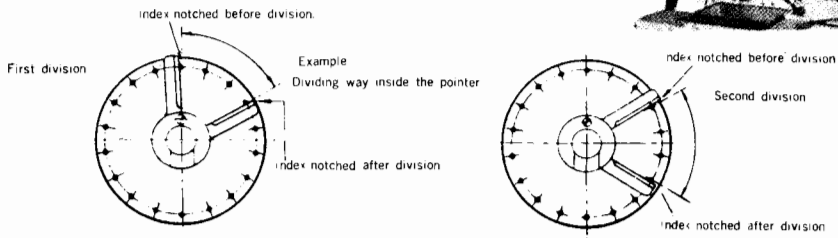
Indirect indexing

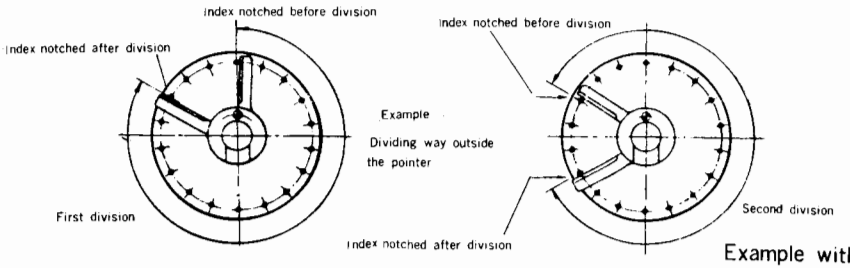
In this case swivel the worm carefully to the stop by means of the swivel lever, at the same time turning slightly the indexing spindle and then the hand crank. Disengage the direct dividing index. Operate clamping device for hole plate.

Then take the following steps:

1. Look up circle of holes in the indexing table. If the particular circle of holes is not visible on the index plate, remove hand crank and indicator bracket, remove index plate after-loosening of holding screws and screw it on again in reversed form. (The circles of holes stated are distributed over both sides of the index plate).
2. Adjust indicator bracket after loosening of locking screw in such a way that the number of holes which is also shown in the table remains uncovered between the legs.
3. Tighten locking screw
4. After loosening of central nut shift hand crank is such a way that the index pin can engage in a hole of the desired circle of holes. Do not disaligh hand crank! After tightening the central nut, it must be possible to engage the index of the hand crank in every desired hole of the circle.
5. Then engage the index of the hand crank in the starting position and turn the indicator bracket in indexing direction until the index lies flush to the inside of the second indicator leg. (Note: If a + is shown behind the number of holes in the table, move the indicator bracket in the direction opposite to indexing until it contacts the index).
6. For further division disengage the index, turn the hand crank until the index can engage in the last hole before the second indicator leg.
7. If, by accident, the index has passed over the intended hole, the handle has to be turned back for several holes in order to engage the index in the right hole by turning the handle again in clockwise direction.
8. Clamp the indexing spindle for heavy work.







Example with a + behind the number of holes

Example: Divisions D = 9. Then T = 40/9, or 4 turns plus 4/9 turn. Multiply the fraction by a suitable number, say 2. Then 4/9 becomes 8/18. Since you have an 18-hole circle, you will index 4 turns plus 8 spaces on the 18-hole circle.

Angular Indexing.

Because the dividing head is geared in a 40:1 ratio, one turn of the crate indexes the spindle 360/40 = 9°. If the angular distance is in degrees only = $\alpha'/9$, where α' is expressed in degrees.

Example: To be milled 43° 20' apart,

$$T = \frac{\alpha}{90} \rightarrow \frac{43° 20'}{90} = \frac{2600'}{540'} = 4\frac{22}{27}$$

We might index 4 turns plus 22 holes on the 27-hole plate.

Differential indexing

This process is employed for all index numbers which cannot be obtained by indirect indexing in this case clamp the differential bolt into the rear end of the indexing spindle and loosen the locking pin for the index plate. Then attach the change gears as per indexing table on the bracket or the differential bolt and engage them with a minimum of slack. Then carry out the indexing process in exactly the same manner as described for indirect indexing.

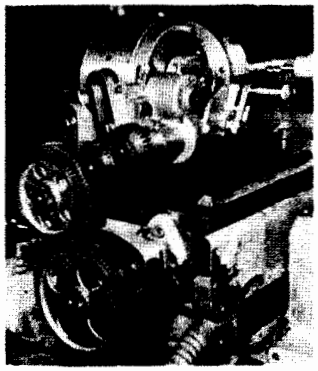
Milling spiral flutes

A twisted flute generally found on twist drills, reamers, screw taps, screw wheels, worms etc. may be always performed by an universal or special dividing attachment if the milling machine used for this purpose is provided with a swivelling table or a swivelling milling spindle head. The spiral is produced by two coincident movements: a straight-lined advancing movement by the milling table and a revolving movement of the workpiece caused by the table leadscrew through change gears gear spindle; worm spindle to the dividing head spindle. These motions are to bear a determinated constant and uniform mutual proportion.

The change gear ratio must be selected in such a manner that the course made by the rotation of the table leadscrew is ecual to the lead "S" required on the workpiece. Moreover, the milling table is to the swivelled from its zero position to the inclined position corresponding to the spiral lead. The result is a constant perpendicular position of the cutter axis to the lead of the spiral produced.

As long as the milling table still rests in the zero position the cutter should be dressed exactly over the longitudinal axis of the workpiece. Then, the milling table is to be swivelled until the longitudinal axis of the table and the cutter axis are forming the lead angle " " that will then agree with the spiral desired.

The direction of rotation of the desired spiral (lefthand or righthand spiral) determinates the swivelling direction of the milling table which is to be swivelled in such a way that the workpiece during its rotating and forward movement is always moving towards the cutter.



NOTICE :

Take worm in mesh; loose indirect dividing plate; engage indirect dividing index; disengage direct indexing pin.

Rule of division: The change gear ratio "i" required for the desired flute and the setting angle " " of the milling table are obtained as follows:

$$i = \frac{s \times k}{S} \quad \frac{\text{(driving wheels)}}{\text{(driving wheels)}} \qquad \tan\beta = \frac{d \times \pi}{S}$$

s = lead of spindle for table
k = transmission ratio in the indexing attachment, mostly 40:1
S = lead of the desired spiral
i = transmission ratio of change gears
d = diameter of workpiece
β = setting angle of milling table

Angle β is found in the Table of Tangens at the corresponding value of tang

Example: How to mill a twist flute

Given: k = 40:1
S = 12"
d = 4"
s = 1/4"

Wanted: a) Setting angle of milling table
b) Change gears required

Solution: a) $\tan\beta = \frac{d \times \pi}{S} = \frac{4 \times \pi}{12} = 1.048$

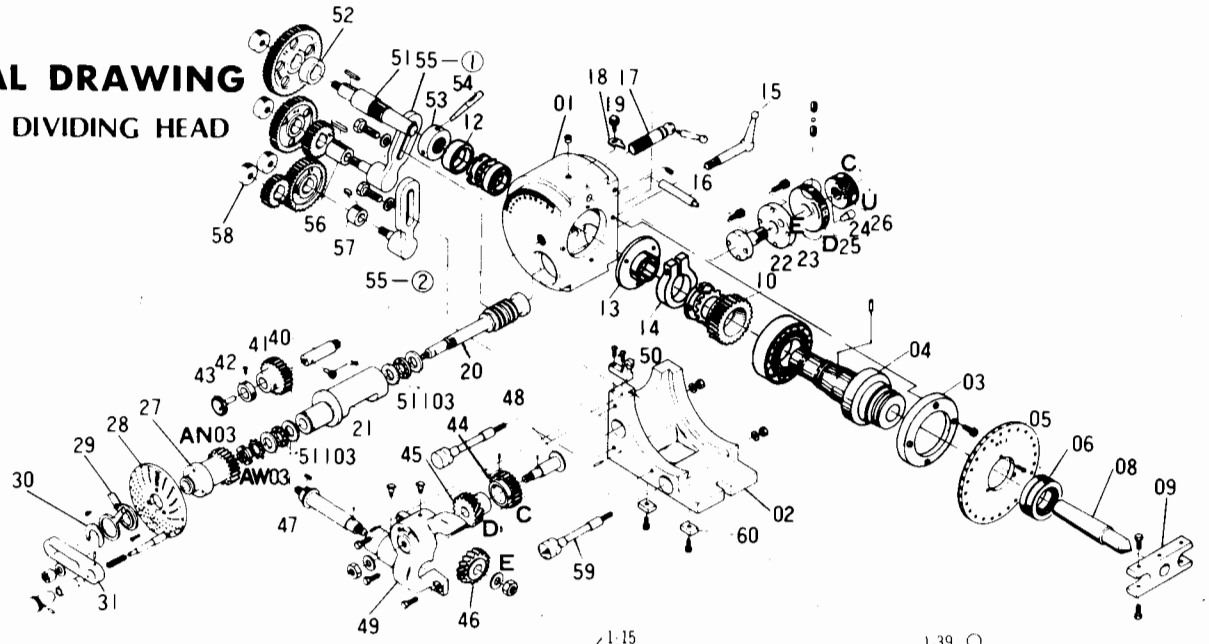
according to Table of Tangers: angle $\beta = 6^\circ$

b) $i = \frac{s \times k}{S} = \frac{1 \times 40}{4 \times 12} = \frac{40 \text{ (driven wheels)}}{48 \text{ (driving wheels)}}$

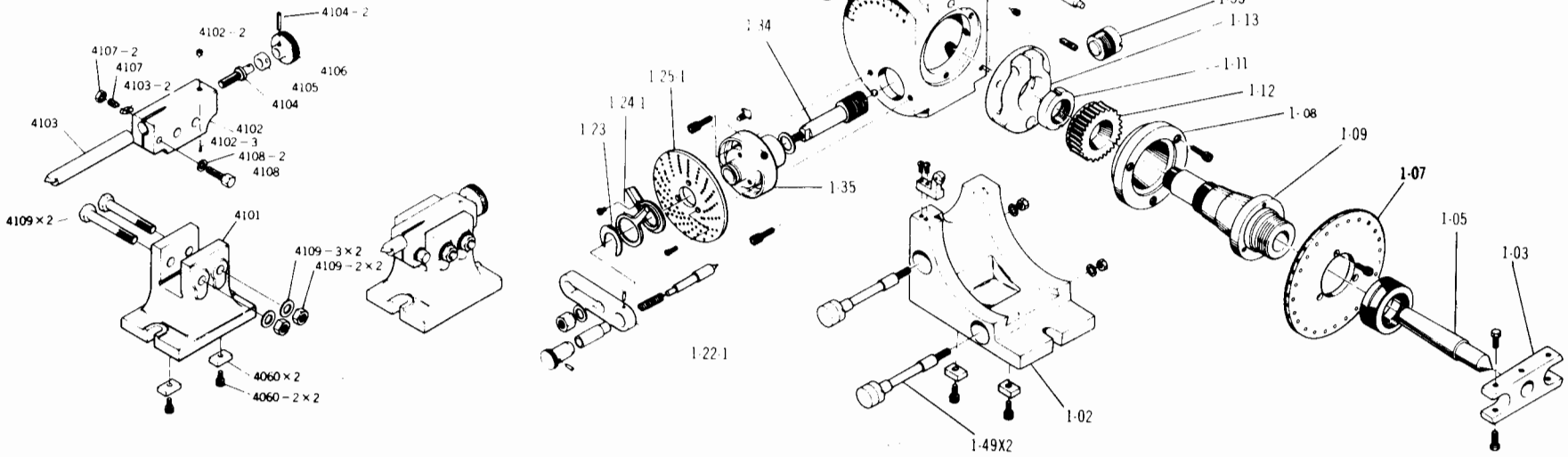
Spiral surfaces (Archimedean spirals) on principle are milled in the same way as spiral flutes, the spindle of dividing head being driven by table leadscrew by means of change-wheels and gearing spindle. Cutter spindle and dividing head spindle must be set perpendicularly to each other or in a suitable angle respectively.

CONSTRUCTIONAL DRAWING

BS-2 DIVIDING HEAD



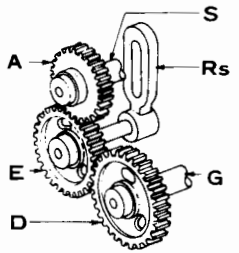
BS-0.1. DIVIDING HEAD



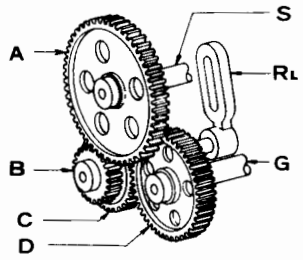
APPLICATION OF CHANGE GEARS

REMARKS:

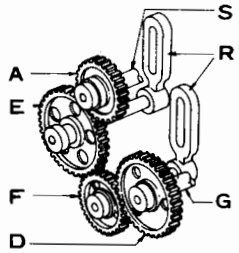
A: gear to be hanged on spindle arbor
B: moving wheel (I)
C: moving wheel(II)
D: gear rotation of gear case arbor
E : gear(I) to be hanged on bracket
F : gear(II) to be hanged on bracket
G: gear case arbor
H: holes of dividing plate
N: rotation of crank handle
R_L R_S: bracket
S : spindle arbor



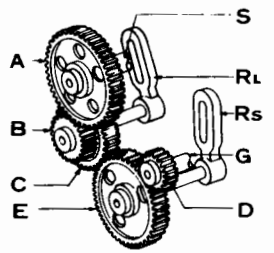
FIG(A)



FIG(C)



FIG(B)



FIG(D)

DIVIDING TABLE (WORM RATIO 1:40)

T	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
H		※	33	※	※	33	49	※	18	※	33	33	39	49	33	20	17	18	19	※	21	23	23	33	20
N		20	13 11/33	10	8	6 22/33	5 35/49	5	4 8/18	4	3 21/33	3 11/33	3 3/39	2 42/49	2 22/33	2 19/20	2 6/17	2 4/18	2 3/19	2	1 15/21	1 27/33	1 17/23	1 33/22	1 13/20

T	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
H	39	27	49	29	33	31	20	33	17	49	18	37	19	39	※	41	21	43	33	18	23	47	18	49	20
N	1 21/39	1 13/27	1 21/49	1 11/29	1 11/33	1 9/31	1 5/20	1 7/33	1 3/17	1 7/49	1 3/18	1 3/37	1 1/19	1 1/39	1	40/41	20/21	40/43	30/33	16/18	20/23	40/47	15/18	40/49	16/20

T	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
H	33	39	33	27	33	49	33	29	33	33	16	31	16	16	39	33	49	17	49	49	15	18	15	37	15	19	20	39	20	20	21	41	21	21	17	43	33	33	18	18
N	24/33	30/39	24/33	20/27	24/33	35/49	22/33	20/29	22/33	22/33	10/16	20/31	10/16	10/16	24/39	20/33	28/49	10/17	28/49	28/49	8/15	10/18	8/15	20/37	8/15	10/19	10/20	20/39	10/20	10/20	10/21	20/41	10/21	10/21	8/17	20/43	15/33	15/33	8/18	8/18
A	64		64			48		32			72		40			48		32			64		64				48		24		40		32				24		24	
B	44		44			24		48			48		32			28		56			24		40				32		48		28		48				44		72	
C	48										40		24								32		32										40				40		64	
D	24										32		48								40		48										56				48		48	
E			28				40		40								32		40								40		44		44									
F																																								

T	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130
H	20	23	20	47	19	20	20	49	20	20	33	33	33	39	21	33	33	27	33	33	33	33	33	33	23	29	33	33	33	33	33	16	33	31	33	16	16	16	33	39
N	8/20	10/23	8/20	20/47	8/19	8/20	8/20	20/49	8/20	8/20	12/33	12/33	12/33	15/39	8/21	12/33	12/33	10/27	12/33	12/33	11/33	11/33	11/33	11/33	8/23	10/29	11/33	11/33	11/33	11/33	10/33	5/16	10/33	10/31	10/33	5/16	5/16	5/16	10/33	12/39
A	72		56			64	48		24		72	64	56			64	48		24		72	64	56	48			24	32	28		48	72	72		40	40	24		40	
B	40		40			40	40		40		44	44	44			44	44		44		24	24	24	24			24	48	48		24	48	44		44	32	64		44	
C	48		48						32		48	48	48						32										32		40	40	40		56	24	40			
D	24		24						48		24	24	24						48										56		24	32	24		24	48	48			
E						28	32									28	32				28	32	32	40			48	44										32	
F																																								

DIVIDING TABLE (WORM RATIO 1:40)

T	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170
H	49	33	49	49	27	17	49	49	49	49	18	15	15	18	29	15	15	37	20	15	20	19	20	20	31	39	20	20	20	20	21	21	33	41	33	21	21	21	18	17
N	1/49	10/33	1/49	1/49	8/27	5/17	1/49	1/49	1/49	1/49	5/18	1/15	1/15	5/18	8/29	1/15	1/15	10/37	1/20	1/15	1/20	1/19	1/20	1/20	8/31	10/39	1/20	1/20	1/20	1/20	1/21	1/21	8/33	10/41	8/33	1/21	1/21	1/21	1/18	1/17
A	48		48	48			24	32	24		40	64	56			64	32		48		72		56	48			24	24	28		40	40	32			40	24		64	
B	56		24	28			28	56	48		48	24	24			40	40		32		32		32	32			32	48	64		24	28	72			56	72		48	
C	72								32			32	32			32			44										32				48			32	40		44	
D	24								56			40	40			48			24										56				44			48	56		24	
E			44	44			56	44			32						44				28		40	40			48	44			44	32							
F																																								

T	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
H	18	43	18	18	18	20	18	18	20	18	20	20	21	23	37	20	49	47	20	19	20	20	20	20	39	49	20	20	21	20	21	21	21	21	41	21	21	33	33	21
N	1/18	10/43	1/18	1/18	1/18	1/20	1/18	1/18	1/20	1/18	1/20	1/20	1/21	1/23	8/37	1/20	10/49	10/47	1/20	1/19	1/20	1/20	1/20	1/20	8/39	10/49	1/20	1/20	1/21	1/20	1/21	1/21	1/21	1/21	8/41	1/21	1/21	1/33	6/33	1/21
A	48		32	64	40	72	32	24	72		72	72	72			56	40		48		72	64	56	48			24	24	44		48	64	64	32		32	32	56	48	
B	24		48	48	24	40	48	72	40		24	40	28			40	56		40		40	40	40	40			40	40	28		28	28	48	28		56	56	44	24	
C			56		32	64		64	56		56	48	48			48	72		44									32	32			32				64		48		
D			24		48	24		48	24		32	24	24			24	28		24									48	24			48				48		28		
E	40			32			40				40										32	32	32	44			48				32		32	44			40		40	
F																																								

T	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
H	33	33	33	33	43	27	33	33	18	33	39	18	33	18	18	18	49	18	18	23	18	29	18	18	47	18	18	18	49	18	33	49	27	49	49	27	39	31	27	33
N	6/33	6/33	6/33	6/33	8/43	5/27	6/33	6/33	3/18	6/33	6/39	3/18	6/33	3/18	3/18	3/18	8/49	3/18	3/18	1/23	3/18	5/29	3/18	3/18	8/47	3/18	3/18	3/18	8/49	3/18	6/33	8/49	1/27	7/49	8/49	1/27	6/39	5/31	1/27	5/33
A	72	32	56	48			24	24	72		72	72	24	64	48	56	72	56	44		48		56	24		32	24	28	32		56	32	56	72		64	56		56	56
B	24	44	44	44			44	44	24		24	24	44	24	32	24	28	28	24		32		48	24		48	48	48	56		44	28	28	28		24	28		24	44
C	24	48						32	28		48				40		64											32	48		72	24	48	48		32			32	40
D	44	24						48	24		24				24		56											56	28		24	56	24	24		24			24	24
E			32	32			40					32	64	32		40		40	48		40		32	48		44	44				40						40			
F													32																											

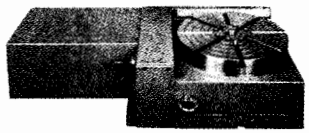
DIVIDING TABLE (WORM RATIO 1:40)

T	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290
H	18	33	33	18	27	49	33	33	49	39	27	49	27	33	49	49	27	49	49	27	49	49	49	49	49	49	49	49	15	49	27	15	49	15	15	15	16	15	15	29
N	3/18	5/33	5/33	3/18	5/27	7/49	5/33	5/33	7/49	5/39	5/27	7/49	5/27	5/33	7/49	7/49	5/27	7/49	7/49	5/27	7/49	7/49	7/49	7/49	7/49	7/49	7/49	7/49	3/15	7/49	5/27	3/15	7/49	3/15	3/16	3/15	3/16	3/15	3/15	5/29
A	44	48	40	56	40	64	56	40	72		64	72	56		40	64	32	48	44		72	64	24	48	40	32	24	32	56		44	56	32	64	56	56	72	64	44	
B	24	44	24	24	48	32	48	44	24		48	28	24		56	32	72	28	28		24	24	24	56	56	56	56	48	40		72	40	64	24	28	24	24	40	24	
C		40			64	48	40						32		72						24	24						24	48		64	48	48	32		32	44		32	
D		24			24	28	44						72		24						56	56						56	24		24	28	56	40		40	32		40	
E	48		44	28				32	32		32	32				40	44	44	40				56	40	44	44	44				40		40		40			44		
F	40			48																																				

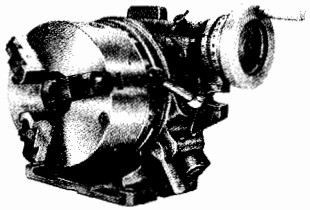
T	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
H	15	15	15	15	15	37	33	16	16	15	43	16	33	16	16	16	15	16	16	31	16	39	16	16	16	16	16	16	33	16	33	33	33	33	33	33	33	41	47	33
N	3/15	3/15	3/15	3/15	3/15	5/37	4/33	3/16	3/16	3/15	5/43	3/16	4/33	3/16	3/16	3/16	3/15	3/16	3/16	4/31	3/16	5/39	3/16	3/16	3/16	3/16	3/16	3/16	4/33	3/16	4/33	5/33	4/33	4/33	4/33	4/33	4/33	5/41	5/47	4/33
A	48	64	56	32	32		56	48	56		72	72	72	56	40	56	56	48	44		72		28	24	40	28	24	24	64		48	64	64	32	40	32	24		72	
B	40	40	40	40	48		28	32	64		24	32	44	28	64	32	40	32	32		24		32	32	32	56	32	48	48		44	44	44	44	44	72	44		24	
C		32	32				48	44	72		40		48		72		48				24				24		28	28				32	28		32	48	32		40	
D		48	48				24	24	24		24		24		24		72				64				48		56	56				48	48		48	44	48		24	
E	44			44	44							28		40		40	24	40	40				48	48		40			32		40			40						
F																																								

T	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370
H	16	18	18	16	33	18	43	18	18	17	33	18	49	43	18	18	49	18	18	18	18	18	18	18	18	18	18	20	43	18	19	43	33	49	20	21	20	20	41	37
N	3/16	3/18	3/18	3/16	4/33	3/18	5/43	3/18	3/18	3/17	4/33	3/18	5/49	5/43	3/18	3/18	5/49	3/18	3/18	3/18	3/18	3/18	3/18	3/18	3/18	3/18	3/18	3/20	5/43	3/18	3/19	5/43	3/33	5/49	3/20	3/21	3/20	3/20	4/41	4/37
A	44	56	72	56	48	64	56	64	56		32	56	72		40	32	72	64	32	40	24	64	32	32	40	24	28	72	48		56	72	72	48	56	72	72	64	56	
B	64	24	24	32	44	24	32	48	24		24	28	24		24	48	56	48	48	24	24	24	24	48	72	72	48	40	86		28	86	24	28	32	28	24	40	24	
C	48	32			40		40	44					40			56	100		44	32		24	28			64	32	56	100			100	56	40	48	48	44	56	48	
D	24	24			72		86	24					24			24	28		24	48		72	48			48	56	24	32			40	24	24	24	24	40	28	28	
E	40		32	48	24	40			40		56	32			44			32			48			44	28				28		40	28							
F				40							40																													

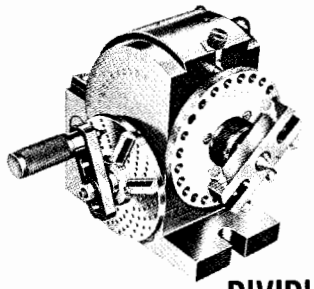
T	371	372	373	374	375	376	377	378	379	380
H	49	20	20	49	20	47	39	20	20	19
N	5/49	3/20	3/20	5/49	3/20	5/47	4/39	3/20	3/20	3/19
A	40	56	72	40	48		64	48	56	
B	56	40	40	56	32		48	40	40	
C	72	48	48	72	40			44	48	
D	24	24	32	28	24			24	32	
E							32			
F										



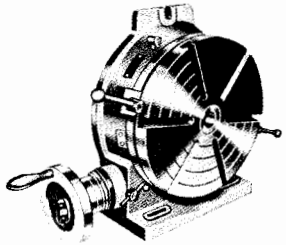
CNC-8 . 10 . 12 . NC ROTARY TABLE



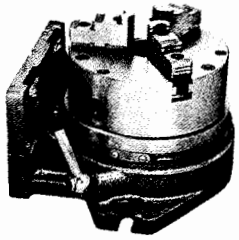
CS-6. 8. SUPER SPACER INDEX



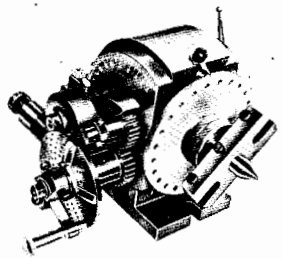
BS-0.1. DIVIDING HEAD



HV-6. 8. 10. 12. 14. ROTARY TABLE



CC-6. 8. SIMPLE INDEX



BS-2 UNIVERSAL DIVIDING HEAD

AGENTS: