

MODEL

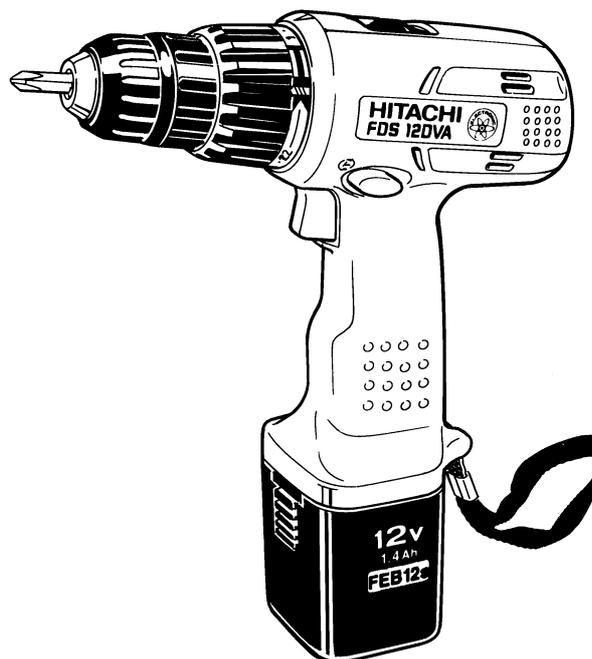
FDS 12DVA

HITACHI
POWER TOOLS

CORDLESS DRIVER DRILL
FDS 12DVA

TECHNICAL DATA
AND
SERVICE MANUAL

F



LIST No. F835

Nov. 1999

REMARK:

Throughout this TECHNICAL DATA AND SERVICE MANUAL, a symbol(s) is(are) used in the place of company name(s) and model name(s) of our competitor(s). The symbol(s) utilized here is(are) as follows:

Symbols Utilized	Competitors	
	Company Name	Model Name
B	BOSCH	PSR12VES-2
J	RYOBI	CTH1202K2

Notice for use

Specifications and parts are subject to change for improvement.
Refer to Hitachi Power Tool Technical News for further information.

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1. PRODUCT NAME

Hitachi 12 V Cordless Driver Drill, Model FDS 12DVA

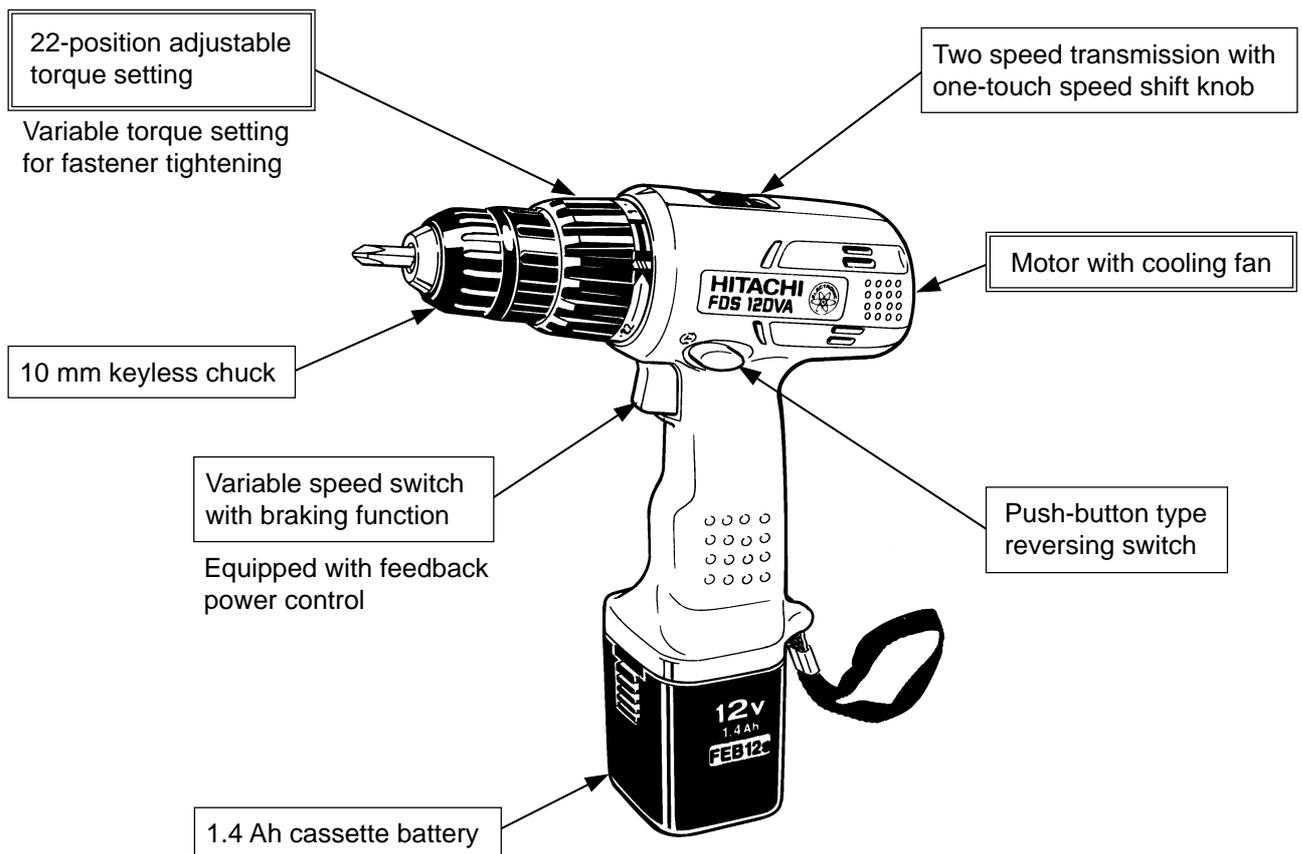
2. MARKETING OBJECTIVE

Since the sales initiation of economically priced cordless driver drills — FDS series, they have been well received over a period of 4 years in international markets. As a result of innovative technical research and development program for operability, overload durability and market price competitiveness, the Model FDS 12DVA has been developed to enhance the market share of Hitachi Cordless Power Tools. Vigorous sales promotion is anticipated with concurrent introduction of new Model FDS 9DVA.

3. APPLICATIONS

- Tightening and loosening wood screws, self-tapping screws and machine screws
- Drilling into wood materials, plastic, mild steel and aluminum

4. SELLING POINTS



4-1. Selling Point Descriptions

4-1-1. 22-Position Adjustable Torque Setting

The number of clutch positions has been increased from the previous five to twenty-two to ensure finer torque setting than that of previous model, and therefore, the operability has been significantly improved. (See Fig. 1.)

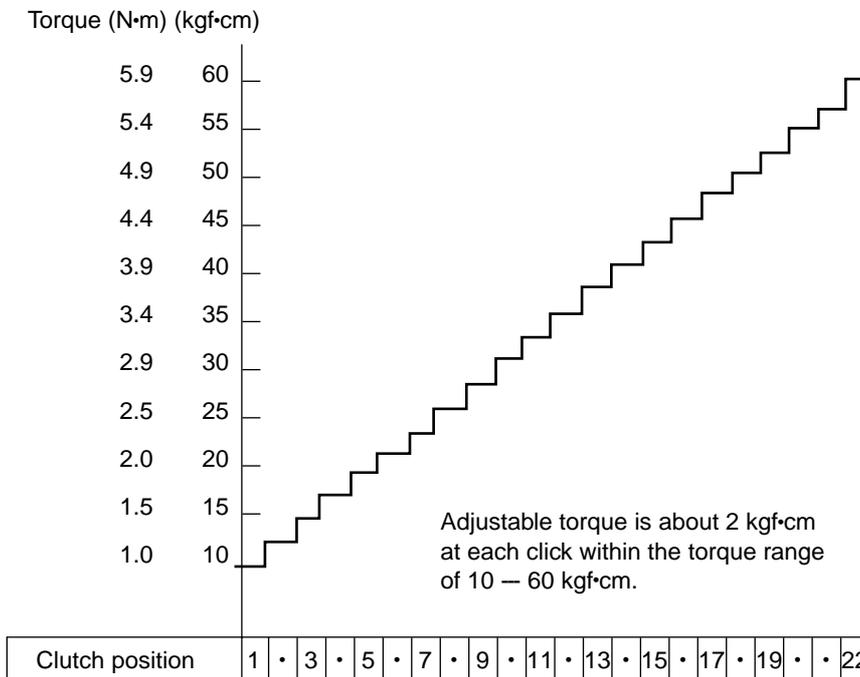


Fig. 1 Clutch torque

4-1-2. Motor with Cooling Fan

The cooling fan incorporated in the motor and the air vents provided in its outer frame greatly enhance the cooling effect, ensuring improved durability in continuous operation.

4-1-3. 10 mm Keyless Chuck

The keyless chuck facilitates fast and easy replacement of driver bits. Replacement can be carried out simply by holding the ring with one hand, while turning the sleeve with the other hand.

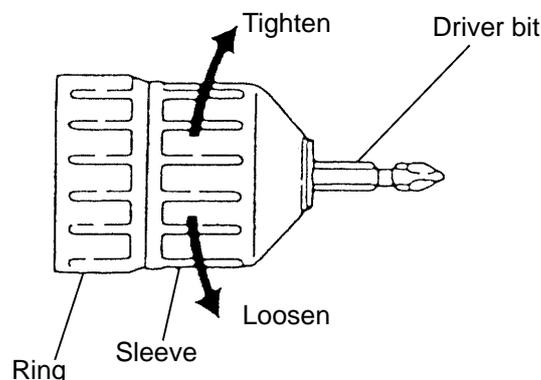


Fig. 2

4-1-4. Variable Speed Switch with Braking Function

The braking function allows the driver unit to stop rotation immediately when the trigger switch is released, which is a convenient feature during actual working. Also, the feedback system ensures a sufficiently large torque even in the variable speed range.

5. SPECIFICATIONS

Capacity	<p>Screwdriver Machine screw6 mm (1/4") Wood screw5.5 x 63 mm (#12 x 2-1/2")</p> <p>Drill MetalMild steel 12 mm (15/32") [thickness 1.6 mm (1/16")] Aluminum 15 mm (19/32") [thickness 1.6 mm (1/16")] Wood.....21 mm (13/16") [thickness 18 mm (11/16")]</p>
Keyless chuck (10TLRE-N)	<p>Mount type Screw-on (UNF 3/8" – 24")</p> <p>Diameter 0.8 – 10 mm (1/32" – 3/8")</p>
Rotation speed	0 – 350 /min, 0 – 1,050 /min
Type of motor	DC magnet motor
Torque	<p>Slip torque 1.0 – 5.9 N•m, 10 – 60 kgf•cm (9 – 52 in-lbs.) [22 stages]</p> <p>Max. torque Low 21.6 N•m, 220 kgf•cm (191 in-lbs.) High 6.9 N•m, 70 kgf•cm (61 in-lbs.)</p>
Type of switch	Trigger switch with push button for forward and reverse rotation changeover (w/o stopper)
Type of handle	T-type
Enclosure	<p>Body Glassfiber reinforced polycarbonate resin (moss green)</p> <p>Battery ABS resin (black)</p> <p>Charger ABS resin (black)</p>
Battery (Type FEB 12S)	<p>Sealed cylindrical nickel cadmium storage battery</p> <p>Nominal voltage DC 12 V</p> <p>Nominal life Charging/discharging: approximately 500 times</p> <p>Capacity 1.4 Ah</p> <p>Charging time 60 minutes (with standard accessory charger at ambient temperature of 20 °C)</p> <p>Charging temperature 10 °C – 40 °C (50 °F – 104 °F)</p>
Charger (Model UC 12SD)	<ul style="list-style-type: none"> • Overcharge prevention circuit: A thermostat monitors the surface temperature of the battery and, on detecting the temperature rise which occurs on completion of charging, automatically turns off the unit to prevent the battery from overcharge. • Input capacity: 51 W • Indication method: Pilot lamp indicator of battery charging • Function: On During charging Off Charging completed
Weight	<p>Main body unit1.6 kg (3.4 lbs.)</p> <p>Charger unit1.4 kg (3.1 lbs.)</p> <p>Gross with charger and case5.0 kg (11.0 lbs.)</p>
Standard accessories	<p>Charger (UC 12SD) 1</p> <p>Phillips (plus) driver bit (No.2) 1</p> <p>Case 1</p>

6. COMPARISONS WITH SIMILAR PRODUCTS

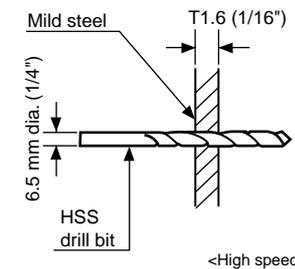
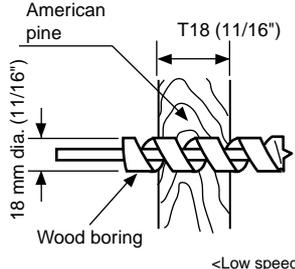
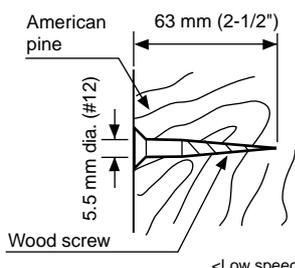
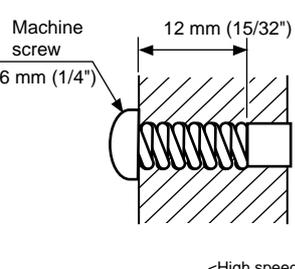
Catalog specifications

Maker		HITACHI	HITACHI	B	J	
Model		FDS 12DVA	FDS 12DV			
Max. capacity	Screw driving	Machine screw	6 mm (1/4")	6 mm (1/4")	8 mm (5/16")	Not indicated
		Wood screw	5.5 mm dia. x 63 mm length (#12 x 2-1/2)	5.5 mm dia. x 63 mm length (#12 x 2-1/2")	Not indicated	Not indicated
	Drilling	Mild steel	12 mm (15/32")	10 mm (3/8")	12 mm (15/32")	Not indicated
		Aluminum	15 mm (19/32")	10 mm (3/8")	15 mm (19/32")	Not indicated
		Wood	21 mm (13/16")	18 mm (23/32")	20 mm (25/32")	Not indicated
Rotation speed	Low	0 – 350 /min	0 – 290 /min	0 – 400 /min	0 – 300 /min	
	High	0 – 1,050 /min	0 – 900 /min	0 – 1,150 /min	0 – 1,000 /min	
Drill chuck	Type	Keyless	Keyless	Keyless	Keyless	
	Capacity	10 mm (3/8")	10 mm (3/8")	10 mm (3/8")	10 mm (3/8")	
Motor		DC magnet motor	DC magnet motor	DC magnet motor	DC magnet motor	
2-Speed transmission		Gear changeover type 2-speed transmission				
Electric brake		Equipped	Equipped	Equipped	Equipped	
Slip torque		1.0 – 5.9 N•m 10 – 60 kgf•cm (9 – 52 in-lbs.) [22 positions]	1.0 – 4.9 N•m 10 – 50 kgf•cm (9 – 43 in-lbs.) [5 positions]	1.0 – 8.0 N•m 10 – 82 kgf•cm (9 – 71 in-lbs.) [5 positions]	Not indicated [23 positions]	
Max. torque	Low	21.6 N•m 220 kgf•cm (191 in-lbs.)	17.6 N•m 180 kgf•cm (156 in-lbs.)	16.0 N•m 163 kgf•cm (142 in-lbs.)	Not indicated	
	High	6.9 N•m 70 kgf•cm (61 in-lbs.)	5.9 N•m 60 kgf•cm (52 in-lbs.)	Not indicated	Not indicated	
Battery	Nominal capacity	1.4 Ah	1.3 Ah	1.4 Ah	1.3 Ah	
	Nominal voltage	12 V	12 V	12 V	12 V	
	Charging time*	60 minutes	60 minutes	60 minutes	60 minutes	
Battery mount		Cassette type	Cassette type	Cassette type	Cassette type	
Overall length		220 mm (8-21/32")	223 mm (8-25/32")	219 mm (8-5/8")	250 mm (9-27/32")	
Weight		1.6 kg (3.4 lbs.)	1.6 kg (3.5 lbs.)	1.6 kg (3.5 lbs.)	1.6 kg (3.5 lbs.)	

Remarks* Charging time varies depending on the type of charger to be used.

7. WORKING PERFORMANCE PER SINGLE CHARGE

Drilling and fastening performance comparison per charge

Type of work	Maker	Model name	Working capacity (*1)					Drilling speed (sec./pc.)
			*0	*250	*500	*750	*1000	
 <p>Mild steel T1.6 (1/16") 6.5 mm dia. (1/4") HSS drill bit <High speed></p>	HITACHI	FDS 12DVA	55					9.3
		FDS 12DV	60					10.3
	B	—	40					6.9
	J	—	55					8.5
 <p>American pine T18 (1 1/16") 18 mm dia. (1 1/16") Wood boring <Low speed></p>	HITACHI	FDS 12DVA	205					3.5
		FDS 12DV	215					4.4
	B	—	140					3.1
	J	—	195					4.3
 <p>American pine 63 mm (2-1/2") 5.5 mm dia. (#12) Wood screw <Low speed></p>	HITACHI	FDS 12DVA	85					4.7
		FDS 12DV	85					5.9
	B	—	45					4.6
	J	—	70					6.0
 <p>Machine screw 12 mm (15/32") 6 mm (1/4") <High speed></p>	HITACHI	FDS 12DVA	*850					0.9
		FDS 12DV	*895					1.0
	B	—	*650					0.8
	J	—	*745					0.9

Remarks* Number of machine screws fastened per charge

Remarks*1 Number of holes or fasteners per charge

The above table shows an example of test data obtained using the battery which is standard for this tool.

As actually measured values listed in the above table may vary depending on the sharpness of the drill bit, workpiece hardness (particularly in wood materials), moisture content of wood, charging condition, operator skill, etc. This data should be used as a comparative guide only.

8. PRECAUTIONS IN SALES PROMOTION

8-1. Safety Instructions

In the interest of promoting the safest and most efficient use of the Model FDS 12DVA Cordless Driver Drill by all of our customers, it is very important that at the time of sale, the salesperson carefully ensures that the buyer seriously recognizes the importance of the contents of the Handling Instructions, and fully understands the meaning of the precautions listed on the Caution Plate and Name Plate attached to each tool.

A. Handling Instructions

Salespersons must be thoroughly familiar with the contents of the Handling Instructions in order to give pertinent advice to the customer. In particular, they must have a thorough understanding of the precautions for use of the cordless tools which are different from those of ordinary electric power tools.

(1) Before use, ensure that the unit is fully charged.

New units are not fully charged. Even if the units were fully charged at the factory, long periods of inactivity, such as during shipping, cause the storage battery to lose its charge. Customers must be instructed to fully charge the unit prior to use.

(2) When charging storage batteries, use only the exclusive Model UC 12SD Charger provided with the tool.

Because of the designed rapid-charging feature (about one hour), use of other battery chargers is hazardous.

(3) Connect the Charger to an AC power outlet only.

Use of any other power source (DC outlet, fuel powered generator, etc.) will cause the Charger to overheat and burn out.

(4) Do not use any voltage increasing equipment (transformer, etc.) between the power source and the Charger.

If the Charger is used with voltage higher than that indicated on the unit, it will not function properly.

(5) Conduct battery charging at an ambient temperature range of 10 °C – 40 °C (50 °F – 104 °F).

Special temperature sensitive devices are employed in the Charger to permit rapid charging. Ensure that customers are instructed to use the Charger at the indicated ambient temperature range. At temperature under 10 °C (50 °F) the thermostat will not function properly, and the storage battery may be overcharged. At temperature over 40 °C (104 °F), the storage battery cannot be sufficiently charged. The optimum temperature range is 20 °C – 25 °C (68 °F – 77 °F).

(6) The battery charger should not be used continuously.

At high ambient temperature, if over three storage batteries are charged in succession, the temperature of the coils on the transformer will rise and there is a chance that the temperature fuse inserted in the interior of the transformer will inadvertently melt. After charging one battery, please wait about 15 minutes before charging the next battery.

(7) Do not insert foreign objects into the air vents on the Charger

The Charger case is equipped with air vents to protect the internal electronic components from overheating. Caution the customer not to allow foreign materials, such as metallic or flammable objects, to be dropped or inserted into the air vents. This could cause electrical shock, fire, or other serious hazards.

(8) Do not attempt to disassemble the Storage Battery or the Charger.

Special devices, such as a thermostat, are built into the storage battery and charger to permit rapid charging. Incorrect parts replacement and/or wiring will cause malfunctions which could result in fire or other hazards. Instruct the customer to bring these units to an authorized service center in the event repair or replacement is necessary.

(9) Disposal of the Type FEB 12S Storage Battery

Ensure that all customers understand that Type FEB 12S Storage Batteries should be turned in to any Hitachi Power Tools sales outlet or authorized service center when they are no longer capable of being recharged or repaired. If thrown into a fire, the batteries may explode, or, if discharged indiscriminately, leakage of the cadmium compound contained in the battery may cause environmental pollution.

B. Caution Plates

(1) The following cautions are listed on the Name Plate attached to the main body of each tool. Be particularly careful to ensure that the customer understands the necessity of removing the storage batteries prior to bit replacement, cleaning, inspection or carrying of the tool when not in use.

For Europe

CAUTION

- Read thoroughly **HANDLING INSTRUCTIONS** before use.

For Germany, Switzerland, Austria, and Belgium

ACHTUNG

- Lesen Sie die Bedienungsanleitung sorgfältig.

For France

CAUTION

- **TRES IMPORTANT** : Lire avec attention la notice d'utilisation.

For Italy

ATTENZIONE

- Leggere attentamente le istruzioni prima dell' uso.

(2) The following cautions are listed on the Name Plate attached to each Type FEB 12S Storage Battery.

CAUTION • Read thoroughly **HANDLING INSTRUCTIONS** before use.

- Do not disassemble nor throw into fire.

8-2. Inherent Drawbacks of Cordless Driver Drills Requiring Particular Attention During Sales Promotion

The cordless driver drill offers many advantages; it can be used in places where no power source is available, the absence of a cord allows easy use, etc. However, any cordless tool has certain inherent drawbacks.

Salespersons must be thoroughly familiar with these drawbacks in order to properly advise the customer in the most efficient use of the tool.

A. Suggestions and precautions for the efficient use of the tool

(1) Use the Cordless Driver Drill for comparatively light work.

Because they are battery driven, the output of the motor in cordless driver drills is rather low in comparison with conventional electric power tools. Accordingly, they are not suitable for continuous drilling of many holes in succession, or for drilling into particularly hard materials which creates a heavy load. Salespersons should recommend conventional electric power tools for such heavy work.

(2) Drilling of large diameter holes should be conducted at low speed.

Instruct the customer that drilling of large diameter holes or other work which requires particularly strong torque should be done at low speed. Because there is less torque at high speed, attempting such work at high speed will not improve working efficiency.

(3) Do not insert a foreign object into body vent holes.

The body of this tool has vent holes for improving the cooling efficiency. As a fan is built into the motor, a foreign object inserted through a vent hole may cause a failure. Please instruct customers to never insert a foreign object into the vent hole.

(4) Avoid "Locking" of the motor.

Locking of the motor will cause an overload current that could result in burning of the motor and/or rapid deterioration of the battery. Salespersons should advise the customer to immediately release the switch and stop operation if the motor becomes locked. (A jammed drill bit can be disengaged from the workpiece material by setting the switch to reverse rotation, or by manually turning the main body of the tool.)

(5) Variation in amount of work possible per charge

Although the nominal chargeable capacity of the storage batteries used with the Model FDS 12DVA is 1.4 Ah, the actual capacity may vary within 10% of that value depending on the ambient temperature during use and charging, and the number of times the batteries have been recharged. It should be noted that other factors which may have a bearing on the amount of work possible per charge are the working conditions (ambient temperature, type and moisture content of the workpiece, sharpness of the drill bit, etc.) and the operational skill of the user.

(6) Precautions in the use of HSS Drill Bits

Although the Model FDS 12DVA is designed for drilling capacities of 21 mm (13/16") in wood, and 15 mm (19/32") in aluminum, and 12 mm (15/32") in mild steel, this capability is not as efficient as conventional electric power tools. In particular, when drilling through aluminum material with a 15 mm (19/32") drill bit, the drill tends to become locked when the drill bit penetrates through the material. For this reason, the customer should be cautioned to reduce the thrust on the main body of the drill when drilling completely through the material to avoid locking the tool. Repeated locking of the drill causes excessive current flow from the batteries which not only decreases the amount of work possible per charge, but could also result in burning of the motor.

B. Suggestions and precautions for the efficient use of the charger and storage batteries

If the Type FEB 12S Storage Batteries are exposed to direct sunlight for an extended period or if the tool has just been operated for a long time, charging may not be possible if the temperature of a battery (type FEB 12S) is above 40 °C (104 °F). In such a case, the customer should be advised to place the battery in a shaded area with a good airflow, and allows sufficient cooling before recharging. This phenomenon is common to all existing batteries and chargers which employ temperature sensitive overcharge protection devices. The cooling time required before recharging can be accomplished varies from a few minutes to about 30 minutes, depending on the load, duration of use, and ambient temperature.

9. REFERENCE MATERIALS

9-1. Speed Control Mechanism

Spindle rotation speed of the Model FDS 12DVA can be controlled by simply varying the amount by which the trigger switch is depressed. The relationship between the amount the trigger switch is depressed (in millimeters) and the rotation speed is illustrated in Fig. 3.

Note: The gradient and values illustrated in Fig. 3 are intended for reference only, and will vary slightly due to differences in the discharge condition of the battery, the ambient temperature, and individual speed-control element accuracy.

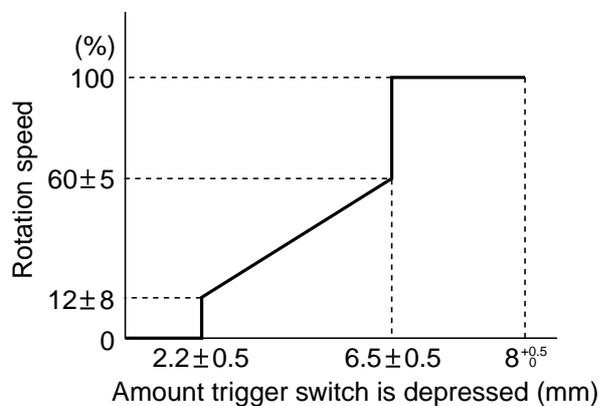


Fig. 3

10. REPAIR GUIDE

Be sure to remove the storage batteries from the main body before servicing. Inadvertent triggering of the switch with the storage battery connected will result in the danger of accidental turning of the motor.

10-1. Precautions in Disassembly and Reassembly

The **[Bold]** numbers in the description below correspond to the item numbers in the Parts List and exploded assembly diagram for the Model FDS 12DVA.

10-1-1. Disassembly

(1) Removal of Housing (B) **[31]**

Remove the seven Tapping Screws (W/Washers) D3 x 16 **[26]** secured to the main body. Gently open Housing (A) **[31]** and Housing (B) **[31]** while holding their battery loading sections.

(2) After Housing (B) **[31]** has been removed, all the internal parts, assembled or separate, can be taken out as they are. Lift the entire contents from Housing (A) **[31]** while holding the Motor **[25]** and Cap **[4]**.

(3) Removal of the Drill Chuck **[2]** (See Fig. 4.)

(a) Turn the Motor **[25]** counterclockwise (when viewed from the rear) and remove it from the Rear Case **[14]**. Remove the Shift Knob **[37]** from the Shift Arm **[16]**. Take care not to remove the Shift Arm **[16]** from the Rear Case **[14]** in this operation.

(b) Attach the motor spacer (an accessory of the special repair tool J-292, Code No. 316379) to the assembly of the Drill Chuck **[2]**, Cap **[4]**, Front Case **[9]** and Rear Case **[14]** and then mount it in special repair tool J-292 clamped in the vise as illustrated in Fig. 4. In this operation, check that the pinion press-fitted in the special repair tool J-292 and Planet Gear (A) **[21]** are engaged properly.

(c) Turn the Cap **[4]** clockwise (when viewed from the front) until it can turn no further. In this position, the drill mark " " on the Cap **[4]** is positioned on the Shift Arm **[16]** side. Secure the Slide Ring Gear **[17]** to the Front Case **[9]** side with the Shift Arm **[16]**.

(d) Turn the sleeve of the Drill Chuck **[2]** counterclockwise (when viewed from the front) to fully open the jaws of the Drill Chuck **[2]**. Turn the Special Screw (Left Hand) M5 x 35 **[1]** clockwise and remove it. (Note that the Special Screw is left-hand threaded.)

(e) Fit the hexagonal bar wrench M10 into the Drill Chuck **[2]** as illustrated in Fig. 4 and remove the Drill Chuck **[2]** by turning the hexagonal bar wrench counterclockwise.

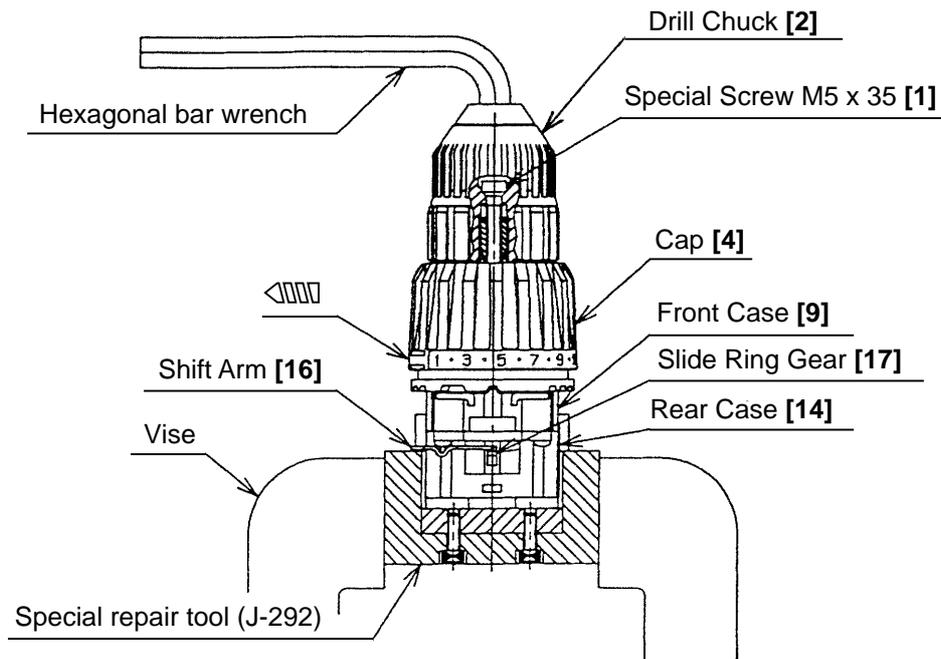


Fig. 4

(4) Disassembly of the gear unit

Remove the Shift Arm [16] from the Rear Case [14], then remove the four Screws Set D3 x 12 [15] connecting the Front Case [9] and the Rear Case [14]. Remove Washer (A) [13], Planet Gears (C) Set [12], Ring Gear [11] and the twelve Steel Balls D5 [10] from the Front Case [9] in order. Take care not to lose the twelve Steel Balls D5 [10] in this operation.

(5) Removal of the Spring [6] and Washer (D) [7]

Turn the Nut [5] counterclockwise and remove it from the Front Case [9], then remove the Spring [6] and Washer (D) [7] from the Front Case [9].

(Note) Do not remove the Front Case [9].

(6) Disassembly of the power supply unit

(Note) Do not remove the fin secured to the DC-Speed Control Switch [34] with a screw.

Remove the two Machine Screws M3 x 8 [29], and take the Motor [25] and the Motor Spacer [24] apart.

Disconnect the Internal Wires (B) [32] [33] from the Motor [25] with a soldering iron, then disconnect them from the DC-Speed Control Switch [34] with a soldering iron in the same manner.

10-1-2. Reassembly

Reassembly can generally be carried out as the reverse of the disassembly procedure, with some items to be noted as follows.

(2) Reassembly of the power supply unit

(a) Be sure to perform wiring connections as indicated in the wiring diagram. (See Fig. 5.)

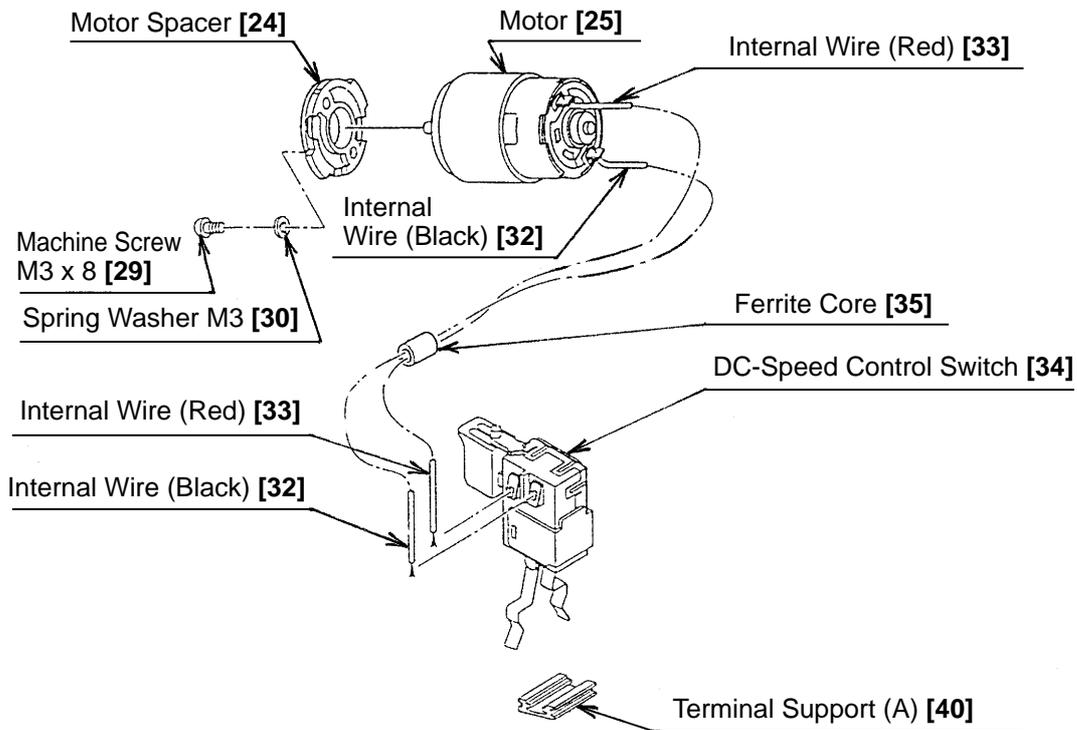


Fig. 5

- (b) Pay attention to the polarity of the Motor [25] when soldering Internal Wires (B) [32] and [33] to the Motor [25]. The red-marked side of the Motor [25] is positive. (See Fig. 6.)
- (c) Apply grease (Hitachi Motor Grease No. 29, Code No. 930035 is recommended) to the pinion press-fitted on the Motor [25] shaft.

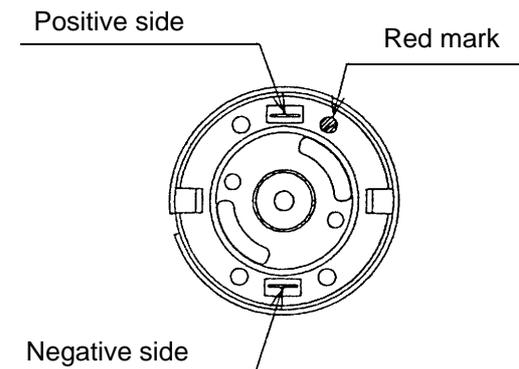


Fig. 6

(2) Reassembly of the clutch unit

- (a) Mount Washer (D) [7] and the Spring [6] to the Front Case [9]. (See Fig. 7.)

When mounting Washer (D) [7] into the Front Case [9], align the projection on the Front Case [9] with the notch of Washer (D) [7].

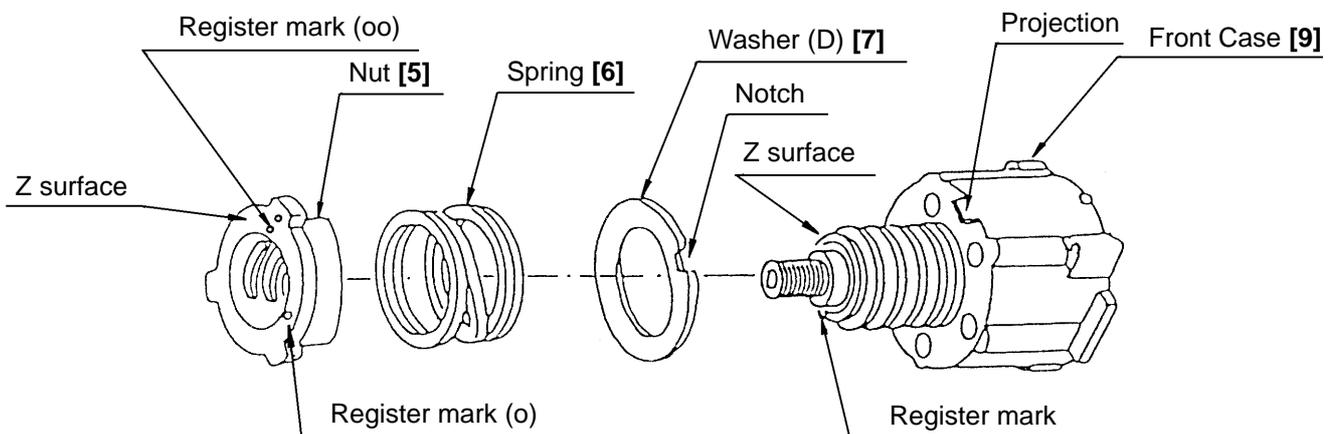


Fig. 7

(b) Mount the Nut [5] to the Front Case [9]. (See Fig. 8.)

Align the register mark (o) on the Nut [5] with the register mark on the Front Case [9]. Turn the Nut [5] about 1 – 1/4 turns clockwise so that the register mark (oo) on the Nut [5] is aligned with the register mark on the Front Case [9]. Check that the Z surface of the Nut [5] is aligned with the Z surface of the Front Case [9].

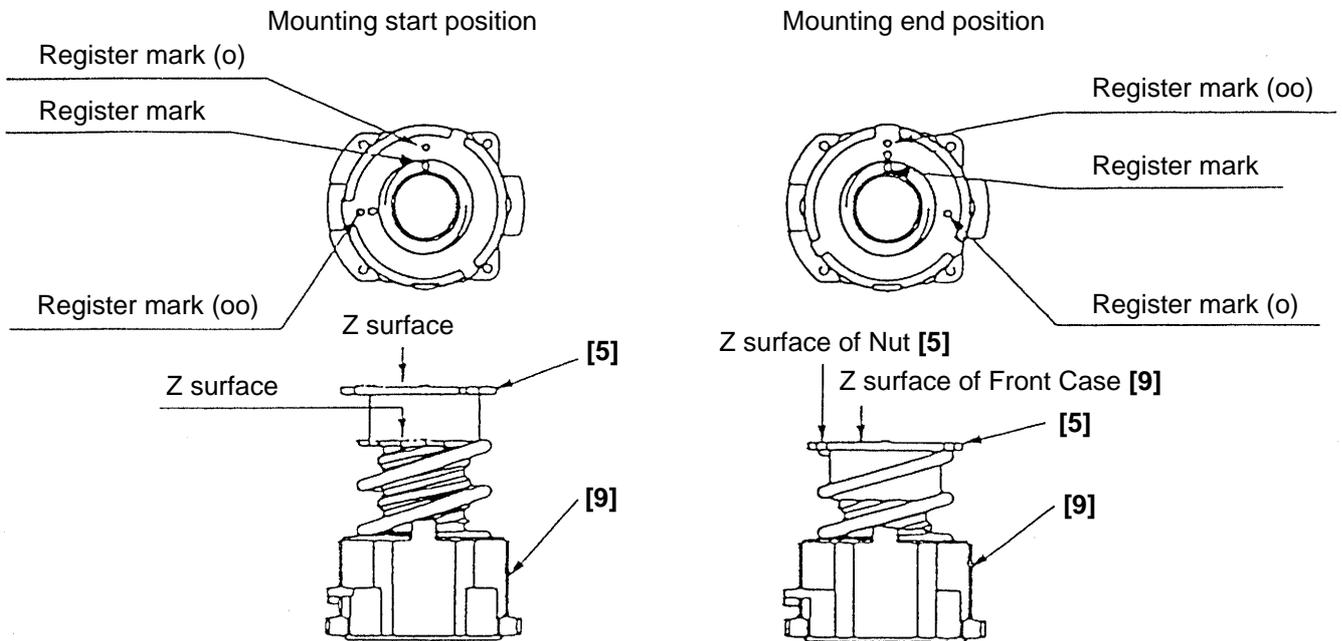


Fig. 8

(3) Reassembly of the gear unit

(a) Apply grease (Hitachi Motor Grease No. 29, Code No. 930035) to the meshing parts of the gear.

(b) Install the parts series from the twelve Steel Balls D5 [10] to Washer (B) [23] into the assembly reassembled in step (2). (See Fig. 9.)

(i) Note the direction of the groove when installing the Slide Ring Gear [17] so that the groove faces toward the Motor [25].

(ii) Install the Front Case [9] and the Rear Case [14] together with the mark on the Front Case [9] aligned with the mark on the Rear Case [14]. (See Fig. 12.)

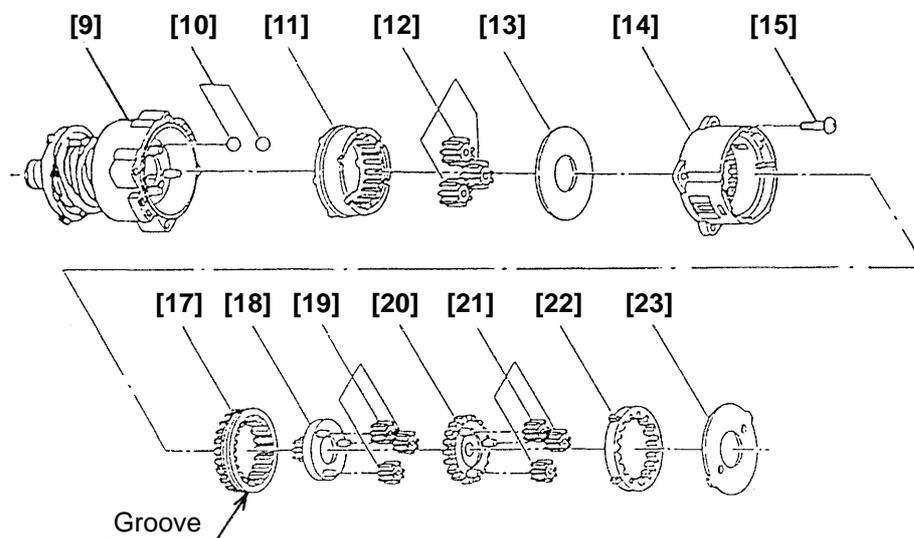


Fig. 9

- (iii) Install Washer (B) [23] in the Rear Case [14] with the projections of Washer (B) [23] engaged with the recesses in the Rear Case [14], and turn Washer (B) [23] clockwise until it can turn no further. (See Fig. 10.)

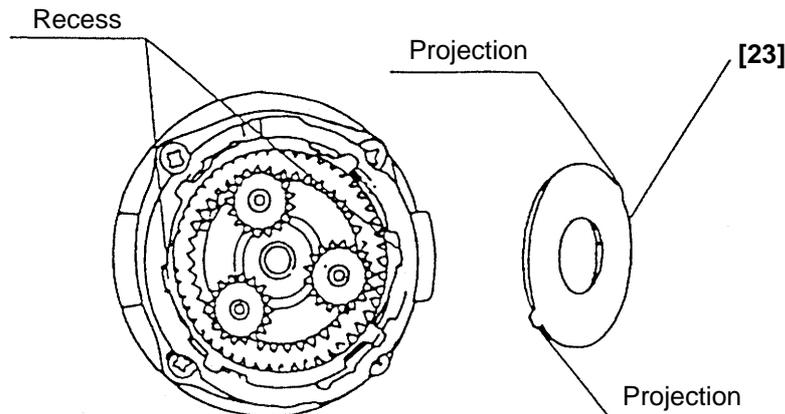


Fig. 10

- (c) Install the Click Spring [8] and the Cap [4] on the assembly reassembled in step (b). (See Fig. 11.)

- (i) Insert the projection of the Click Spring [8] into the hole of the Front Case [9].
(ii) Mount the Cap [4].

Mount the Nut [5] into the Cap [4] engaging the wider projection of the Nut [5] with the wider recess of the Cap [4]. (The wider recess of the Cap [4] is positioned at "1" when viewed from the outside.)

- (iii) Apply grease (Hitachi Motor Grease No. 29, Code No. 930035) to the sliding surfaces of the Cap [4] and the Click Spring [8].

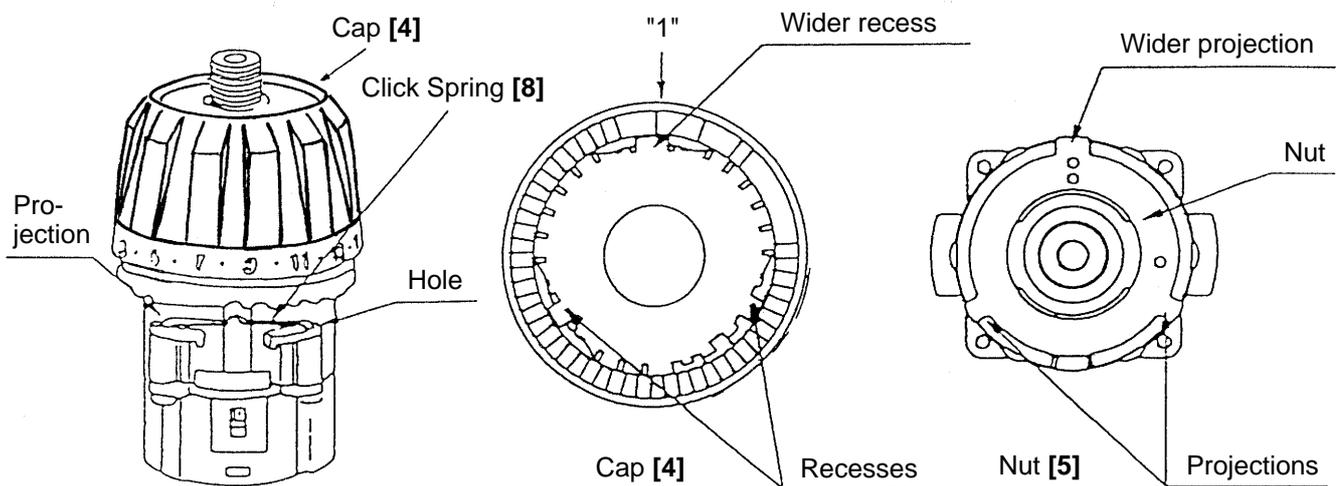


Fig. 11

- (d) Install the Shift Arm [16] into the assembly reassembled in step (c).

With the ridge at the Shift Arm [16] facing the Motor [25] side, first install them on the unmarked side of the assembly reassembled in step (c). Then insert the projections on the Shift Arm [16] into the holes in the Rear Case [14] and make sure that the projections are fitted into the grooves in the Slide Ring Gear [17] mounted within the Rear Case [14]. (See Fig. 12.)

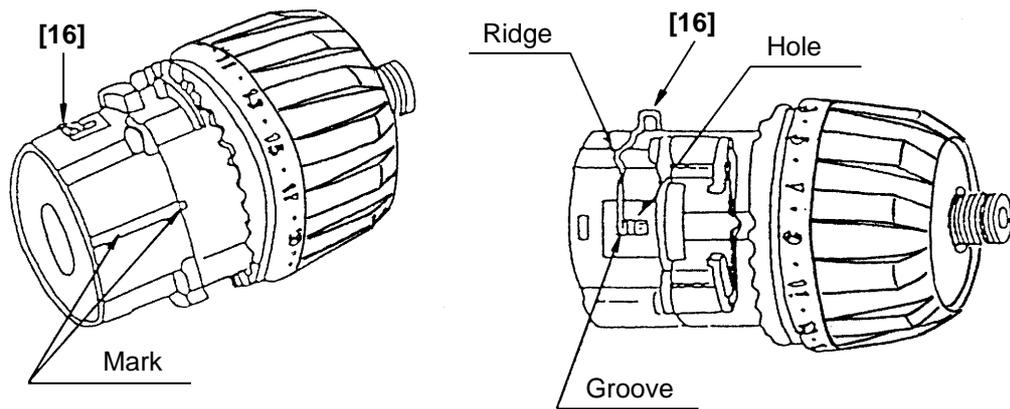


Fig. 12

(e) Install the Drill Chuck [2].

Install the Drill Chuck [2] using the special repair tool (J-292, Code No. 316379) and secure it with the Special Screw (Left Hand) M5 x 35 [1].

(f) Install the Shift Knob [37] into the assembly reassembled in step (e).

When installing the Shift Knob [37] into the Shift Arm [16], note that the "LOW" mark on the Shift Knob [37] faces the Motor [25] with the Shift Arm [16] engaged with the recess in the Shift Knob [37].

(g) Install the assembly reassembled in step (1) and the assembly reassembled in step (f) together. (See Fig. 13.)

Fit the projection on the Motor Spacer [24] into the recess in the Rear Case [14] while ensuring that the Shift Knob [37] is aligned with the positive side of the Motor [25] and turn the Motor Spacer [24] clockwise when viewed from the rear of the Motor [25] until it can turn no further. During installation, make sure that the pinion press-fitted onto the shaft of the Motor [25] and Planet Gear (A) [21] mesh properly.

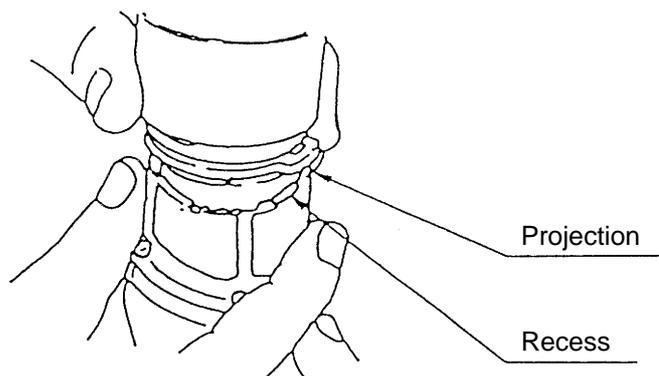


Fig. 13

(4) Installation of the Bit Holder [28] into Housing (B) [31]

Fit the upper and lower projections of the Bit Holder [28] in the grooves in Housing (B) [31].

(5) Installation of the assembly reassembled in step (3) into Housings (A) and (B) [31]

(a) Install the Pushing Button [36] into Housing (B) [31]. (See Fig. 14.)

(b) Install the assembly reassembled in step (3) into Housing (A) [31]. Note that the projections on the Front Case [9] and the Motor Spacer [24] are engaged in the recesses in Housing (A) [31], and the projection on Housing (A) [31] is engaged in the groove of the Cap [4]. (See Fig. 15.)

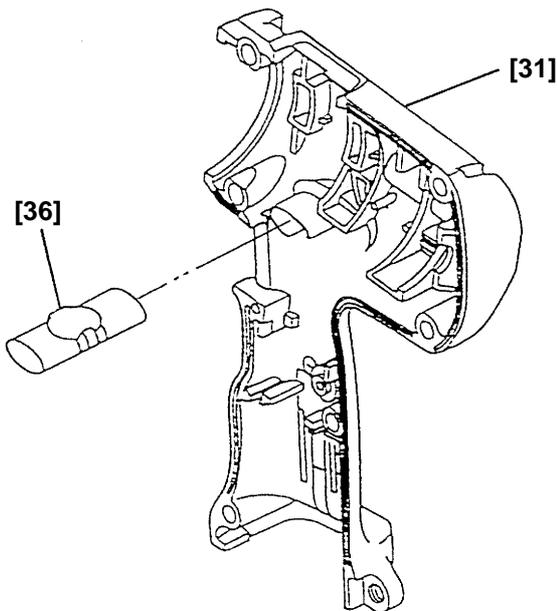


Fig. 14

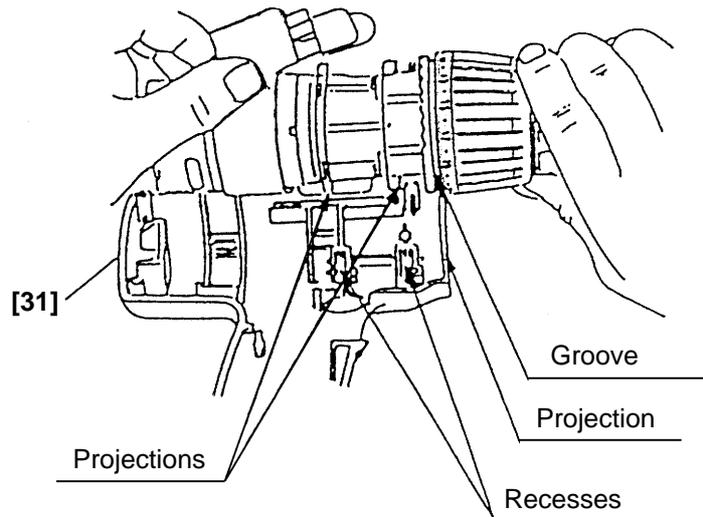


Fig. 15

(c) Set the assembly reassembled in step (b) to Housing (B) [31] and secure it with the seven Tapping Screws (W/Washers) D3 x 16 [26].

(d) Verify proper operation of the Cap [4].

When the assembly procedure up to step (c) is completed, ensure that the number "1" on the Cap [4] and the drill mark "◁▽▽▽" are in alignment with the triangle mark on Housings (A) and (B) [31]. If the Cap [4] turns loosely, correctly re-install the Click Spring [8] as it is improperly installed. If the number "1" on the Cap [4] or the drill mark "◁▽▽▽" cannot reach the triangle mark on Housings (A) and (B) [31], correctly re-install the Cap [4] referring to step (3) (c), as it is improperly installed.

(6) Other precautions in reassembly

(a) When the assembly procedure is completed, make sure that the turning direction of the Drill Chuck [2] corresponds to the position of the Pushing Button [36]. When the Pushing Button [36] is pressed from the (R)-marked side, the Drill Chuck [2] should turn clockwise when viewed from the rear (opposite side of the Drill Chuck [2]). Also make sure that the turning speed of the Drill Chuck [2] switches between "HIGH" and "LOW" by switching over the Shift Knob [37]. Make sure that the run-out of the Drill Chuck [2] holding a 9 mm dia. test bar is below 0.8 mm at a distance of 85 mm from the chuck end.

(b) The tightening torque of each screw is given below.

Special Screw (Left Hand)	M5 x 35 [1]	: 2.9 – 3.9 N·m (30 – 40 kgf·cm, 26.1 – 34.8 in-lbs.)
Drill Chuck	[2]	: 12.7 – 16.7 N·m (130 – 170 kgf·cm, 113 – 148 in-lbs.)
Screw Set	D3 x 12 [15]	: 0.6 – 1.0 N·m (6 – 10 kgf·cm, 5.2 – 8.7 in-lbs.)
Machine Screw	M3 x 8 [29]	: 0.6 – 0.9 N·m (6.5 – 9.5 kgf·cm, 5.6 – 8.3 in-lbs.)
Tapping Screw (W/Washer)	D3 x 16 [26]	: 1.1 – 1.9 N·m (11 – 19 kgf·cm, 9.5 – 16.5 in-lbs.)

10-2. Precautions in Disassembly and Reassembly of Battery Charger

Please refer to the Technical Data and Service Manual for precautions in disassembly and reassembly of the Battery Charger UC 12SD.

11. STANDARD REPAIR TIME (UNIT) SCHEDULES

MODEL	Variable		10	20	30	40	50	60
	Fixed							
FDS12DVA		Work Flow						
	General Assembly	Spring Drill Chuck Housing (A).(B) Set Motor Cap DC-Speed Control Switch Nut Shift Arm Fin (Gear Box Ass'y) Front Case Lock Ring Ring Gear Carrier First Ring Gear Planet Gear (A) Set Pinion (B) Pinion (C) Slide Ring Gear Planet Gear (C) Set Rear Case						

Assembly Diagram for FDS 12DVA

