Operating Instructions and Parts List

Helix

Spring Assembler
Model HX20

Helix Assembler

Model HX20

Instruction Manual

Contents

1   The Machine

The model HX20 Spring Assembler is designed for the production of Bonell type spring units.

The machine comprises an upper and lower set of jaws to receive individual coil springs, an upper and lower set of helical formers which work in conjunction with the jaws to assemble the coil springs and a table to index the assembled springs forward.

The jaws will accept a limited range of spring coil diameters but the helical formers will only work correctly with the designated diameter of wire.

Electrical System

The HX20 is controlled by an industrial controller, which works in conjunction with electronic motor controllers. This combination ensures a safer operation with reduced wear on the driving components.

The sequence of operations is controlled by a pre programmed **Programmable Logic Controller (PLC)**. The push button station inputs basic instructions to the PLC. The operator's panel is for the operator to load the spring unit production details into the PLC.

Proximity switches are used to control the position of the machine. These switches have a much longer life than those with moving parts, however care must be taken not to subject them to severe forces.

The motors are controlled by frequency inverters. The inverters reduce the shock loads associated with starting and stopping motors when connected directly to the mains. The inverters also protect against overload and other electrical failures.

2   Technical Specification

The steel wire used in the production of Bonell spring units has a high carbon content which will be abrasive where it comes into contact with the machinery used in its construction.

The HX20 Assembler is, therefore, made from high quality materials with many parts specially hardened to reduce wear.

As most of these parts are directly associated with the setting of the machine and the resulting quality of the product it is essential that they are properly maintained. Worn parts should be replaced to prevent lost production time.

Care must be taken with hardened components because they tend to be brittle.

Never drop hardened parts!
Do not hit them with hard objects!
Do not use pliers or similar tools when fitting or removing them!

3   Machine Settings

To obtain the best output from the HX20 Assembler it is important that it is set correctly. The sequence of setting is important because of the inter action between the settings.

The following are factory set and should only require adjustment if the associated parts have been removed.

- **Synchronisation of the upper and lower jaws**
- **Timing cam setting**
- **Transporter setting**

The following may require adjustment particularly after the replacement of parts subject to wear. They should done in this order, otherwise settings may have to be repeated.

- **Helical pitch adjustment**
- **Helical former position setting**
- **Jaw separation setting.**

3.1   Upper and Lower Jaw Synchronisation

The upper and lower jaws are factory set to close together and should not need resetting. If they are out of time follow the steps below:

- Set the machine to manual.
- Close the jaws by stepping on the foot pedal.
- Turn off the power at the machine isolator.
- Unscrew the 4 bolts, item 2, in figure 1.
- Pull the motor, item 3, down.
- Slide down the splined shaft, item 1, away from the two gearboxes.
- Turn the worm shaft of the lower gearbox , item 6, clockwise until the cutting knife in the first lower jaw starts moving.
- Turn the worm shaft of the upper gearbox , item 5, clockwise until the cutting knife in the first upper jaw starts moving.
- Slide back the splined shaft, item 1, ensuring that the two worm shafts, items 5&6, are not turned other than enough to align the splines.
- Replace the motor, item 3, ensuring that the key is in place and secure with the 4 bolts, item 2.
- Turn on the power and check the setting in manual mode.

NOTE:
Before synchronising the upper and lower jaws check the top and bottom hexagon drive shafts are not twisted. Any twist will result in some of the jaws closing at the wrong time. A twisted drive shaft must be replaced.

3.2 Timing Cam setting

The electrical and mechanical components are synchronised by the timing cam shown in figure 2.

After factory setting a dimple is drilled between the cam, item 4, and the worm wheel hub, item 2, of the upper reduction unit to show the setting.

3.3 Transporter Setting

Once the helicals have been formed the jaws open and the part made spring unit is transported back ready to receive the next row of springs. The timing of the transporter is, therefore. important to the efficient running of the machine.

The timing is factory set and should only need setting if the mechanism has been disturbed. Figure 3 illustrates the parts and the adjustment is as follows:

- In manual mode close the jaws by depressing the foot pedal.
- Turn the power off.
- Remove screw, item 1, and slacken screw, item 2.
- Pull gear, item 3, away from gear, item 4, so that they are out of mesh.
- Rotate cam, item 5, until the centre of the ball bearing aligns with the right side of the bearing extraction hole, "A".
- Bring the two gears back into mesh without moving the cam.
- Replace screw, item 1, but do not tighten. Take up the slack in the chain then tighten both screws.

3.4 Helical Pitch Adjustment.

The setting of the helical pitch is very important to the efficient running of a Spring Assembler.

The main principle of the operation of a Spring Assembler is to place adjoining rows of spring coils in special jaws and produce two helicals that pass through the jaws and so connect the rows together. To achieve this it is essential that the pitch of the helical is the same as that in the jaws and the spacing of the jaws is a multiple of the pitch.

If the helical pitch is not set correctly there will be unwanted friction as the helical passes through the jaws and they will not pass smoothly into the jaw mouth. This can result in wire breakage or cause the helical to jump out of the jaws.

A calibration gauge is mounted on the upper helical former. The gauge has slots for coarse setting and two pins for fine tuning.

Set the machine to manual mode and press the helical forward button until a length of 30 cm can be cut off. Place the cut piece across the gauge slots and check the pitch alignment.

If the pitch of the helical does not align release the pitch adjuster, part 3903, by undoing the clamp "T" bar, item S227.

To reduce the pitch of the helical turn the adjuster clockwise a little

To increase the pitch of the helical turn the adjuster anticlockwise a little.

For fine adjustment rest the cut piece over the two pins and check that both ends sit down on the pins. Adjust the pitch in the same manner until both ends sit down.

3.5 Helical Former Position Setting

After parts have been replaced it may be necessary to adjust the position of the helical former relative to the first jaw. As the position of the first jaw is fixed the adjustment must be made to the position of the helical former.

There is a pin, part 3900, located in the first jaw, which locates the helical.

To set the position of the Helical Former feed out 50 cm of calibrated helical in manual mode then turn off the power supply.

Cut this off at a point 15 cm from the pitch adjuster.

Feed the cut piece in to the first jaw until the end touches the end of the piece left in the helical former. At this point they should appear to join as one piece, if they do not loosen the four screws that secure the Helical Former to the machine and slide it to align the two ends.

Tighten the four securing screws.

3.6 Jaw Setting

It is essential that the helical passes around the springs in the jaws with the minimum of friction. To achieve this see figure 4 and proceed as follows:
- Set the machine to manual, fit two rows of springs and then close the jaws by depressing the foot pedal.
- Turn off the power supply
- Loosen screw (4) and move the moving arm (3) to align the fixed (1) and moving (2) dies. Tighten screw (4).
- Loosen nut (5) and then nip up finger tight.
- Adjust the opening between the jaws by turning screw (6) in or out until a helical just passes freely through the jaws and over the top of the springs.
- Tighten nut (5)

3.7 Jaw Separation Setting

From time to time it will be necessary to alter the separation of the jaws to achieve the correct width of spring unit. As it is essential that the helical moves smoothly through the jaws they must be set a whole number of pitches apart.

A setting gauge is provided with pins set at different pitch centres.

Start the repositioning of the jaws from the fixed jaw on the right.

Loosen the clamp screws at the back of the jaws and move the jaw to its approximate position.

Locate the gauge pins in the hole in the front die to obtain the precise separation. Tighten the clamp screws checking that the jaw has not moved when tightening.

4   Operator Panel

The operator panel allows the operator to enter the details of the next batch of work and then during the work program displays the progress of the batch. There are 6 screens which the operator can view pressing the **F1** button moves on to the next screen whilst pressing **F2** moves back to the previous screen

4.1   Batch state

The top row displays the number of units complete and can be reset to zero by pressing **F6.**

The second row displays the number of rows and can be reset by pressing **F5.**

4.2   Number of jaws

This is the number of working jaws and can be altered firstly by resetting to zero pressing **F6** followed by **F5.** Enter the tens by pressing **F4** (each press increases the value by 1) then press **F3** to move the number to the left and enter the units value by pressing **F4.** To confirm the correct number press **F6** which will then cause both digits to blink on and off.

4.3   Number of rows

This is the number of rows per spring unit. Enter the value in the same manner as jaws.

4.4   Number of units

This is the number of units to be produced. Enter the number.

4.5   Coefficient

This determines the length of helical to be produced for the number of jaws. The number entered must be determined for the setting of the jaws by trial and error.

4.6   Mode

The machine can work with or without clench by the mode. 0 is without and 1 is with. To change between modes press **F6**

5   Push Button Panel

The basic functions of the machine are controlled from the pushbutton panel and the floor pedal. The machine can work either in **Auto** or **Manual** mode.

5.1   Auto

Pressing the **Auto** button puts the machine in automatic mode. Once the springs have been placed into the jaws and with the helical wire in each helical former then pressing the foot pedal will close the jaws, feed the helicals through the jaws cut the helicals and clench (if selected), open the jaws and transport the unit forward ready to receive the next row of springs.

When the correct number of rows have been assembled the helical are not inserted between the last row and the first row of the next unit.

5.2   Manual

Pressing the **Manual** button sets the machine into manual operation. This allows the operator to carry out single operations in any order. Pressing the foot pedal closes the jaws.

5.3   Transport

Pressing the **Transport** button and holding it down will open the jaws and operate the transporter finishing with the jaws open. Transport will not work from the open jaws condition.

5.4   Jaws open

Pressing the **Jaws open** button opens the jaws, pressing the foot pedal closes them again.

5.5   Helical feed

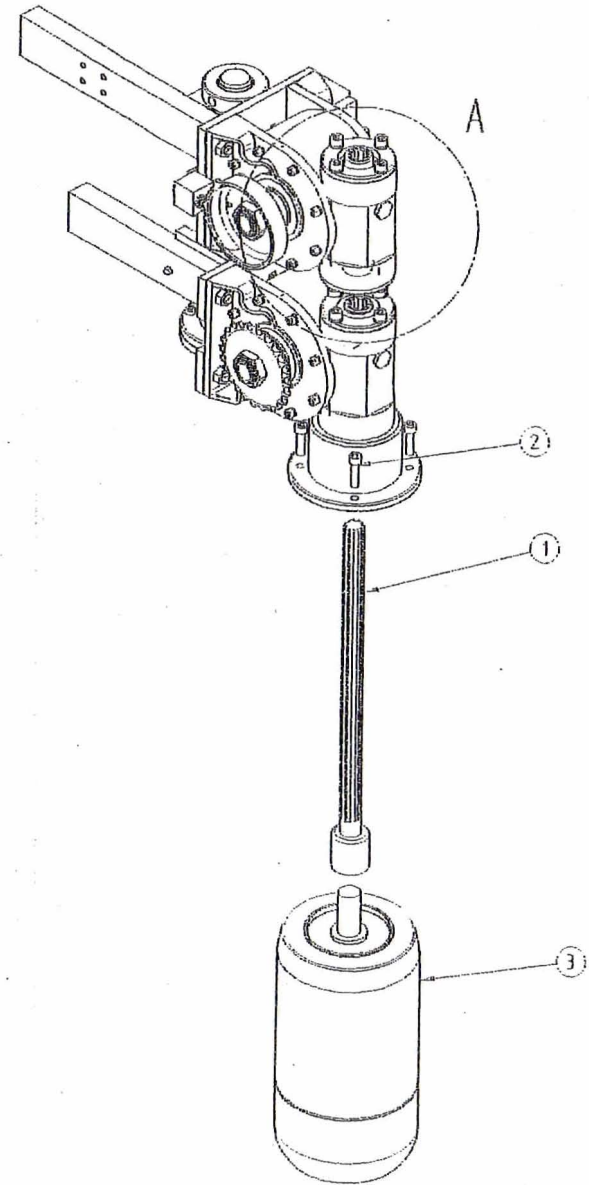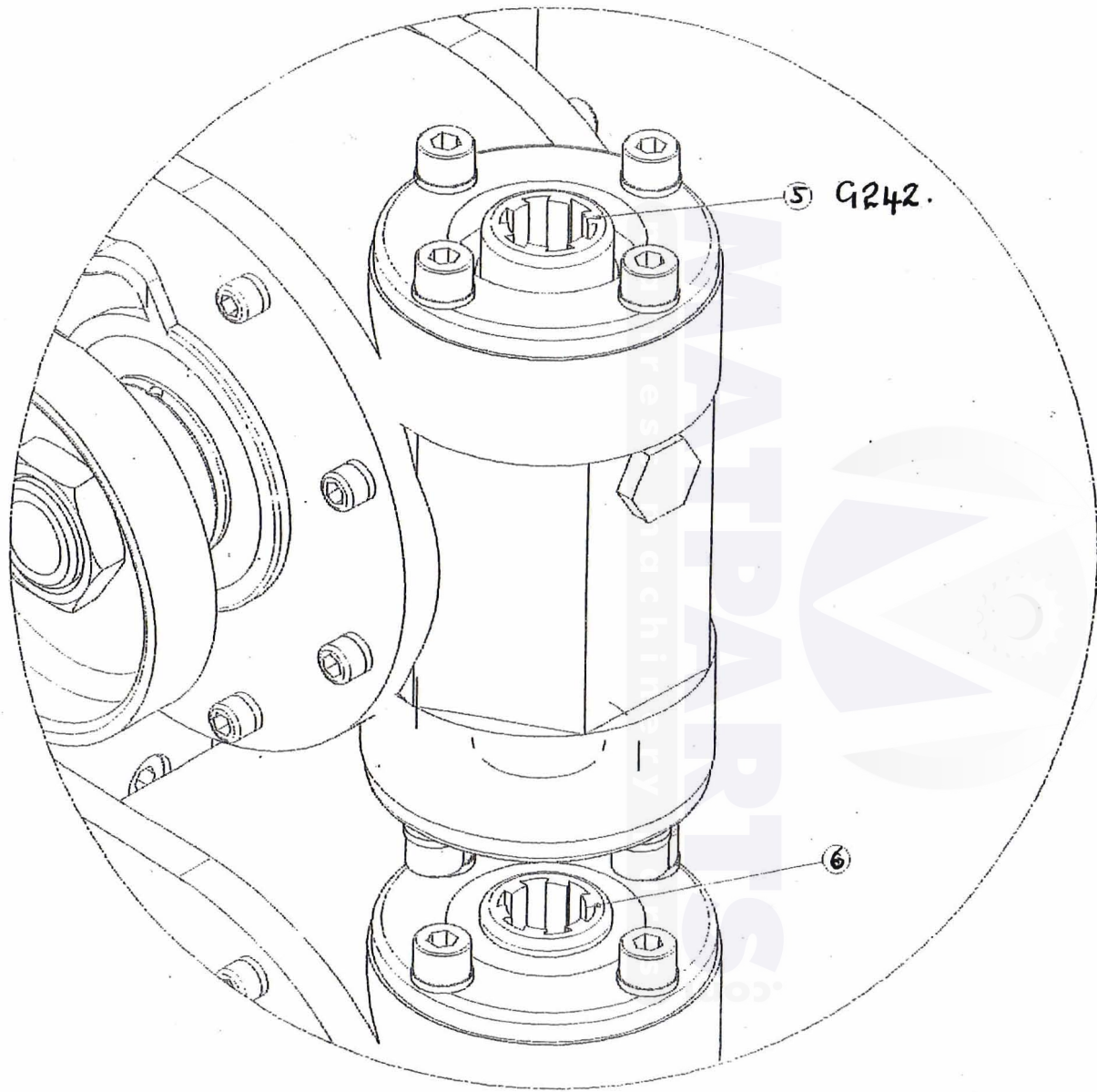The upper and lower helicals can be fed forwards or reversed by pressing the relevant button.

G242.

A
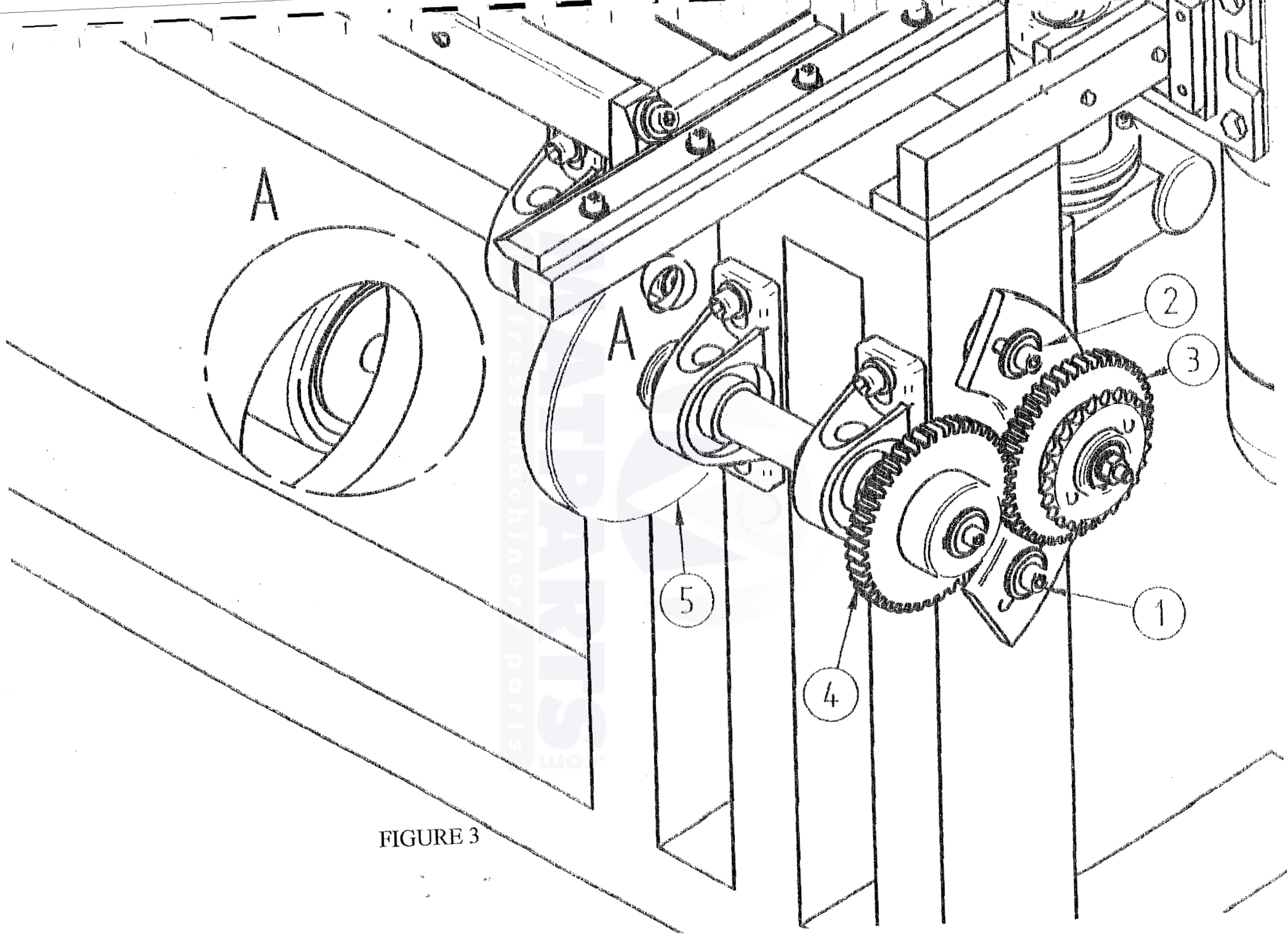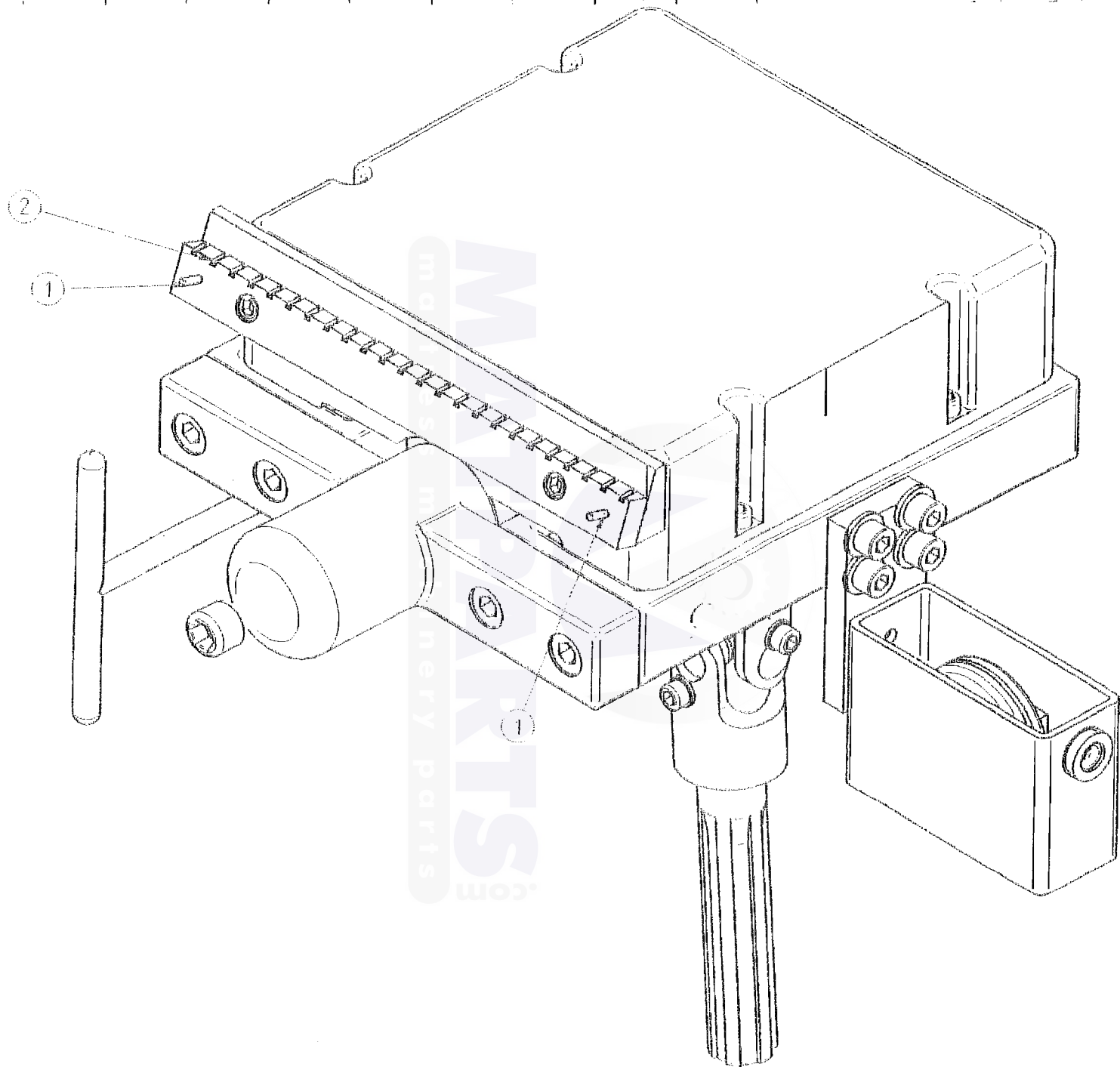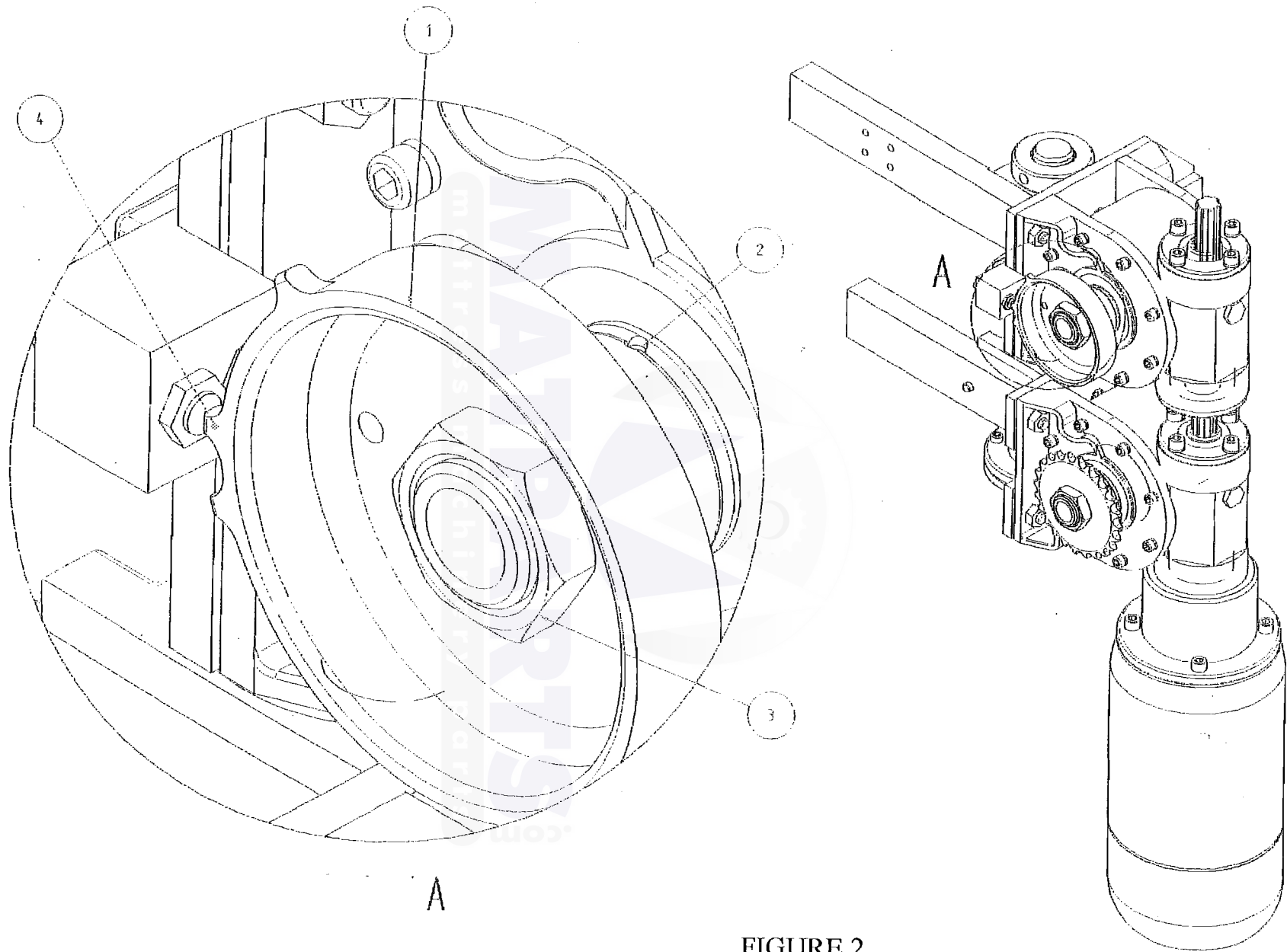
FIGURE 1

FIGURE 3

FIGURE 2
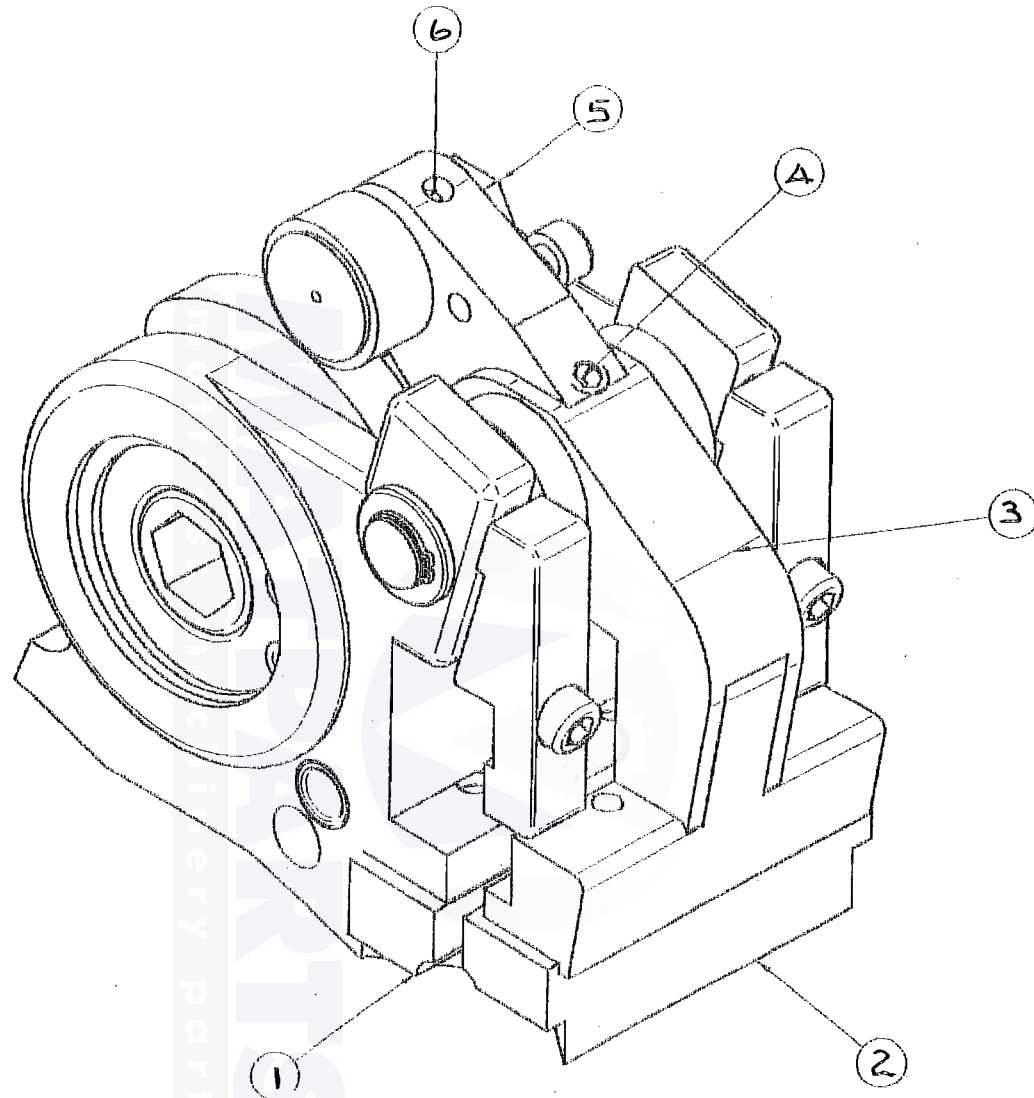
FIGURE 4
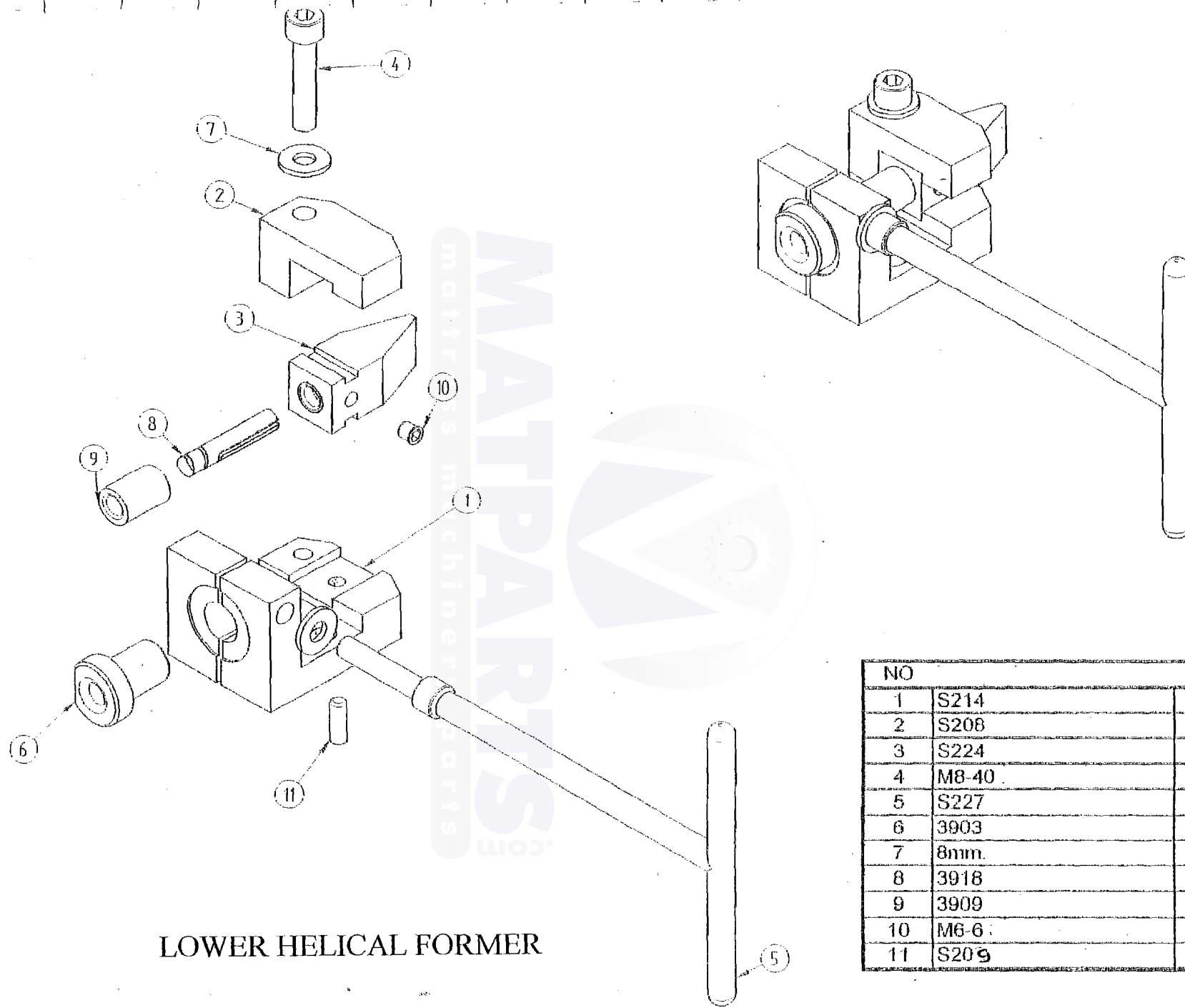
LOWER HELICAL FORMER

NO		
1	S214	1
2	S208	1
3	S224	1
4	M8-40	1
5	S227	1
6	3903	1
7	8mm.	2
8	3918	1
9	3909	1
10	M6-6	1
11	S209	1
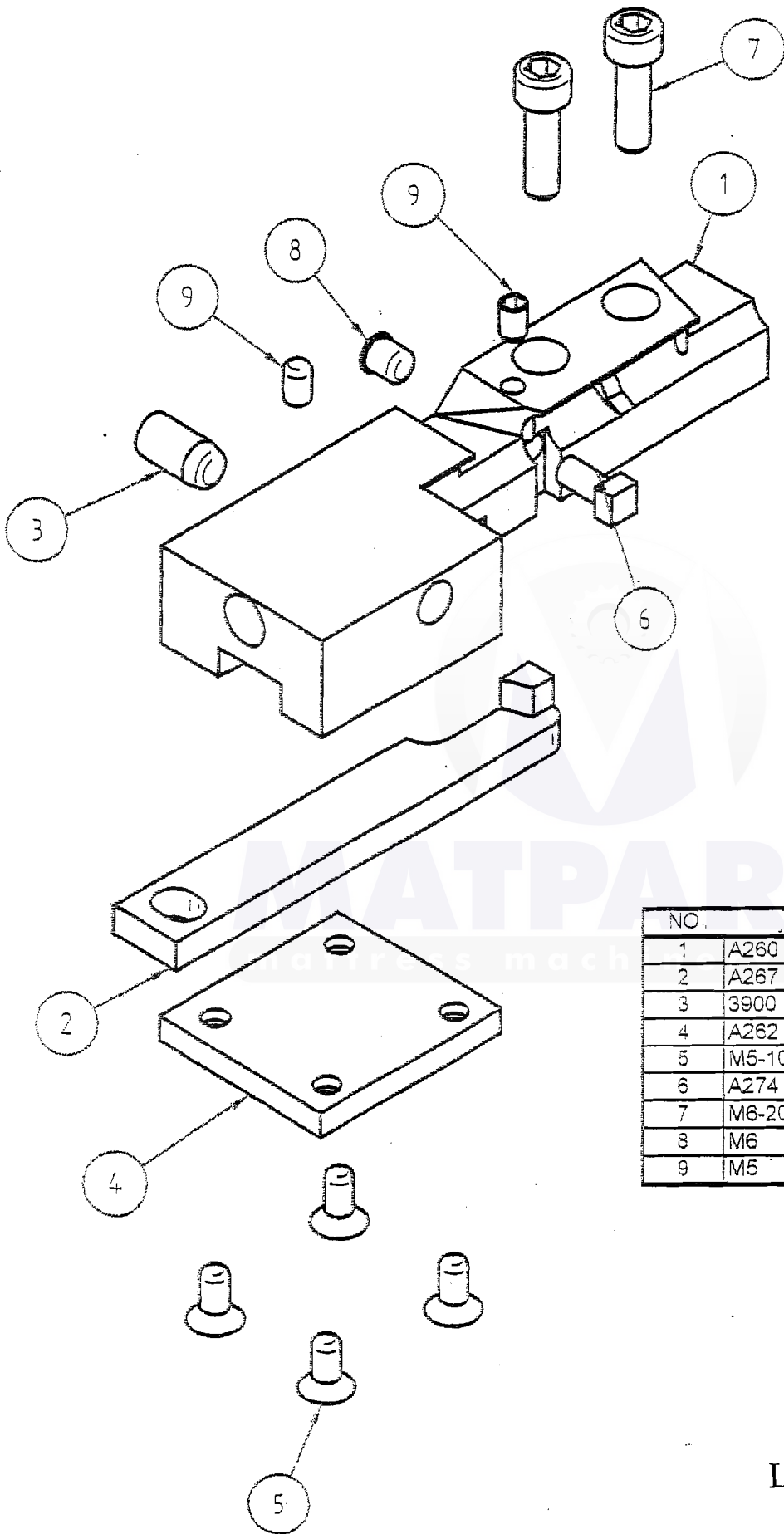
NO.		
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2	A267	1
3	3900	1
4	A262	1
5	M5-10	4
6	A274	1
7	M6-20	2
8	M6	1
9	M5	2

LOWER FIRST JAW
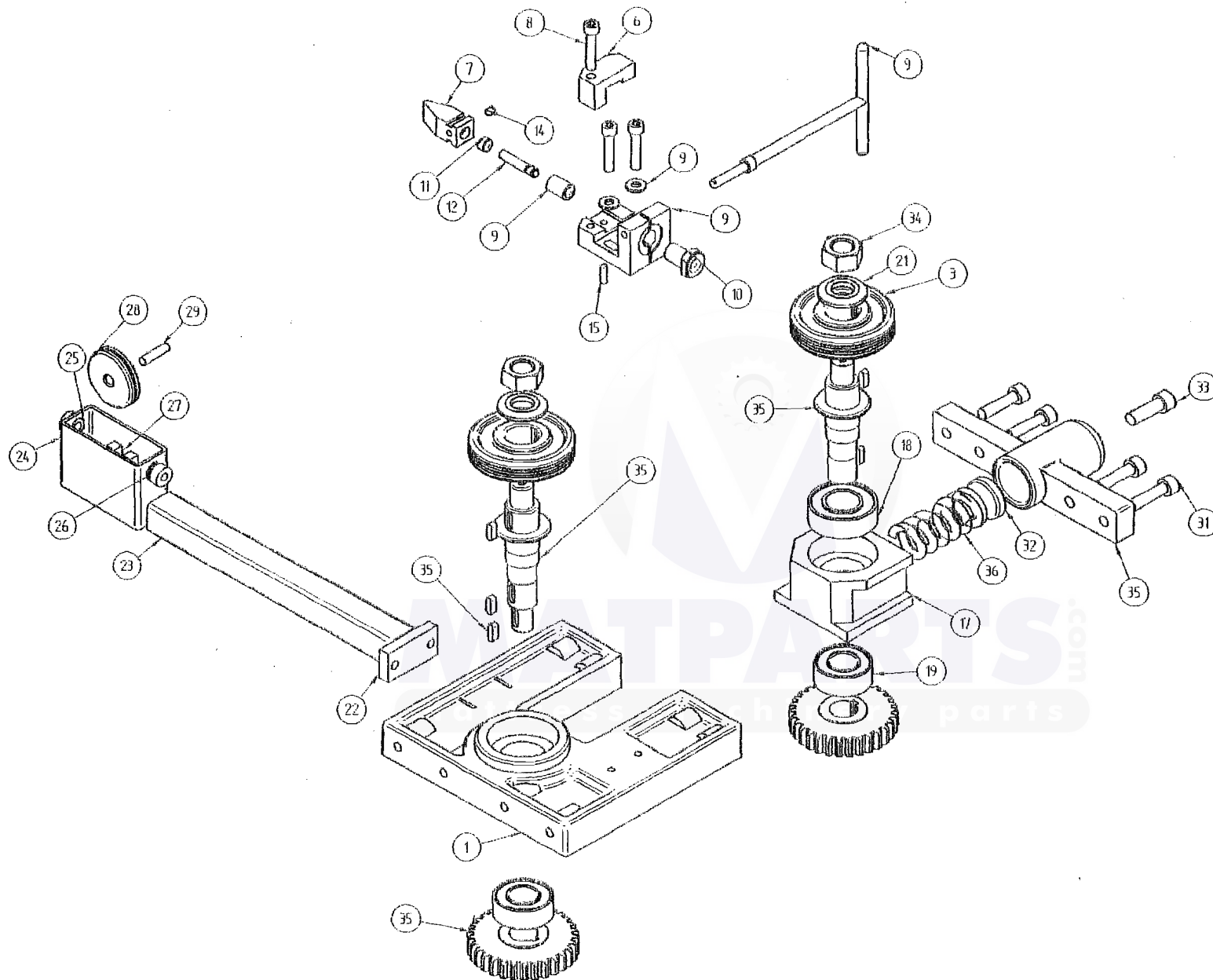
NO		
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2	S213	1
3	S222	2
4	S221	2
5	S214	1
6	S208	1
7	S224	1
8	M8-40	4
9	S227	1
10	3903	1
11	3901	1
12	3918	1
13	3909	1
14	M6	1
15		1
16	8mm.	2
17	s202	1
18	4206	1
19	3205	2
20	S220	1
21	S229	2
22	G247	1
23	T201	1
24	G268	1
25	G250	1
26	G251	1
27	G249	2
28	G253	1
29	G286	1
30	S230	1
31	M10-40	4
32	S231	1
33	M12-35	1
34	M20-1,5	2
35	6-6-18	5
36	3711	1

NO		
1	A255	1
2	A257	1
3	A244	1
4	KR-16	2
5	A258	1
6	A249	1
7	M6-1	2
8	3205	2
9	M6-10	4
10	M5-10	2
11	472-52	2
12	A256	1

NO		
1	A263	1
2	A259	1
3	A264	1
4	A266	1
5	M6-20	4
6	3-18	2
7	M6-10	1
8	4268	1
9	M2,5-10	2
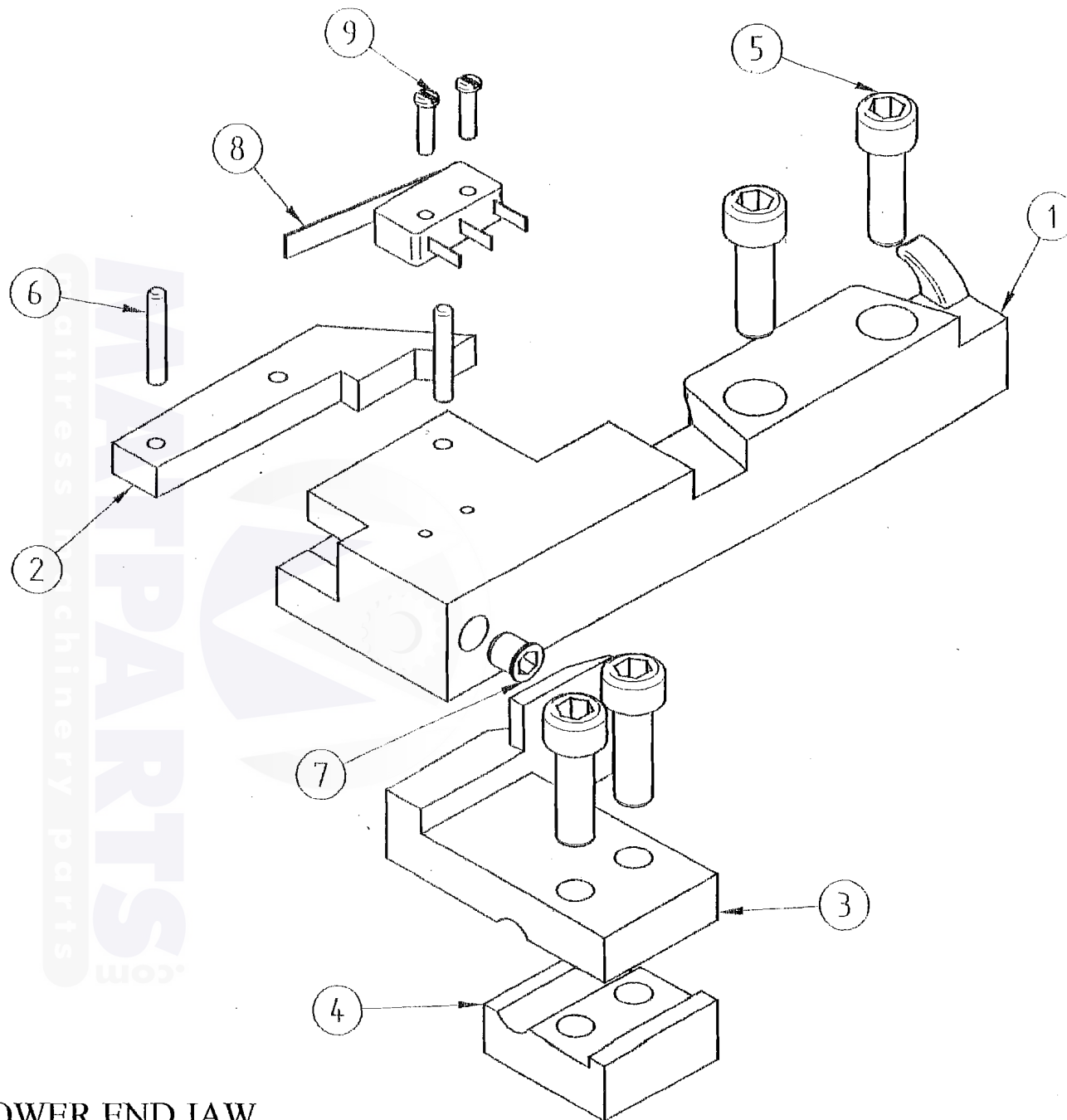
LOWER END JAW

NO		
1	K201	1
2	6005	2
3	K204	1
4	K242	2
5	K207	1
6	472-47	2
7	K208	2
8	471-12	2
9	M6-25	2
10	K202	1
11	M6-10	1
12	M6-16	2
13	KR-26	1
14	M10	1
15	K234	1
16	K236	1
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19	M6-20	2
20	M6-10	1
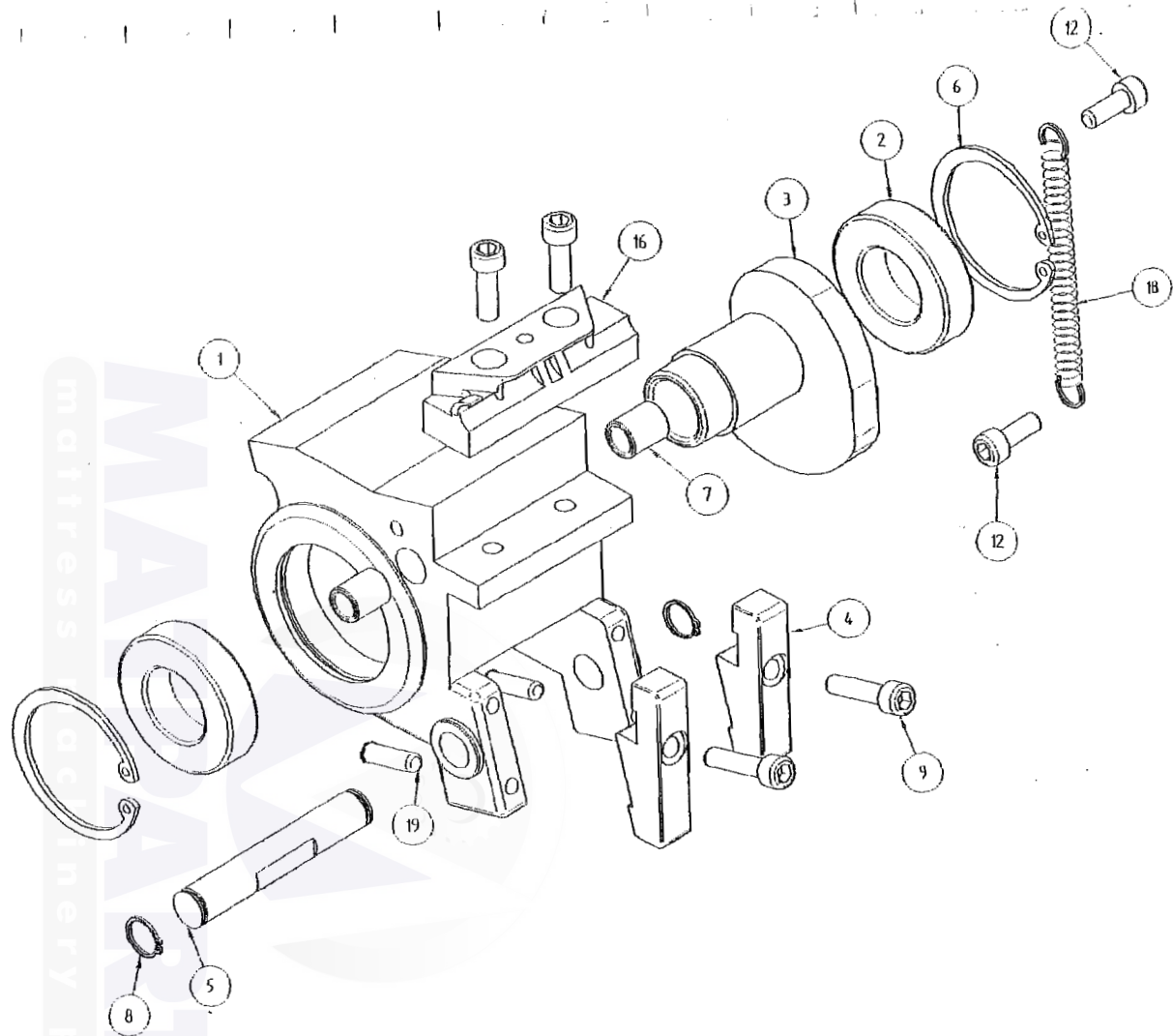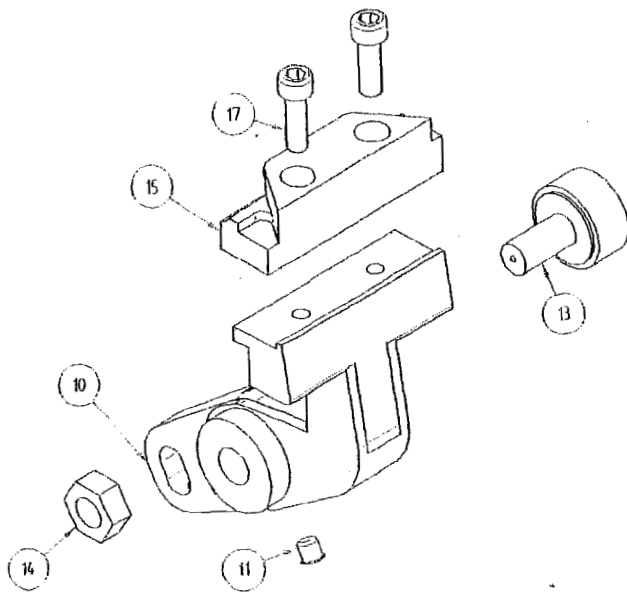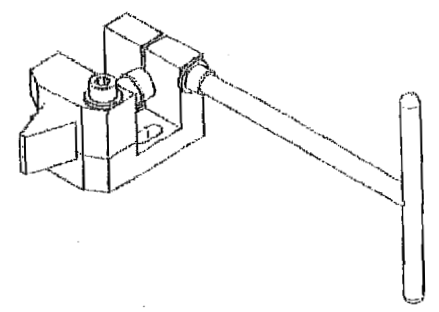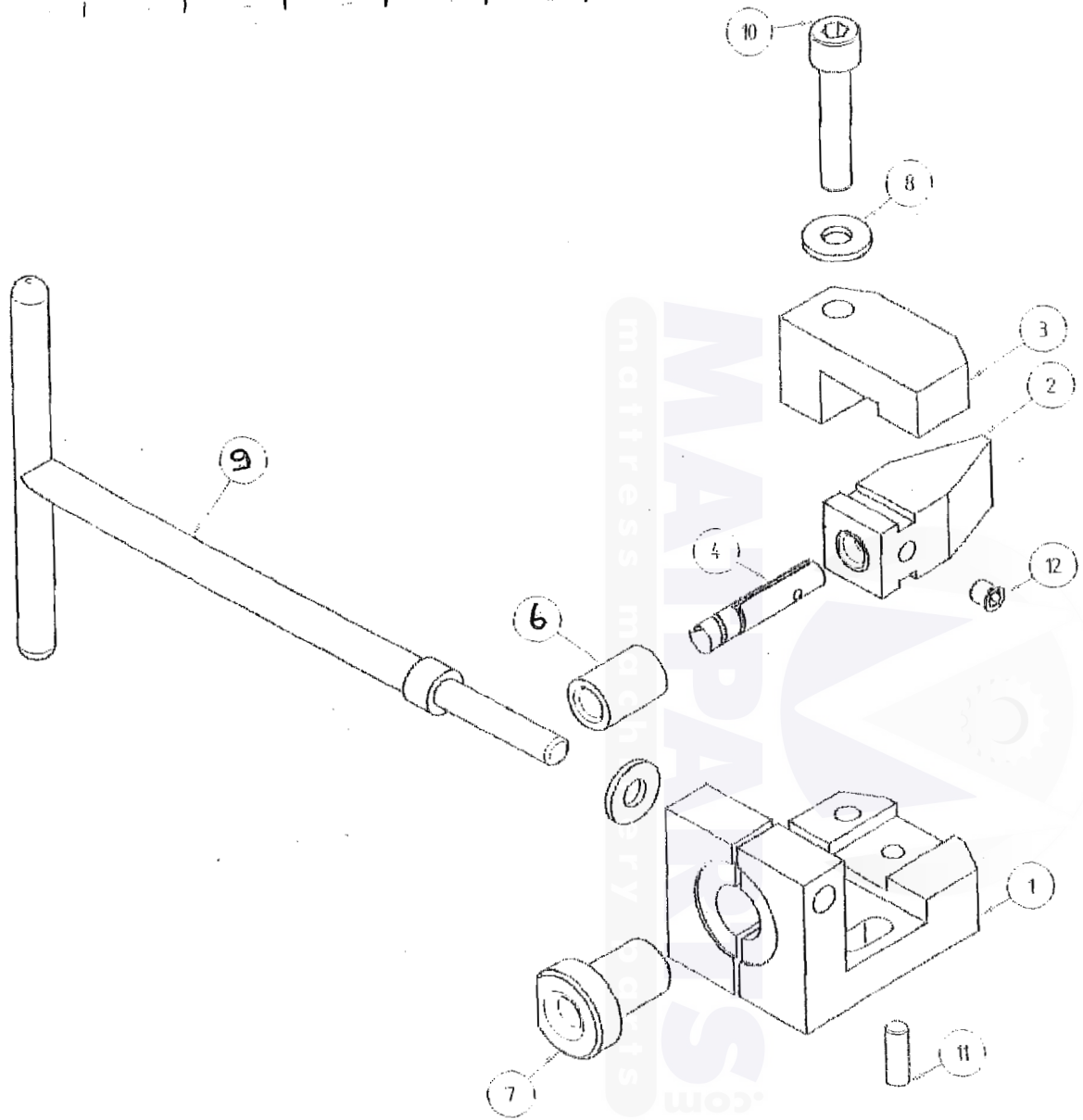
NO		
1	S204	1
2	S224	1
3	S208	1
4	3918	1
5	3901	1
6	3909	1
7	3903	1
8	8 mm	2
9	S227	1
10	M8-40	1
11	S209	1
12	M6-6	1

UPPER HELICAL FORMER
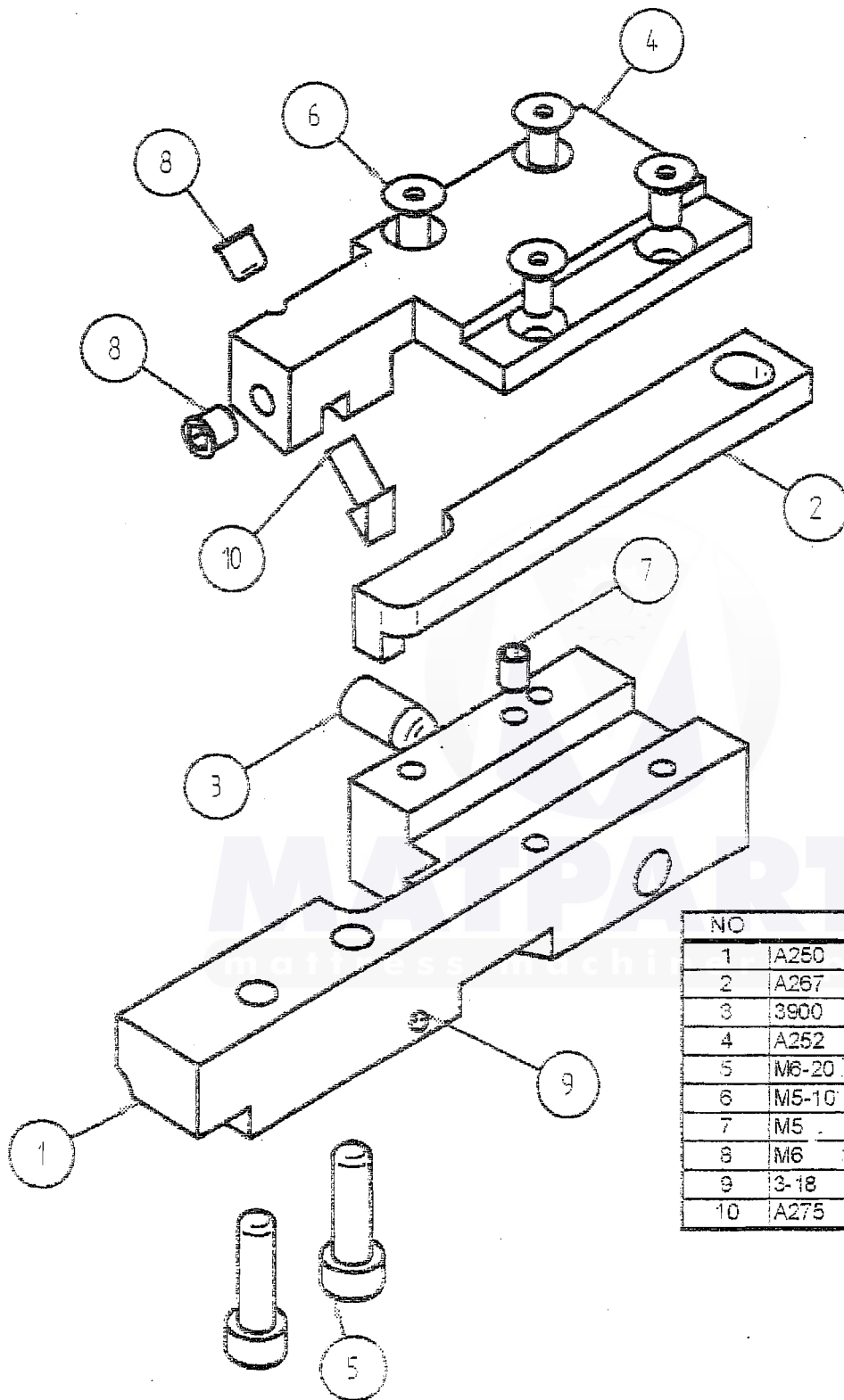
NO		
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2	A267	1
3	3900	
4	A252	1
5	M6-20	2
6	M5-10	4
7	M5	1
8	M6	2
9	3-18	1
10	A275	1

UPPER FIRST JAW
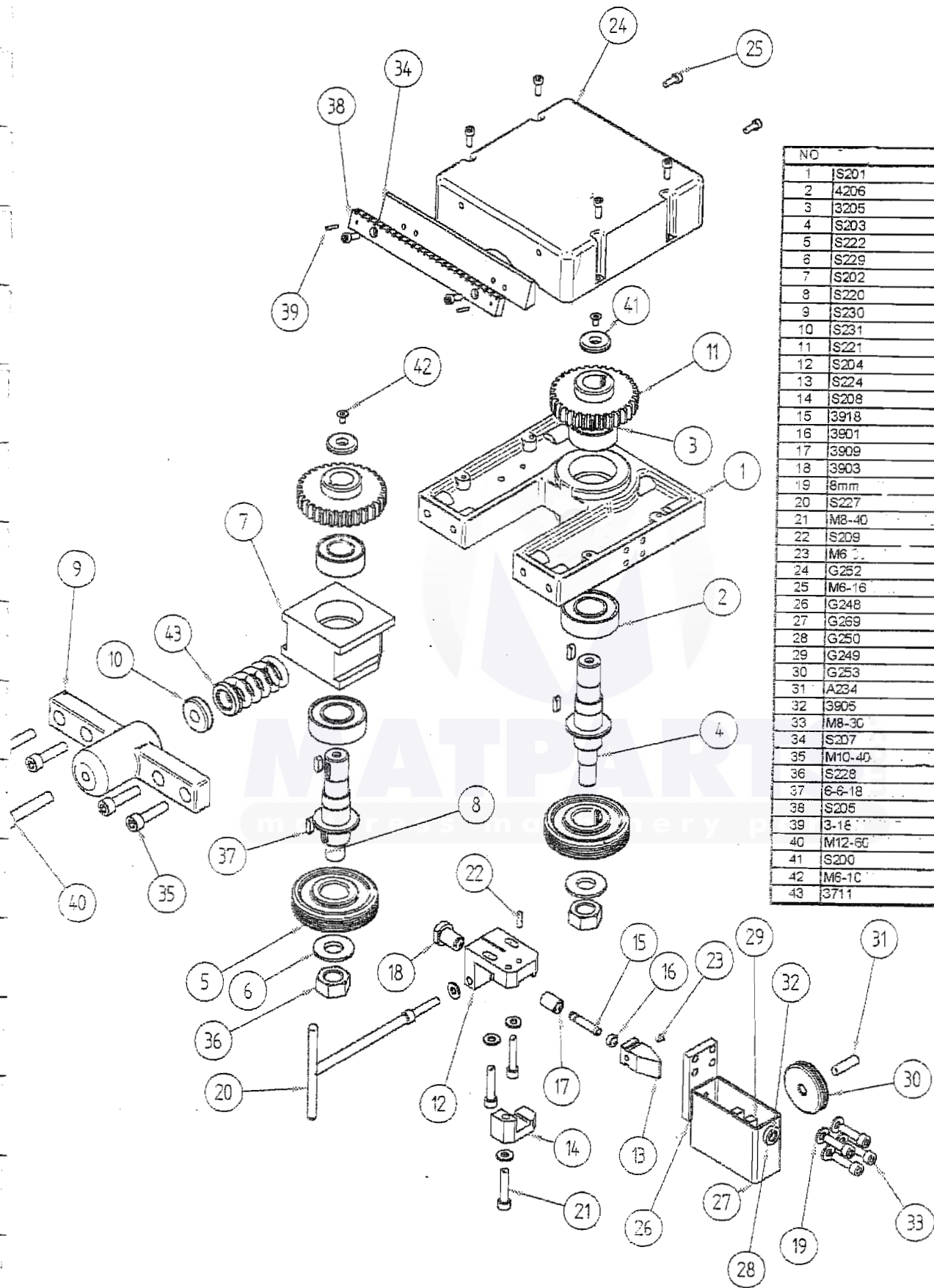
NO		
1	S201	1
2	4206	2
3	3205	2
4	S203	1
5	S222	2
6	S229	2
7	S202	1
8	S220	1
9	S230	1
10	S231	1
11	S221	2
12	S204	1
13	S224	1
14	S208	1
15	3918	1
16	3901	1
17	3909	1
18	3903	1
19	8mm	3
20	S227	1
21	M8-40	4
22	S209	1
23	M6	1
24	G252	1
25	M6-16	8
26	G248	1
27	G269	1
28	G250	1
29	G249	2
30	G253	1
31	A234	1
32	3905	2
33	M8-30	4
34	S207	1
35	M10-40	4
36	S228	2
37	6-6-18	4
38	S205	1
39	3-18	2
40	M12-60	1
41	S200	2
42	M6-10	2
43	3711	1

NO		
1	A245	1
2	A247	1
3	A244	1
4	A249	1
5	M5-10	2
6	M6-15	4
7	472-52	2
8	3205	2
9	A248	1
10	KR-16	2
11	M8	2
12	A246	1
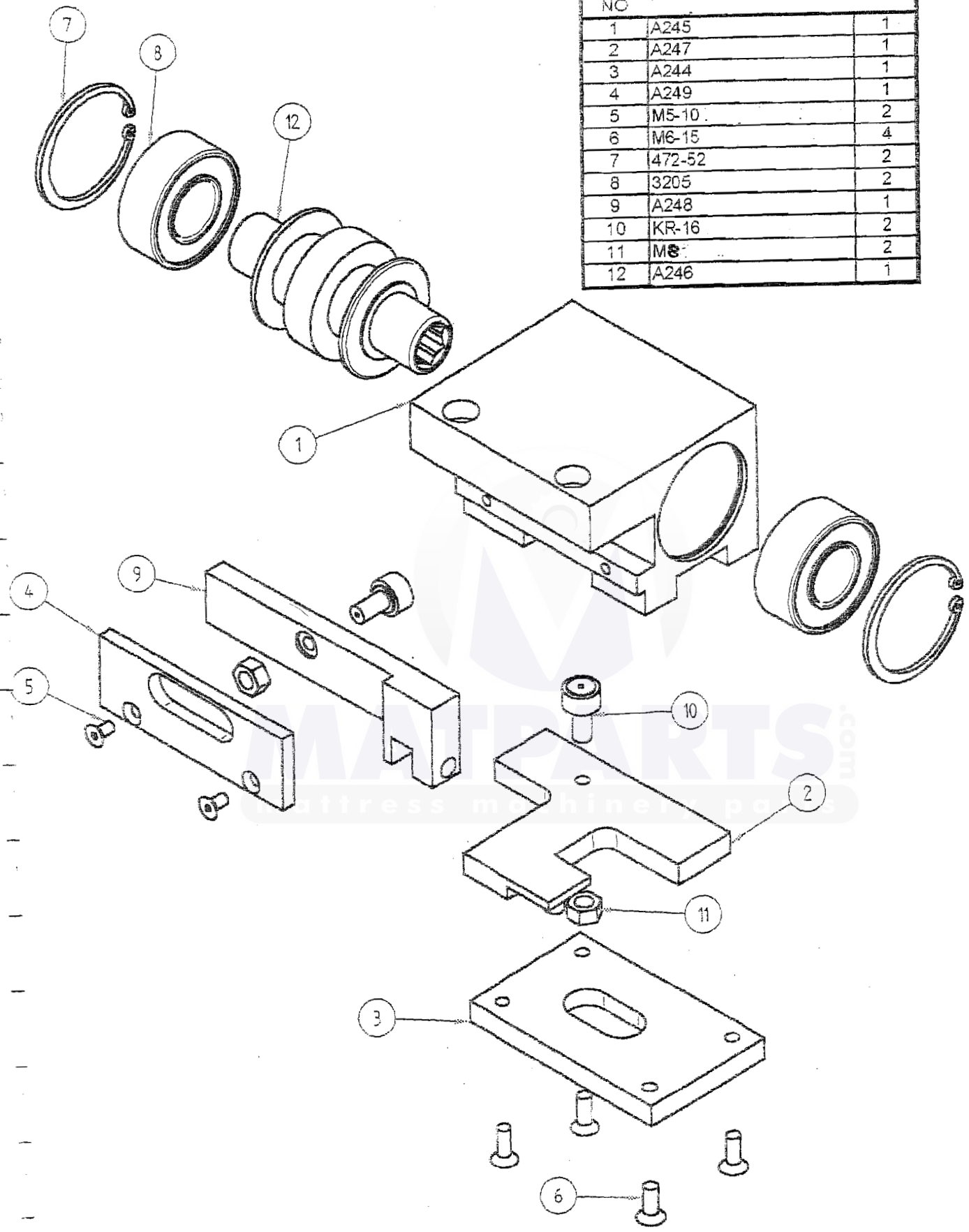
NO		
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2	A265	1
3	A254	1
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5	M6-20	4
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7	M6-10	1
8	A266	1
9	M2,5-10	2
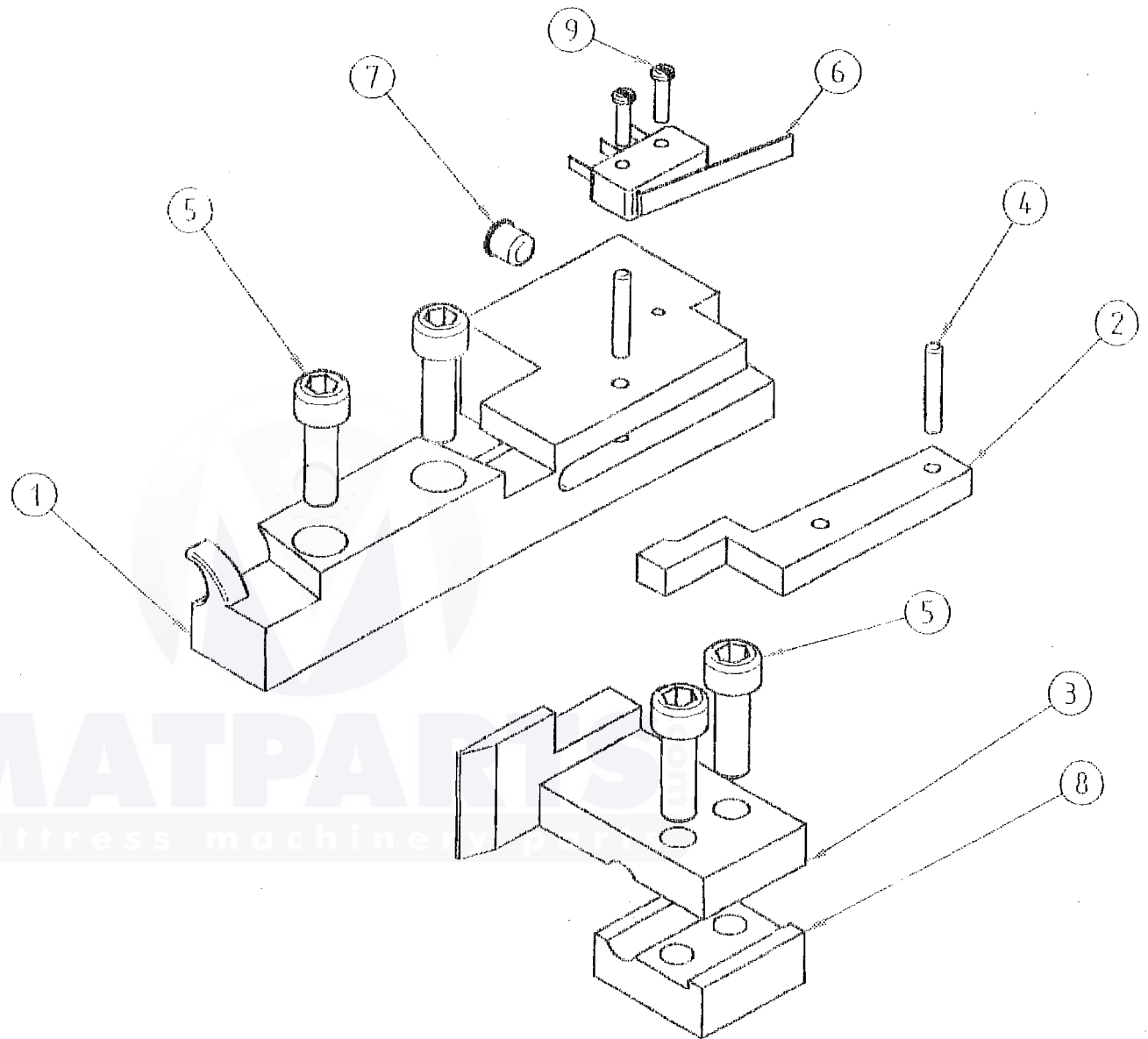
UPPER END JAW
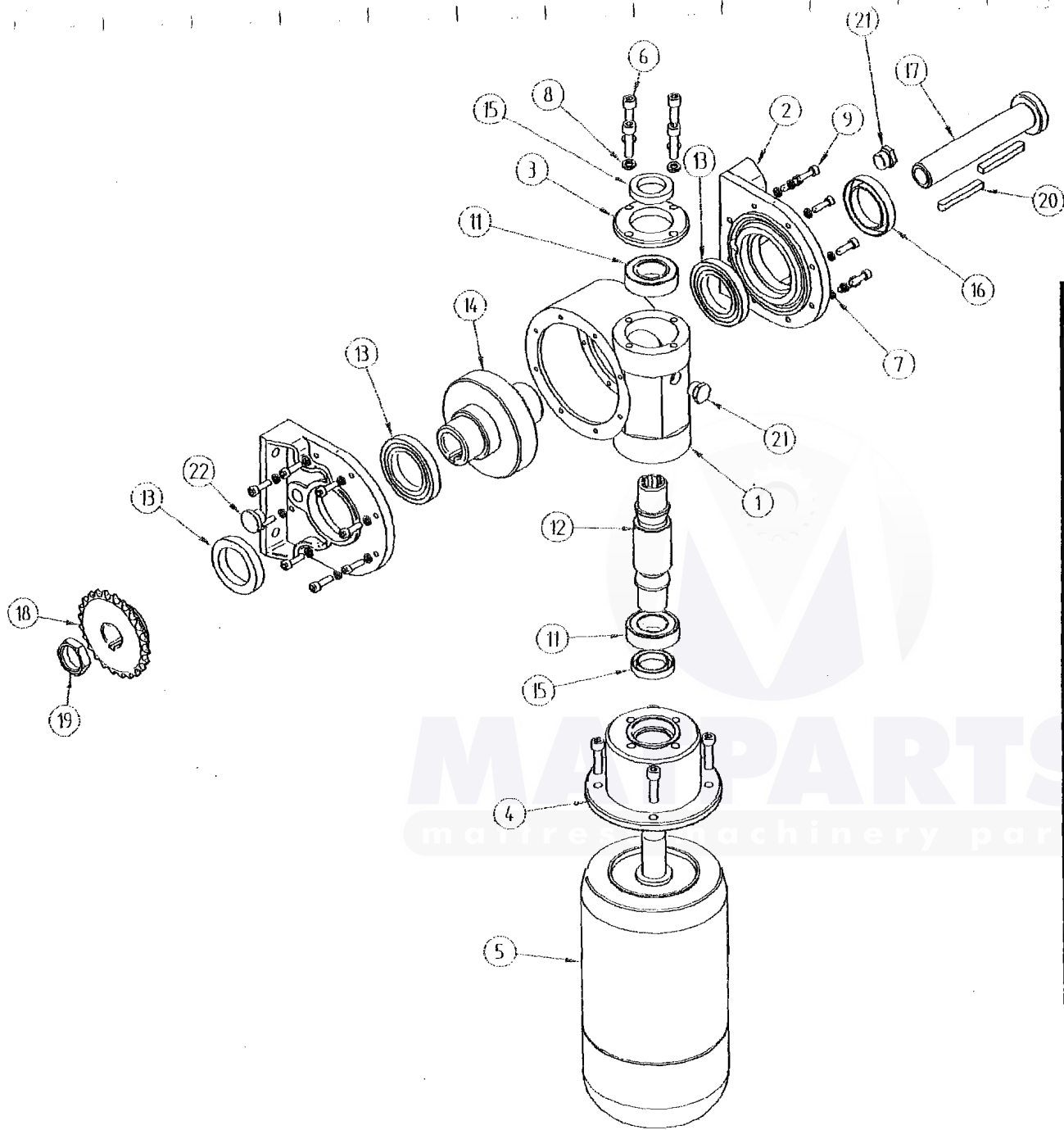
NO		
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2	R212	2
3	R215	1
4	R216	1
5	3803	1
6	M8-30	8
7	3112	16
8	3105	4
9	M6-20	16
10	M10	4
11	32006	2
12	R213	1
13	16009	2
14	R214	1
15	30-45-8	2
16	45-65-10	2
17	G228	1
18	G226	1
19	G229	1
20	8-7-60	2
21	5342	2
22	5305	1

NO		
1	R211	1
2	R212	2
3	R215	2
4	3112	16
5	3105	8
6	M8-30	8
7	M6-20	16
8	M10	4
9	32006	2
10	R218	1
11	16009	2
12	R217	1
13	45-65-10	2
14	30-45-8	2
15	R206	1
16	8-7-80	1
17	5305	1
18	5342	2
19	A212	1
20	G229	1

R S T Q4

Q3 11 A 7
1 42 7 B 11
43 5 9 D
44 D
47

INV1 3G3JV AB007 CUE BOTTOM HELICAL MOTOR
L S4 SC S1 S2 S3 (FAULT RST, REV, JOG, EM STOP, S5)
U V W N
10 11 12 N
55 56 57
54 55 56
M1 3~
GND 58 0

Q1 2 46

INV2 3G3JV AB007 CUE TOP HELICAL MOTOR
L S1 SC S5 S2 S3 S4
U V W N
4 5 6 N
51 52 53
50 51 52
M2 3~
54 0
L3 60 73 62

14 D 57
13
C 5 9 38
6 10 37 B
B 39
40
6 A 10 48 41
L4 59 72 62 13 C 14

PLC1 OMRON SYSMACCPM1A-30CDR
COM OUT00 OUT01 OUT02 OUT03 1CH
COM OUT01 OUT02 OUT03 0CH OUT00
COM
OUT05 OUT06 OUT07
OUT04

32
L5 61 74 66 62
50

9 B 5 33
34
35
36
Q2 5 A 9 49

INV3 3G3MV AB015 CUE ASSMBLY MOTOR
S5 S3 S2 S1 SC S4 L
U V W N
7 8 9 N
1 2 3
75 76 77
M3 3~
4 0

24V. DC

Project Description: HX-20 ASSEMBLER MACHINE
Sheet Description: POWER DIAGRAM
Designed by
Drawn by
Verified by
Date Revisions
Project date 7/2/02
Sheet date 6/11/01
1/4

PLC 1

COM **0CH** **1CH**

| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 00 | 01 | 02 | 03 |

17 63 · 18 64 · 19 65 · 20 66 · 21 67 · 22 68 · 23 69 · 24 70 · 25 7 · 26 8 · 27 11 · 16 74 · 28 9 · 29 10 · 30 73 · 31 72

58 · 59 · 60 · 61 · 62 · 63 · 64 · 65 · 13 · 14 · 81 · 67 · 83 · 82 · 71

S1   S3   S5   S7   S11   L2   PROX1   PROX2   S15

S2   S4   S6   S8

PROX3   PROX4   S14

MA   MA
MC   MA
MA   MC
MC

L1

62

71-6-12   Ø5   Ø5
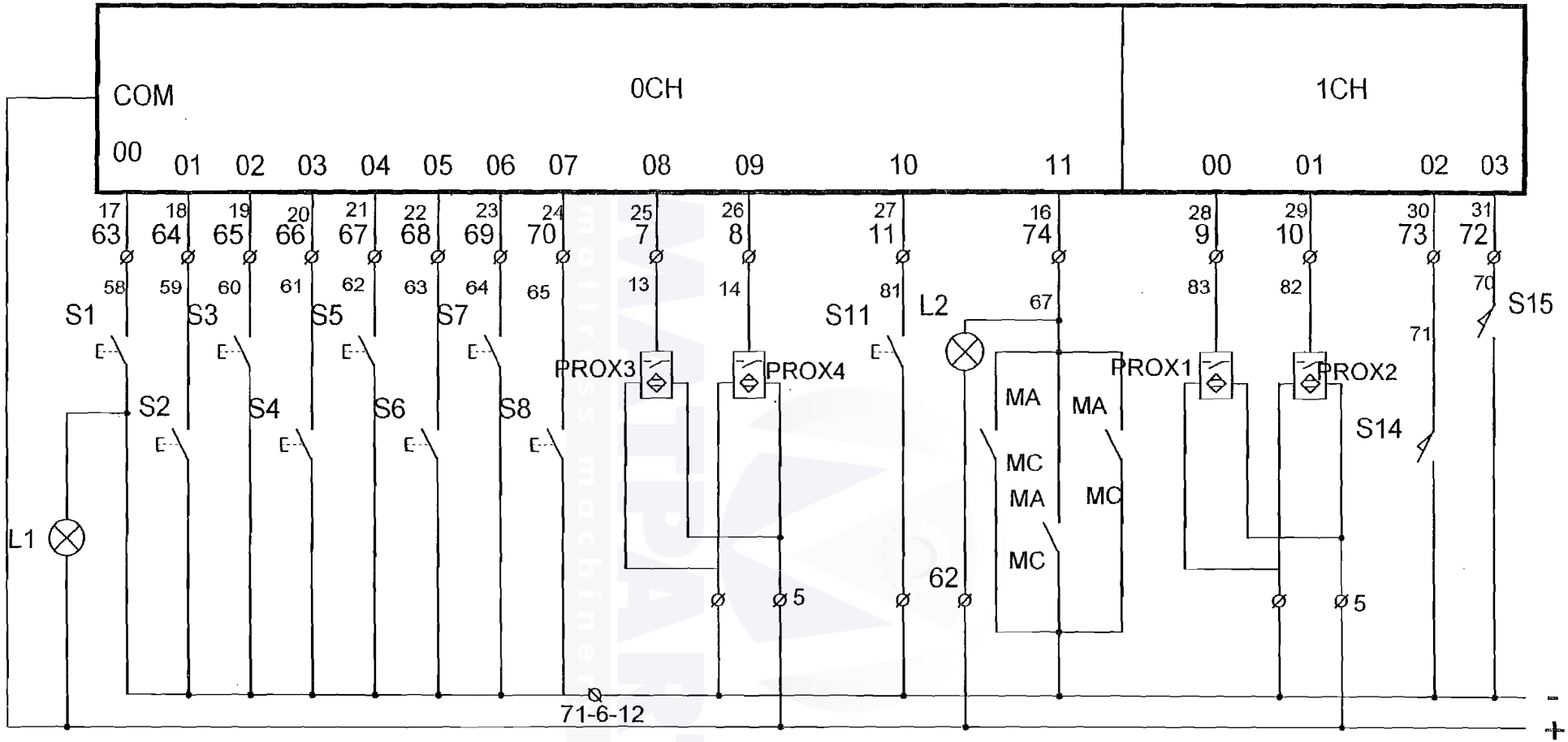
POWER LAMP

BOTTOM HEL. FWD.

BOTTOM HEL. REV.

TOP HEL. FWD.

TOP HEL. REV.

MANUAL

AUTOMATIC

CUT

JAWS REOPEN

TOP HEL. END

BOTTOM HEL. END

FOOT SWITCH

FAULT LAMP

INSIDE PROX.

OUTSIDE PROX.

BOTTOM

TOP

Project Description	HX-20 ASSEMBLER MACHINE	Designed by	Date	Revisions	Project date 7/2/02
Sheet Description	CONTROL DIAGRAM	Drawn by			Sheet date 26/11/01
		Verified by			

NT2S

(9 Pin D-SUB MALE)

PLC

(9Pin D-SUB MALE)

NT2S				PLC
TXD	2		3	RXD
RXD	3		2	TXD
SG	9		9	SG
RTS	4		4	
CTS	5		6	
	7		7	
	8		8	
			1	SHIELD

Project Description	HX-20 ASSEMBLER MACHINE	Designed by	Date	Revisions	Project date 7/2/02
		Drawn by			Sheet date 26/11/01
Sheet Description	CONTROL PANEL CABLE	Verified by			3 / 4

A

14

13

15

75

S16 69

⊗E

71

B 14

13

C 6   D 6

10   10

78   79

77   78

V1   V2

76

+

Project Description		HX-20 ASSEMBLER MACHINE		Designed by	Date		Revisions		Project date
									7/2/02
				Drawn by					Sheet date
Sheet Description		CONTROL DIAGRAM							14/12/01
				Verified by					4 / 4