BELL HUEY COBRA

Hegi

MODELLBAU

INSTRUCTIONS

FOR HELICOPTER "BELL HUEY COBRA", HEGI 201 400 AND 201 410

The instructions will seem different and unfamiliar to you because a helicopter is an all new craft, and most of you in general will have no experience with this type of machine. Therefore the instructions are more than building instructions, and directed to the experienced as well as the beginner. We try to give you as much information as possible, so you may profit from our experience in this new branch of model flying.

History Of The BELL HUEY COBRA

This RC BELL HUEY COBRA helicopter, developed by engineer Dieter Schlüter, Mühlheim am Main, Germany, is the worlds first fully controlled model helicopter.

The development of this model began in 1967, and, at the time it seemed impossible to build a model of a full sized helicopter and control it the same as the full scale conterpart.

As there was no knowledge about the drive, the control system, and the flight characteristics, many experiments had to be made to find the problems involved in the development of a model helicopter.

After many, many attempts, in 1969 the control system which is now used on the BELL HUEY COBRA was developed. In January 1970, the first real controlled flights took place.
In March 1970 the first BELL HUEY COBRA was ready for take off. This prototype had a balsa fuselage, a worm gear, and after some flight time, other problems developed. In addition, the pilot was like a fish out of water, and to learn how to fly the helicopter.

Only a few months later, on June 20, 1970, Dieter Schlüter marked a new world's record of 11,5 kilometers while flying in a circle, with a total time of 27 minutes 51 seconds. This was a recognized official world's record.

After this achievement, Schlüter, a successful automotive engineer, received many requests for complete helicopter kits. Until the end of 1971, some 100 home made helicopter kits were distributed all over the world, and they were flying!
The increasing demand on one end, and the problems of mass production and distribution on the other, lead to the relationship between engineer Schlüter and the Schuco-Hegi model building firm of Nürnberg, Germany.
The entire drive mechanism was now reworked as a result of the previous experience. It was improved and modified to the requirements of mass production. The components for the mechanical drive system are produced by Eng. Schlüter in association with the firm, Präzisionswerkzeugbau, Georg Meindl, Inh. Robert Kunz, located in Bergen (Bavaria).

The components are then distributed by Schuco-Hegi, Nürnberg. This is the complete mechanical universal kit, Hegi No. 201 400. The firm of Schuco-Hegi, Nürnberg, is the exclusive distributor of the mechanical parts, and under the exact specifications of Eng. Schlüter, produces the ultrafab kit of the BELL HUEY COBRA, Hegi No. 201 410.

TECHNICAL INFORMATION

For a better understanding of the mechanical drive, and the control system, some information is now given.

Motor

For power, any modern .60 engine is qualified. Preferably, engines with a crankshaft diameter of 8 mm (1/4 "), as the cooling fan is made to fit this most standard size motor. Of course it is possible to use an engine with another size crankshaft, without the necessity of reworking the engine. You may use rear valve and front intake motors. To get a good flying model, it is only necessary that your engine be equipped with one of the new throttles. In the original, a Veco 61 with a Perry throttle (Hegi No. 215 150) was used.

Cooling

As a helicopter engine does not use a propeller, and the motor is housed inside the fuselage, a special cooling system is necessary. In hovering flight, where there is no forward speed and therefore no air cooling, the cooling system must be very effective. On the other hand, the cooling system should not take too much power away from the motor. The radial cooling fan of the BELL HUEY COBRA, with its special housing, has proved the best. With this new housing, and if you are using a front intake engine, it is possible to remove the engine without removing the housing.

Starting

To start the engine, a V-belt which fits into the flywheel of the cooling fan is used. We recommend you use an electric starter, however, it is possible to use a longer V-belt and start the motor by hand.

Clutch

The motor and main gear are connected by a centrifugal clutch. This clutch allows easier starting because the main gear and clutch are not engaged while starting the motor. Since clutch and gear are not engaged at this point, the drive shafts are also disengaged from motor power. The totally new developed clutch is self enclosed, and requires no servicing. It begins a "soft" engagement of motor and main gear at 3500 rpm's and continues its functioning without slipping.

Main Gear

The high rpm's of the motor must be reduced for driving of the main rotor and tail rotor. This is the function of the main gear, especially developed for the helicopter. Important for a main gear is its degree of effectiveness, which is necessary for little loss of power. This is accomplished with the use of special cog wheels, and the placing of all gear shafts in high precision ball bearings. The main gear is self enclosed and runs service free in oil bath. The oil level is easily checked and controlled, as the gear housing is transparent. Having the gear housed is necessary, as the dust produced by the rotor in hovering flight would harm an open gear.

Drive

All parts including engine, cooling, fan, clutch, and main gear are integrated and mounted on the base plate. This assembly is done outside the fuselage, so that any eventual inaccuracy, in the building of the fuselage will have no effect on the drive unit when installed. It is also possible to use this unit in another fuselage.

Tail Rotor Drive Shaft

The flexible shaft which drives the tail rotor may also be installed in other fuselage forms. The guide for the drive shaft is a thin brass tube which has proved to be very functional. The drive shaft is greased with normal car grease before installing.

Tail Rotor

The tail rotor gear serves as the drive for the tail rotor which corrects the torque of the main rotor and allows movement of the model around the vertical axis. The tail rotor gear is capsule enclosed and contains special, lightweight, ball bearing angle gears and cog wheels. The connecting mounts of the tail rotor blades move very easily because of the miniature ball bearings, and allow easy movement even at high rpm's and corresponding centrifugal force. Changing the pitch in the tail rotor blades is done by a pushrod which slides in a shaft and is guided through a control guide slip free. By modifying the control guide, the tail rotor controls may be used in other model forms.

Main Rotor Shaft

The main rotor shaft (mast) couples the main gear to the main rotor, and is made of high quality steel which is tested for precision roundness. There are special ball bearings at the top of the fuselage, but for service or repair, the shaft can be removed without disturbing the other components.

Swashplate

The swashplate is at the fuselage top and transfers controls for the forward and backward, left and right movement from the servos (which are mounted in the fuselage), to the turning counterparts of the main rotor. The swashplate is contained slip free in a special ball and socket joint, and fitted with an additional ball bearing.

Main Rotor

The main rotor consists of a hub, which connects the main rotor shaft with the rotor head, the upper cardan unit, the control system, and the blade mounting. All moving parts in the rotor head are assisted by ball bearings. All the materials used, have been carefully selected so they provide the necessary strength.

Main Rotor Blades

The main rotor blades have a special, tested airfoil (Clark-Y). Very important in the selection of the airfoil was the simple production, due to its flat bottom, and also the strong possibility of eventual warping, and the incidence. Two blades are necessary for each model.

The blades are already glued and shaped, and the mounting holes are drilled. The foil, when applied, makes for a very fine finished surface on the wood. The blade itself has a hardwood leading edge, and a balsa trailing edge. This makes possible: 1) an exact mounting on the rotor head. 2) a strong rigid mounting and 3) a good laying for the center of gravity in the airfoil. The additional effort of applying weights in the nose of blade for obtaining a more forward center of gravity is not necessary with this airfoil.

Fuselage

The fuselage of the BELL HUEY COBRA is made of fibreglass, and is already finished. For the installation of the various mechanical parts, the fuselage is reinforced with formers and longerons. The guide tube for the tail rotor drive shaft is installed in the fuselage. The canopy is also reinforced with formers, and is removeable. This is necessary for installing the RC gear and starting the engine. The slim, relative high form of the fuselage gives first, good mechanic strength, and second, good aerodynamic qualities. The fixed stabilizer is exact in size and incidence, and serves for stabilization on fast forward flight.

Training Landing Gear

The special training landing gear was developed for trimming the helicopter, and for pilot training. The gear has proved very functional as it comes in the kit. With coil springs on both main gears, and the rubber shock absorbing bumpers of the main gear struts on the fuselage bottom, plus the long, flexible action of the nose gear, even hard landings from 2 meters high are possible without damage. The wide spread of the training gear will allow a lopsidelanding, and as the gear has wheels, you can also land while going forward as you do with an airplane.

Landing Skids

The skid landing gear is also of rugged construction, and will take a lot of punishment from rough landings. However, you are strongly advised to use this gear only when you have learned to be absolutely exact when you fly and land the helicopter. If this is not the case, this gear should only be used when you exhibit the model and because it does not require as much room as the training landing gear.

Fuel Tank

A 500 ccm fuel tank (Hegi No. 217 961) is installed across the inside of the fuselage behind the main landing gear so that it is fully exposed on the left fuselage side. This permits watching the fuel level while flying.

RC Gear

Any good, modern proportional RC system with four channels is okay. Exceptionally strong servos are not necessary because of the small amount of force required to move the controls. The installation of the RC gear is done after removing the canopy, and the exact location is determined by the center of gravity. The four servos are also mounted in the fuselage and connected to control surfaces with the usual links and bellcranks. The special control rod for moving the tail rotor and other controls of the mechanical parts are included in the kit.

CONTROL SYSTEM

Before the control system is explained in detail, we will now explain the system in general. By turning the positive angled main rotor blades, the air is absorbed and pressed down. Depending on the size of the rotor, the rpm's of rotor blades, the blade incidence, and the airfoil, a certain lift is produced. If there is more lift than the weight of the helicopter, the helicopter moves upward. If the lift is the same as the weight, it keeps the height it has. If the lift is less than the weight of the helicopter, the helicopter sinks. In each case, the needed lift is regulated by changing the incidence (collective blade adjusting), or by changing the engine rpm's.

For changing the rotor blade incidence (collective pitch adjusting), push rods and linkage are necessary. When the lift is controlled by changing the engine rpm's, these parts are not used. With every change in the blade incidence, a change in the engine rpm's is also necessary due to different air resistance. When the lift is regulated by engine rpm's this procedure happens automatically when you give the engine more power or when you reduce the power.

To drive the main rotor, power from the motor is necessary. This motor power leans itself on the fuselage of the helicopter. This makes the fuselage want to turn in the opposite direction that the main rotor is turning. If for instance the main rotor is turning to the right (clockwise as seen from above), the fuselage will turn to the left. This rotation around the vertical axis is prevented by the tail rotor. The tail rotor works similar to a normal aircraft propeller in that it pulls the tail of the fuselage and therefore balances the torque of the main rotor. Because this turning is always changing, depending on the incidence of the main rotor blades, the thrust of the tail rotor must be changeable as well. So, the incidence of the tail rotor blades is also adjustable. When adjusting the pitch of the tail rotor, this side thrust also serves for turning the entire fuselage around the vertical axis. (Direction changing of the fuselage).

When using the collective blade adjusting, any change in the lift will cause a change of the torque. This means the fuselage has a different pull around its vertical axis, and requires exact regulation or adjusting in the pitch of the tail rotor.

In addition, any adjusting of the main rotor incidence will require adjustment of the motor power.

On the other hand, if the lift is not controlled by changing the blade incidence, but by varying the motor rpm's, you don't have all these problems. When you open the throttle, the motor rpm's increase, and with it, the motor power. The increasing torque is balanced out automatically by the tail rotor, because it gets more rpm's, and this produces more side thrust.

Applied to a model, and especially to the BELL HUEY COBRA, this means: Vertical movement is controlled by only one channel, and that's the motor throttle. By opening the motor throttle, the motor power and the motor rpm's increase. At the same time, the tail rotor rpm's increase as well, and that provides the harmony of a constant balance in the increasing "fuselage torque".

All of this is dependent on a exact aerodynamic turning of the main and tail rotor, which to develop, took much time. For this reason, it is not good to make any change in the airfoil or the incidence. You only trim the tail rotor one time so that the proper direction of the machine is kept, thus preventing it from turning around the vertical axis.

If now you open or close the throttle steadily, the torque is balanced automatically. This means that the fuselage will not, or only slightly, tend to turn around the vertical axis. Now, if you want to change the fuselage direction by turning it on its vertical axis, this is done by changing the tail rotor incidence. You do the same thing if you have to adjust to wind, etc.

The motor throttle control is done by channel 1, the best longitudinal movement on the left transmitter stick. The tail rotor controlling is done by channel 2, the cross movement of the left transmitter stick. The stick, when moving to the left, will reduce the tail rotor incidence and turn the fuselage nose to the left. Move the stick to the right, and the fuselage nose goes to the right. The neutral position must be trimmed so that with a steady throttle opening, the fuselage does not move around vertical axis. (Wind however, will affect this).

Do not confuse <u>fuselage direction</u> with <u>flight direction!</u>
The flight direction of the helicopter is not controlled by the tail rotor, but nearly exclusively by the main rotor.

For a better understanding of the main rotor control, read on:
The turning rotor blades produce a certain lift which must be equal to the helicopters weight for hovering. The area of the turning rotor blades is called "rotor circle area". If this circle area is exactly horizontal in the air, an exact vertical thrust is produced and the helicopter will hover over one certain point. If the circle area is dipped in another direction, (by an outer influence, or by a control movement) an additional thrust takes effect in this direction, producing a corresponding acceleration in the direction the rotor axis is dipped. Here it is important you remember that there is no prefered direction for the main rotor system. The main rotor may be dipped in all 360 degrees!

The dipping of the main rotor on the BELL HUEY COBRA is done by <u>cyclical blade adjusting.</u> This control movement is transfered to a so-called swashplate in the rotor head. The swashplate is connected to two servos. One causes the swashplate to dip forwards or backwards (flight direction), and the other to the right or to the left. By moving both servos, a dipping of the swashplate in any 360 degree direction can of course be accomplished. The control of the main rotor is obtained by a certain connection between the upperturning part of the swashplate, and the pushrods that lead to the blades of the main rotor.

This control mechanism is built so that the rotor area keeps the exact same plane as the swashplate. In other words, if the swashplate is dipped 3 degrees forward, the rotor area also dips 3 degrees forward. The swashplate moves in all directions. The servos for the swashplate are controlled by channels 3 and 4 on the right stick of the transmitter. When the stick is neutral, the swashplate is exactly horizontal at a 90 degree angle to the main rotor shaft. If the right stick is moved forward the swashplate dips forward. When the stick is moved backwards, the swashplate dips backwards. If the stick is moved right or left, the swashplate does the same. The point is, the swashplate moves in any 360 degree direction.

In every case, the movement of the stick (and with it the swashplate) causes an acceleration in the direction the stick is moved.

The BELL HUEY COBRA has a rotor head with cyclical "over controlable" gyroscope stabilizing. This is described as follows:

A dipping of the main rotor area in a certain direction is not accomplished by dipping the entire rotor head, but by so-called cyclic blade adjusting. This cyclic blade adjusting is not to be confused with collective blade adjusting, by which the incidence of the two rotor blades is adjusted in a positive or negative direction. (And also the before-mentioned torque changes).

With this control system, the two rotor blades are of course rigidly connected to the main rotor hub. Each rotor blade has a measured positive incidence of 4 degrees. If the hub is dipped to the side, the incidence is increased on one rotor blade, while the incidence is decreased on the other, the same amount. For example, one blade has an incidence of only 3 degrees while the other now has 5 degrees, however, the sum of the two is still 8 degrees and therefore, the sum of blade resistance and the resulting torque is constant. Only, the blade with the least incidence will of course have less lift, than the blade with the most. This means a corresponding dipping of the entire rotor system, because, the blade with the most lift will go more upward, while the blade with the least will go down. This cyclic blade adjusting of the main rotor blades is done by the stabilizer bar where two small, but relatively heavy, stabilizers are mounted.
When the swashplate is on a horizontal bearing, the stabilizers run in a neutral plane and have the effect of a stabilizing gyroscope. The stabilizer bar is therefore kept on a certain horizontal plane by the weights. Because the rotor blades are angled (4 degrees incidence) to the stabilizing bar, they run on the same plane as the stabilizing bar. If now the swashplate is dipped forward, then the pushrod on the stabilizer bar causes the bar to twist. This causes one stab blade to have positive incidence and the other to have negative. Before, the stabs were only used as weights, but now, they have a control function. The stab with the positive incidence will go up, the one with negative incidence, down. This means a change in the running plane of the stabilizing bar until it runs parallel to the dip of the swashplate. The stabilizing bar now controls the main rotor blades until they reach the same dip as the swashplate. If the swashplate is now moved in a rectangular position to the main rotor shaft, the cyclical adjusting of the stabilizer-control keeps its plane, and at the same time, the main rotor system stays on the same plane as the stabilizers. A change is made only with a new control movement of the swashplate.

BUILDING INSTRUCTIONS FOR FUSELAGE

Be sure to follow the plans exactly. Parts are numbered, and the building sequence is done accordingly.

Place the fuselage (1) on the plan and use a square to be sure you have exact alignment with the plans. Mark the position of the formers on inside of the transparent fuselage with a felt pen or soft lead pencil. (Fig. 1).

Now place bottom of fuselage on the plan, and again make sure it is aligned. Place bottom longerons (2) in the correct position in the bottom of fuselage, and mark the former positions on the longerons. Also mark the front edge of the former positions on the inside bottom of fuselage. (Fig. 2).

With a balsa plane, shape edge of the bottom longerons (2) so you have a good, clean fit with the fuselage. (Fig. 3).

Included in the kit is a large pack of stabilit express (epoxy). Now put 5 measures of powder into the mixing well (marked 5), then fill the remainder of well from the stabilit tube. Mix well.

Put a generous amount of epoxy on the inside of the fuselage bottom, and press one longeron (2) into its correct position. Clamp with clothes pins if necessary. Now do the other longeron the same way. (Fig. 4).

Nail rear former (3) on the end of a long strip or dowel. (Fig. 5). From the front of the fuselage, push former (3) into correct position in the rear of fuselage. The fuselage is somewhat flexible, and by working it with your hand, former (3) is easily fitted into its proper position (Fig. 6). When former (3) is in the tight fit position, remove the strip or dowel from the former. Now, with a small piece of wood, epoxy former (3) to fuselage from the rear opening (this opening is left open for now). When epoxy is cured, remove nail.

Drill a 6,5 mm hole as marked, in former (4) for the tail rotor drive shaft guide tube. Epoxy former (4) into position. (Fig. 7).

Guide tube (5) is now bent to exact shape as shown on plans. Do this carefully so the flexible drive shaft (301) will turn freely and not bind. (Fig. 8).
Insert tube from the back of fuselage through the top slot in rear former (3), and slide the tube to the front through the hole drilled in former (4).

Measure the correct distance from the front end of tube to former (4). When exact, epoxy the tube to former (4).
Between formers (3) and (4), epoxy a piece of fibreglass (appro. 5 x 8 cm) over the tube and to the bottom of the fuselage as shown on the plans.

Check the position of the tube at former (3), when correct, epoxy tube to former. The small support former (30) is later fitted here (Fig. 9).

Drill two holes (2,5 mm) as marked, in former (6). Fit and epoxy into fuselage. (Fig. 10).

Now shape longerons (7) as per plan, and fit into fuselage between formers (4) and (6). If necessary, shape for a good fit along the inside of fuselage. Do not glue. (Fig. 11).

Longeron (9) is also shaped on both ends as per plan. Together with former (8) fit into fuselage. If necessary, round the outside of longeron (9) so it fits neatly in fuselage. Do not glue! (Fig. 12).

Now fit formers (10 and 11) at their positions. Do not glue. (Fig. 13).

Now the frame work, which is temporarily positioned, is fitted in the fuselage exactly as marked. Epoxy the frame work together. Do not epoxy frame work to fuselage! (Fig. 14).

After the epoxy has cured, separate the fuselage sides from the frame work by using wooden wedges. (Fig. 15).

STOP! Read the following instructions and study the pictured illustrations before you proceed!
The longerons (7) and (9) are to be epoxied to the fuselage sides. At the same time, the upper part of former (11) is to be epoxied behind the fuselage top. Also, all other formers must be epoxied to the fuselage sides. You cannot do all of this in the short working time of Stabilit-Express. Therefore it is suggested that you use an epoxy with a longer working time (Stabilit-Ultra). Now proceed as follows:

Stabilit-Ultra is applied to inside of fuselage opposite longerons (7) and (9) which are separated from fuselage by wedges. Then remove wedges and pin fuselage sides to frame work. Now epoxy all formers (8), (10) and (11), to fuselage, additional epoxy along the longerons where they join the fuselage is suggested. Do not close the holes for the pushrods or fuel line. (Fig. 16).
Fit the support formers (12 left) and (13 right) and epoxy them between longerons and in front of former (4). Reinforcement (14) is now epoxied into the fuselage dome with Stabilit-Express (Fig. 17) and (18).

Drill 5 holes of 3,5 mm Ø into support for tail rotor gear housing (15) and epoxy it into the recess of right fuselage fin. Use plenty of epoxy, and be sure the holes in the support are properly positioned (Fig. 19).

Drill 3 holes of 2 mm Ø into tail gear support (16) as marked. Slip tail gear (17) with angled part into support (16) as shown on the plan. Insert two cotter pins over gear and through the support. Slip on the washers, and bend the cotter pins flat on the top side of support (16). (Fig. 20). Epoxy this unit to the inside back bottom of fuselage. Use plenty of epoxy and reinforce further with fibreglass (4 x 6 cm).(Fig. 21).

Put fuselage on the plan and align. Make the cutout for the tail rotor pushrod guide tube. Slip the guide tube (18) through the cutout and through the holes in formers (3) and (4) on the right, and along longeron (7) through formers (8), (11) and (10).

ATTENTION! The upper right openings in formers (8) and (11) remain open. Epoxy the guide tube in this position to the formers mentioned, and to the right side of the fin (from the inside) with Stabilit-Express. (Fig. 22).

Epoxy and fit parts (19) and (20) in place on the fin. (Fig. 23). Be sure the fin is not warped.
(Note: The support former (30) is put in place later.)

Now cut out the slots in the left and right side of fuselage for the stabilizer. Slip the stab through the slots, align it in the center, and epoxy to fuselage from the outside. Make sure it is not forced through the fuselage. (Fig. 24).

Canopy Assembly

Cut longerons (21) so they lay flat on the fuselage cutout and be sure they fit exactly on the front and rear. Now fit formers (22) and (23) to longerons (21) and fuselage. Sand an additional 0,5 mm from formers (22) and (23) to compensate for thickness of the canopy. Glue these parts together and glue gussets (24) and (25) in place. Longerons (21) are not shaped so far, but when glue is dry, shape the longerons as per for the form of fuselage. Drill the holes for the dowels in formers (22) and (23), and through fuselage formers (11) and (6). Remove canopy frame work from fuselage and glue dowels in place. (Fig. 25).

Now the snap fastener (27) is screwed to former (6). To do this, the inside edge of the fibreglass fuselage above former (6) is cut out the width of the fastener so the fastener is flat on former (6). Now fasten to former (6) with two bolts M 2 x 10, washers, and nuts. (The large hole is for the dowel).

After painting the frame work as desired, glue canopy to frame work with VHV-Hart or Stabilit-Dur. (Fig. 26).

Drill two holes of 5 mm Ø in the lower fuselage front for installation of tubes (29). Epoxy tubes in position as per plan. (These tubes are needed only for training landing gear). If you use the landing skids, it is not necessary to install tubes. (Fig. 26). If you wish to make a scale cabin interior, study photographs. The cabin sides and bottom are made from balsa. (Fig. 27) and (Fig. 28).

Check again and see that all parts are well glued and epoxied. Make cutouts in fuselage as follows: The left and right side of tank reinforcements (12) and (13). It is also necessary to cut away 5 mm from left longeron (7). (The tank shown on the plan is Hegi No. 217 961). If another tank is used make the cutouts in fuselage accordingly.
In any case, it is important that one end of the tank can be seen from the outside so the fuel level can be checked. (Fig. 29).
Now the excess of the fuselage bottom between formers (4) and (10) and longerons (2) is trimmed and sanded neatly. A hole 15 mm Ø is drilled in the exact middle of vault in fuselage dome. The jet intakes may also be cut out, but for better stability of fuselage dome, you may not wish to make the cutouts. The opening for the tail rotor gear is now marked and cut out as per plan. 5 holes (3,5 mm) are drilled in reinforcement (15).

Now support former (30) is slipped over guide tube of the tail rotor shaft for alignment. Insert flexible shaft into guide tube (5) from the front. The tail rotor gear box with coupling, is inserted through fin cut out and fastened to flexible shaft. Use 4 self taping screws found in mechanical kit, and temporarily mount tail rotor gear box in correct position. The gear box is aligned exactly with flexible shaft and tube. When exact epoxy former (30) to tube and inside of fin, using plenty of Stabilit-Express.

Important! Be sure no epoxy gets inside guide tube. Insure by using masking tape. When epoxy has cured, remove gear box until final assembly to avoid damage caused by sanding and painting. (Fig. 30 and 31).

Now we suggest you temporarily install the entire mechanical system as directed in assembly of mechanical kit.

Installation of RC

The RC installation is done according to recommendations of the manufacturer, and is dependent on size of servos, receiver and power-pack. The position of pushrods, and the location of bell-cranks can be seen on the plan. Be sure pushrods move easily, but without play. It's a good idea to install the radio gear, and especially the servos temporarily.

Painting

Before painting, all mechanical parts are removed. The guide tube for the tail rotor shaft remains in the fuselage and each end is closed with tape. The bearing ring for main rotor shaft which is epoxied on fuselage top is also protected with tape. Now sand entire fuselage using fine sandpaper for better paint adhesion. Apply a primer (not too much) then carefully sand as necessary.
The fuselage is now painted with a good enamel based paint. For a better finish use a spray gun. Don't forget to paint the formers and longerons around motor and drive unit, so no oil is absorbed by the wood. The final finish and trim can be seen on the photographs. This also applies to the cabin interior. Special decals are included in kit.

Final Assembly

If you have not already done so, epoxy the bearing ring and ball bearing in position on fuselage top before the final installation of mechanical components. The mechanical systems are assembled and installed as per instructions. In addition, all controls between swashplate, tail rotor, engine throttle, and corresponding servos are also installed.

Training Landing Gear Assembly

The assembly of the main gear and nose gear is now completed. The correct method of assembly can be seen on the plan, and the photos:

(Fig. 32)	Front gear parts.
(Fig. 33)	Front gear assembled and attached to fuselage.
(Fig. 34, 35)	Assembly of main gear struts of left landing gear.
(Fig. 36)	Upper coil spring.
(Fig. 37)	Complete assembled training gear.

BUILDING INSTRUCTIONS FOR MECHANICAL KIT

All parts of the mechanical kit can be assembled by the average modeler, using his normal tools. All holes are predrilled except those which must be drilled at time of assembly, where special fitting is required.

While assembling the mechanical parts, it is important that you follow the suggested sequence according to instructions. Please do not alternate because it could effect the function of the model.

The number refered to in the instructions coincides with the part number as shown on the parts list.

Main Rotor Assembly

From small parts box No. 1, take two ball bearings (503) and two socket head screws (033). Screw ball bearings into stabilizer hub (500). You will find the necessary socket head wrenches in the kit. Insert one washer (002) between each screw and ball bearing. Now be sure the screws are tightened well. (Fig. 38).

This unit must be pressed from the top, into the cardan shell bottom (502). Two ball bearings (503) are now fitted on the stabilizer rod (505), and then inserted into place in the cardan shell.(Fig. 39).

Slip on the second cardan shell (502). Insert four bolts (032) from the top through both shells, and tighten with four nuts (011).
Attention! Nuts and bolts must not be tightened too much. (Fig. 40).
Slip collar (506) on the one side of stabilizer rod. On the other side of the rod, the control link (507) must be slipped on so the ball part points to center of rotor. These parts should be fastened with socket head screws (041) to the middle of the stabilizer rod, but not yet adjusted. (Fig. 41).

Mount stabilizers (508) on the outer thread of the stabilizer rod. Align both so that one has the trailing edge down and the other has trailing edge up. Now fasten with socket head screws (041) to secure on rod. (Fig. 42).

Now balance stabilizer unit on the rotor head by sliding stabilizer rod back and fourth. (Fig. 43).

Prevent rod from slipping by fastening collar (506) on one end, and control link (507) to the other. The control link must be exactly parallel to the stabilizer. Test the balance again, if not balanced, there will be a vibration in the rotor motion. (Fig. 44).
Put main rotor hub (501) on the bottom of the cardan shell with four bolts (032). The rotor hub is curved slightly upward to give dihedral to the rotor blades. Fasten the rotor hub securely with four lock-nuts (012). Make sure the bolts are tight!
From small parts box No. 2, take rotor blade mounts (504), socket head bolts (031), and lock-nuts (012). Assemble the mounts temporarily. Very important! The centrifugal force of the rotor blades is extremely high, therefore, use only these parts. (Fig. 46).

Covering The Rotor Blades With Self Adhesive Foil

Sand rotor blades slightly. Round edges, but under no circumstances should the air foil on the rotor blades be changed. Peel backing from foil, and lay foil on a flat surface with adhesive side up. (Fig. 47). Put curved area of rotor blade on the foil so that foil overlaps trailing edge of blade about 1 cm. Now press the blade on foil. (Fig. 48). Wrap overlapping foil around trailing edge, and on to the bottom.

Now wrap foil around the leading edge, and all the way to trailing edge. (A view of this is also shown on the building plan.) Now smooth out the foil on the entire blade, and make sure the foil sticks well on the trailing edge. (Fig. 51).

Rotor Blade Installation

Important! Again be aware of high centrifugal force on the rotor blades and use only the mounts (504), the special bolts (031) with nuts (012). (Nuts must be on top). Don't forget, the rotor turns ·lockwise.
Glue parts (56) and (57) together to be used as a pitch gauge for the main and tail rotor blades.

Fasten the gauge with rubber bands to the under part of rotor blade, and while tightening the three bolts, align the pitch gauge with the stabilizer rod. The best way is to put the pitch gauge on your work bench and check the exact horizontal position with the stabilizer rod.

Now tighten the two bolts on the main rotor hub. It is essential that the rotor blade is in the exact longitudinal line with the rotor hub. To make necessary corrections, you will notice that the outer holes are larger than the inner holes on the rotor hub. After the five bolts are tightened, check the pitch and alignment with the stabilizer rod again. Small adjustments can be made by bending the blade mounts (504). (Fig. 52).

Mount the other blade the same as the first, and check the pitch and alignment. While tightening the bolts on the rotor hub, be sure the stabilizer balances out horizontally. If not, the rotor blade should be turned and adjusted clockwise until proper balance is obtained. (Another reason the outer holes are larger on the rotor hub). Now tighten all five nuts and again check the rotor blade pitch with the gauge compared to stabilizer rod. Also be certain the stabilizer rod is in perfect balance. If not, do not adjust the rod, but move rotor blade in clockwise direction to obtain balance.

Put rotor head with stabilizer rod on two blocks of the same height, or between an open vise, so the rod can move freely, and the blades can swing without resistance. (Fig. 53). Now it will show that one blade is heavier than the other. To balance, cut a piece of foil of estimated size, peel off backing, and place, with the adhesive up, on the tip of the lighter blade. When you have the right amount of foil, stick it on the tip of blade.

Important! We suggest that you use foil (or plastic tape) of a different color than the tip of the other blade so you have a distinct contrast between the two. Later on, it will be easy to identify a blade that is not turning in a proper pattern. Please remember that exact balancing of the rotor head is very important to having a quiet and easily controlled helicopter. The work in aligning and balancing the rotor head must be done with extreme care, which in the beginning requires some attention, but later on, becomes routine.

Radial Cooling Fan Installation

Remove front nut and washer from Veco 61. Take parts out of box No. 3. Slide cone (104) on the end of crankshaft. Put cooling fan (105) on cone by using the original crankshaft nut and tighten. (Fig. 55). Be careful not to bend fan blades. Insert the centrifugal clutch (106) with needle bearing (107) into the fan opposite the engine, with two socket head screws (034). (Fig. 56).

Remarks: Should an engine be used that has a longer crankshaft, use washers (103) to compensate before you slip on the cone. In any case, be sure the threaded end of the motor crankshaft does not reach into the needle bearing of the clutch. The cone is made for a motor crankshaft of 8 mm dia. With a smaller shaft, a bushing adapter has to be made to fit over the shaft. With a crankshaft dia. more than 8 mm, the following is suggested. The cone should be fastened to the fan with epoxy. Now the pulley part of the fan should be mounted on a lathe so it is completely centered, and the glued cone can be carefully turned (not drilled) to the desired diameter. A punch tool will remove the cone from the fan, and after cleaning and removing the epoxy remains, it can now be installed on the crankshaft. It is important that the fan turns smoothly and not wobble, otherwise vibration will effect the proper function of the clutch.

Main Gear Box Assembly

Place the right side of the main gear housing (201) on the work bench with the openings facing up. The outer rings of the ball bearings on gearblocks (210), (220) and (230), must be cleaned with thinner or lighter fluid so they are free of grease.
Mix a small amount of Stabilit-Express and apply a thin layer in the half round grooves made to accept the ball bearing rings of upper gearblock (230), and middle gearblock (220). Press both gearblocks into the grooves. (Fig. 57). Now slide gearblocks so they fit together and match. The play on the gears should be appr. 0,1 mm. Let Stabilit cure while in this position and then check for proper function of the gears within tolerance. (Fig. 57). Mix more Stabilit and fix gearblock (210) into position. Align gears by rotating back and forth. (Fig. 58). After Stabilit has cured, check the function of the gears. Remove excess Stabilit, especially on the outer rings of the ball bearings, with a balsa knife. (Fig. 59).

Again mix Stabilit-Express. Apply Stabilit to the left main gear housing (200) thin, but evenly, on the facing and all six grooves. Attach the two halves by using six bolts (022), and nuts (011). Excess Stabilit should be removed with balsa knife after it has cured. (Fig. 60).

Important! Sealing of the gear housing and the fastening of the ball bearings with Stabilit-Express has proven the best in hundreds of tests, therefore we suggest that you not use other glue or gasket material for the assembly of the gear housing.

Now fill the gear housing with hypoid transmission oil SAE 90, which can be obtained from any gas station. The filling hole is on the side of the gear box. The oil level in the gear box, should not by any circumstances be above the filling hole. In general, the oil level should reach the top of the lowest square on middle part of gear box (where the clutch shaft turns).
The oil contents can always be checked through the transparent housing. It is important that the breather hole on the top of the gear box is not pluged up. The filler hole is closed with screw (025). (Fig. 61).

Power Unit Assembly

Take contents out of box No. 4. Mount the assembled gear box on to base plates (100) and (101), with four bolts (023) and nuts (011). The proper position of the right and left base plate can be seen in (Fig. 62).

The fan housing (108) is fastened with four screws (021) and washers (001) to the treaded holes in the base plate (Fig. 63). Slip the starter belt (109) over the pulley on the fan, and insert the power unit into the fan housing and clutch bell. (Fig. 64). Lay supports (102) underneath motor flange, align motor, and drill four holes (3,5 mm dia.) through supports and base plate. Mount engine with four socket head bolts (031) and lock nuts (012). Now fasten fan housing, and gear box. Be sure all parts are in alignment.

Important! The entire power unit must be cleanly bolted together and aligned exactly. When mounting the engine, be sure the exact width of the base plate is not altered. The protruding ends of the bolts used for mounting the fan housing will have to be filed evenly with the base plate. The plate will have to be flat to install in fuselage.

Tail Rotor Gear Assembly

Take parts out of box No. 5. (Note the washers and nuts below the foil). Insert the gear block with hub (321) into the gear housing (310) opening which is opposite the opening of the square part of housing. The gear block without hub (320) is inserted into the other end of housing. By sliding the gear blocks back and forth, a remarkable tolerance can be obtained. The hypoid gears must function exactly. After any adjustment has been made, enlarge the holes in the housing with a 2 mm bit and fit in four self tapping screws (042). Fill the gear box through the opening with car grease by using your finger, and then press cover (311) into place. (Fig. 66). With two socket head set screws (041) the brass coupling (300) is fastened to the tail rotor drive shaft (301). Tighten screws with wrench (1,5 mm). Now fasten the two ball bearings (316) to the hub on gear (321) with socket head screw (030). (Fig. 67). Slip the blade mount without arm (318) and the blade mount with arm (317) over the ball bearings (316) and fasten together with bolts (020) and nuts (010). Now fasten two ball joints. The bolts go through the balls, with the balls on the inside of the blade mounts, and facing the center of the hub. Fasten control plate (315) on to the shafts of the ball joints (050) by using two screws (020) and washers (000). Two bolts (023), four washers (001) and two lock-nuts (012) are used later to mount the tail rotor blades and should now be temporarily fastened to the nylon blade mounts. (Fig. 68).

Further assembly of this unit will be done on the fuselage. Insert the unit into the corresponding cutouts in rear of fuselage from one side, and fasten it with the two self tapping screws (043), and two washers (001) from the outside. Use only the top two holes on the square part of the gear box. Now the control rod (312) will be slipped through the control guide (313) slot, and through the hole in housing cover (311) and continue through the center hole of the rotor hub (321). The control guide (313) will now be fastened to the two bottom holes of the gear box by using two screws (043) and washers (001). After the guide is fastened, the rod will have some resistance in the guide slot. By moving rod back and forth, and with the help of oil in the slot, the aluminum will widen enough so the rod has easy movement without play. The rod must move freely the entire length of slot. (Fig. 69).

Now the rod will be guided through the hub (321). Slip a collar (314) over the rod, and guide rod through control plate (315). Finally, a second collar (314) will be slipped on the rod. When the rod is in center position of the guide (313), the pitch of the blade mounts should be appro. plus 8 degrees. This pitch will now be fixed temporarily by the proper adjustment of the collars (314). Exact adjustment will be made later when blades are mounted. (Fig. 70).

Important! Be sure the final position of the gear box is in perfect alignment with the drive shaft (301). This is explained in the fuselage building instructions.(Fig. 30 and 31).

Installing Drive Unit Into Fuselage

By using the bolts from box No. 7, the complete, assembled drive unit will later be installed in the fuselage. Insert the main rotor drive shaft (400) into the top clutch piece of the gear box outlet. A hole must be drilled in the fuselage top for the main rotor shaft (15 mm dia.). Now place the drive unit into the fuselage. (Fig. 71).

The drive unit has to be moved on the lower part of the fuselage until the drive shaft is in the exact center of the drilled hole. For exact alignment, the drive unit should be moved forward and backward, and if necessary, thin plywood pieces should be inserted between the base plate and the fuselage. The holes are already drilled in the base plate and have only to be marked on the fuselage bottom. Now drill eight (3 mm) holes for mounting the base plate. Fasten the base plate to the fuselage with eight bolts (024) and eight washers (002). It will be helpful to insert the bolts from the inside of the fuselage and epoxy them in place, therefore it is practical later on to loosen the nuts without turning the bolts, should it be necessary to remove the drive unit. While tightening the bolts, be sure the drive unit remains centered in the 15 mm hole in the fuselage top. If not, the support area on the fuselage bottom must again be corrected. This is most important, otherwise the drive shaft will be constantly strained on the lower support of the gear box. (Fig. 72) and (73). After installing the drive unit, the gear ring (401) and the ball bearing (402) will be slipped over the top of the main drive shaft. The support area on the fuselage dome will be covered with epoxy, and the bearing ring (401) pressed in place. By applying the epoxy (Stabilit-Express), any uneveness of the fuselage will be corrected, and the bearing is automatically aligned with the drive shaft. After the epoxy has cured, drill four holes (3,1 mm dia.) through the top of the fuselage. Fasten the bearing ring with four bolts (023), four washers (001), and four nuts (011). (Fig. 74).

Swashplate Installation

Take two control arms with ball joints (404) out of parts box No. 6. They must now be screwed into the outer ring of the assembled swashplate. The control arms must be screwed in all the way and secured with lock-nuts (011). The third control arm also has a nut (011) and is screwed 5 mm into the hole of the top bearing ring of the swashplate. Secure with nut (011). The ball of ball joint (050) will, now be slipped over bolt (020), and screwed into the 2 mm hole in the large outer ring of the swashplate. Now with the swashplate in this form, place over main rotor shaft so the small part of swashplate with collector pin faces up. The collector fork (403) is now fitted on the shaft so the recessed part of the fork faces down. The collector fork will be fastened temporarily with a socket head bolt (031) and lock-nut (012). The proper alignment will be done later.
The holding rod for the swashplate is made by using rod (405), and one ball joint with ball as shown in (Fig. 75). The ball of the rear ball joint will be fastened to the fuselage by using bolt (020), washer (000) and nut (010).

Remarks: Since the drive unit and the main rotor shaft have been installed, it is very difficult to put the nut on the bolt from the inside of fuselage for fastening the ball joint. Since the drive unit has to be removed later on when painting the fuselage, we suggest that a 2 mm hole be drilled and the joint be fastened after drive unit is removed.

Tail Rotor Drive Shaft Adjusting And Pre-Installment

The tail rotor drive shaft (301) is now temporarily inserted into the guide tube. Slip it in from the front. But do not apply grease as yet. Coupling (300) is fastened on the tail end of drive shaft, and connected to the tail rotor gear. The support former (30) which you have been saving, is now positioned on the guide tube. Fix the guide tube so the drive shaft and gear box are in perfect alignment. If necessary, the gear box should be adjusted with its fastening screws. Now epoxy support former (30) in place. Don't let epoxy come in contact with the inside of tube, or drive shaft. (Fig. 30) and (31).

Later on, drive shaft will be well greased, and grease will also be pressed into the guide tube. The shaft will be connected to the main gear and tail gear with two couplings (300) and four socket head set screws (041). At the final installation, be sure the shaft does not bind, it must turn very free and easy.

The final alignment of the swashplate, tail rotor and main rotor, is explained in flying and operating instructions.

ADJUSTING AND TESTING

Before flying the helicopter, the following basic adjustments must be checked again.

(a) Center of Gravity

The center of gravity should be appro. 5 mm in front of the main rotor shaft. (Empty Tank.) The easiest way to check the CG, is by inserting a rod through the top hole of the main rotor shaft (crosswise). The model should balance out slightly nose heavy. When the tank is filled, the model should balance out exactly horizontal.

In any case, better nose heavy than tail heavy. When testing for center of gravity, be sure the landing gears are installed. (Fig. 76).

(b) Swashplate

With the transmitter control sticks and trim levers in neutral, the swashplate should be in an exact 90 degree angle to the main rotor shaft. (Crosswise to flight direction). A slight dip (1 degree) is advised. (Swashplate dips to the right). It is also important that the lower control arms of the swashplate be aligned in an exact 90 degrees from the flight direction. Incorrect alignment can be adjusted by changing the length of the control arms. The collector fork is placed on the middle tube of the swashplate guide so it moves up and down, however final fastening of the collective fork will be done later. (Fig. 77).

(c) Main Rotor

The balanced and assembled main rotor is now put in place on the shaft and fastened with a 3 x 15 socket head bolt and lock-nut. The stabilizer rod should be in proper running position. The rotor turns clockwise as seen from the top. (Fig. 78). Connect the angled control arm of the stabilizer rod to the top turning part of swashplate. The top of swashplate is adjusted by moving the collector fork so the rod goes through the center of hole in the main rotor hub. When exact, tighten the collector fork. Both rotor blades must follow the center line of the fuselage while you check this adjustment. Now the control arm for the stabilizer rod must follow the center line of the fuselage, either in front or in back of the rotor shaft. Now, the length of the control rod between the swashplate and stabilizers are in exact horizontal position. (Fig. 78).

(d) Tail Rotor

With tail rotor servos neutral and trim neutral, the tail rotor push rod should be in the center of the slot of guide. Again be sure the rod moves freely in the guide by disconnecting the rod at the ball joint. Now adjust the two rotor blades to a 8 degree pitch by using the pitch gauge, with the center line of fuselage as reference. The pitch is adjusted not by changing the length of the pushrod, but by adjusting the collars on the outer end of the pushrod.

Refer to (Fig. 78). Note that tail rotor blades move to a minimum of 0 degrees when you give a control movement to the left (nose turns to the left). For a speed flight later on, it must move to appro. 2 degrees. If the pitch is not minimized to 0 degrees, a left turn at a slow forward movement is impossible. (Fig. 79).

(e) Engine Adjustment

Adjusting the engine throttle is done by hand since it can vary with different type engines and carburators. By moving the left stick on the transmitter backward, you should be at full throttle. When stick is neutral, the throttle is 1/3 open. The final adjusting will be done with the engine running. The needle valve should be opened about 2 1/2 turns if you use the suggested Veco 61.

(f) Fuel

Before starting the engine, there is one suggestion regarding fuel. The great amount of experience with many types has shown that the best helicopter fuel is normal fuel without nytromitham additives. The best are mixtures with mytanol 18 to 20 % castor oil, and a softer engine run will be accomplished by adding 3 % high test gasoline.

(g) Engine Starting

An electric starter with a flywheel is the best way to start the engine. If you intend to make a starter, be sure to use the proper dimensions for the flywheel. The outer diameter is 28 mm, the thickness about 5 mm, the V-groove some 36 degrees, and 6 mm deep (Fig.80) Pull the drive belt out of fuselage. It should be slung around the flywheel on the fan and the flywheel on the starter. Press downward on the starter to tighten belt. Now turn switch on, and the motor should be turning. Be sure it's turning in the proper direction. Connect battery to glow plug, and fuel line to tank. Now choke the engine slightly to draw fuel. The motor should not be on full throttle while starting. The best setting is a slightly increased idle. Hold the rotor head while starting the engine because the clutch will start engaging at higher rpm's. When engine has fired, remove starter and push belt back into fuselage. Should the engine run at high rpm's the first time, don't let go of the rotor blades and set engine to idle as soon as possible. This prevents overheating and unnecessary wear on the clutch. After engine is adjusted to proper idle, the clutch is disengaged and the rotor should not turn. However it takes a while for the main rotor to stop turning. <u>Do not stop the main rotor suddenly as it could easily change the pitch of the blades.</u>
Should the engine be hard to turn, which happens with a new engine or an engine that has not been run for a long time, lower the compression by loosening the glow plug about 1/2 turn. But don't forget to tighten plug when engine fires. A new engine can be "broken in" installed in the helicopter. This is okay, because the engine almost never reaches its full rpm's and therefore runs cool. At first, we suggest you fasten the model to the ground and let the rotor turn as it will. Now, with a rich setting, adjust the throttle. An exact idleing is not obtained right away.

(h) Engine Setting

Assuming the engine is fairly broken in, we will now adjust the engine to full throttle. Hold the model to the ground by the landing gear, or put model on a table and let someone else hold it. With the tank half full, full throttle should be given (but slowly, please!) At full throttle, a remarkable amount of smoking occurs. (This means it is over rich). Keep engine at full throttle for a minimum of 30 seconds and notice that engine does not loose rpm's. If it does, the needle valve is set to lean. It is best to follow the engine manufacturers suggestions. The idle setting does not effect the actual flying, however, it can influence the disengagement of the clutch. The idle should not be too rich so you will have a good change from idle to full throttle. Especially since later on, most of the flying will be on the inbetween area. Full throttle is seldom used. In general, relatively hot glow plugs are best, however this depends on fuel and engine.

At this time an important point must be made for the safe operation of the helicopter. At all tests with the helicopter, one should always remember that turning rotor blades have a momentum that can not be underestimated. While hovering, the rotor turns at about 1000 rpm's. This means a circular speed on the tips of blades of over 300 kilometers per hour. At full performance, the blade speed is close to 400 km per hour. The centrifugal force on each rotor blade at that speed, weighs 50 to 60 kilograms (more than a sack of cement). Therefore, when operating a helicopter the main rule should be: To use only original parts for rotor connections, rotor head, and blades. Only this way can you be sure that safety is maintained due to proper installations.

All plate connections must be inspected once in a while, nuts and bolts must be inspected, and in case of doubt, change them!

Beginners, in particular, should never fly close to spectators. Get rid of children and curious people. Never, ever, fly over spectators!

(i) Checking Alignment

The main rotors must, at full speed, turn on the same level. To check this, one tip must be marked with a contrasting color of foil. (See also: balancing of the rotor blades.) To check this alignment, rotor blades must be turning as fast as possible. Tie the model down, or hold down by the tail. From the side, look at the tips of the blades. Now you can see if blades are turning at the same level as the colored tip will identify the blade that is not proper. A difference of 5 mm can be disregarded. Should the difference be more, it must be corrected, otherwise there is a loss in the steering ability of the helicopter. When you see that a level difference is more, it must be corrected, otherwise there is a loss in the steering ability of the helicopter. When you see a level difference, the rotor must be stopped (or, idle motor, and let the rotor stop by itself). Use the pitch gauge and check if the pitch of the lower running blade is below 4 degrees in reference to the stabilizer rod. If below 4 degrees, the pitch must be increased. If more than 4 degrees, it must be decreased. (Fig. 81). The change of pitch should only be done by bending the rotor blade mounts. Never bend the aluminum rotor head hub. To bend the rotor mounts, use a pair of pliers from the leading edge side, and counter act with a screwdriver in the hole of rotor hub. It is seldom necessary to bend the mounts, but it should be checked often in the beginning, until experience is gained. (Fig. 82).

In almost every case, any level difference is caused by rotor blade pitch. It is of course assumed that the blades are balanced. When both blades have been adjusted to proper 4 degree pitch, it is still possible the level varies. The centrifugal force can cause a small, but remarkably easy change in the level alignment. And added to this, a small possible difference in the airfoil of the blades. The rotor blades are made of wood, and even though they appear the same on the outside, they may not have the same elasticity, or take the same amount of strain. It can also happen that the pitch gauge shows that pitch is different even though blades run on the same level. This is not important. It is important that the blades run level when turning at high rpm's.

(k) Trim of the Tail Rotor

Now we are at the point of the test flying where the tail rotor must be trimmed. The model should be placed on ground as even as possible, and slowly but evenly, accelerate the motor, but be careful the model does'nt lift suddenly. This is especially important when there is wind, at the time first flights are made. A certain amount of head-wind will increase the lift capability of the main rotors and cause an unwanted liftoff. This will later be explained more fully. To adjust the tail rotor, only enough throttle should be given, so model becomes light, and starts to "swim" on its landing gear. The nose of the model must always be pointed into the wind. At this point, you can tell whether the model has a tendency to turn right or left. In other words, changing its course. If you have followed instructions, and the tail rotor is properly aligned, the trim on the transmitter should be sufficient to counteract any turning tendency. Whereas, hereby, and therefore, the following basic rules must be adhered to.

If the model turns its nose to the left, the pitch of the tail rotor has to be increased. Do this by adjusting the trim lever on transmitter to the right. If the model turns its nose to the right, adjust the trim to the left. Got it? The trimming of the tail rotor should be continued until the model has no tendency to turn when you open the throttle slowly and evenly. However, you should always be aware of the possible change in wind direction. The model will always tend to face the wind because of the influence of vertical fin. Should the trimming on the transmitter lever not be enough to adjust the tail rotor, then make corrections by adjusting the collars on the pushrod. Do not alter the rod between servo and tail rotor! The first few hovering flights are only to trim the tail rotor and get the feel of the model. Before you start the real test flying, please study the following basic rules.

BASIC RULES

Basic Rule No. 1

Never tether the model to the ground. The model should never be fastened to the ground with strings or similar devises. The model must have its freedom, only then the stabilization of the main rotor can work. Tethering the model would hinder the natural flying movement of the model, and totally unbalance the helicopter. Furthermore, this would require the pilot to maintain the most difficult of all flight positions, flying over an exact fixed point. This is asking too much!

Basic Rule No. 2

Keep nose of model into the wind! Always be sure, especially in the beginning, that the nose of the model is pointed into wind direction. Never try to take off with a crosswind, even if it seems easier or there is only a slight breeze. Even with correct tail rotor trim a light breeze will cause the model to turn after liftoff and an untrained pilot will find it difficult to correct this sudden turn. A liftoff with tailwind is worse because the model will almost always turn around 180 degrees and really confuse the pilot!

Basic Rule No. 3

Walk with the model. Especially in the beginning, always walk with the model. It is best to have the 'copter at two or three meters distance, (nose into wind) then slowly lift the machine and let it pick the direction it wants to go. Don't stand in one spot, instead, walk with the model always keeping your distance. You can observe the model if it is not too far away, furthermore, you can be sure you are looking the same direction as the model.

Basic Rule No. 4

Forget the tail rotor. That's right! Overlook the tail rotor completely during practical flight. Instead, keep your eyes on the middle of fuselage, and the nose of the fuselage. Just like a fixed wing plane, a left turn will be controlled by automatic reflex with the transmitter stick so the model goes to the right. An amazing number of pilots make the mistake of not controlling the model according to its flight direction, thus watching the tail rotor instead of the nose. If the tail turns to the left, a correction to the right would counteract. No! This incorrect steering should be overcome while hovering, until you master the model. No later than your first fly a round, and if the model is at a distance, this incorrect practice will lead almost certainly to a crash. Principally, the tail rotor has to be thought of as the rudder of a fixed wing model.

Basic Rule No. 5

Operate engine throttle slowly and evenly. Open and close the engine slowly and evenly because any change of rpm's will result in a change of torque. At a slow and even opening of the throttle, the rpm's increase on the main rotor and tail rotor at the same time, therefore, an automatic torque balance is obtained. (See explanation for control). A sudden acceleration will create a sudden, heavy torque change that cannot be balanced out by the tail rotor immediately. This could cause the model to turn around its vertical axis.

Basic Rule No. 6

Don't be afraid of attitude.

A certain attitude, or tilt, is much safer than a model which is without ground relation, it has no turning tendencies. However, one should always keep in mind that a helicopter will take the direction of the attitude and immediately accelerate. This acceleration in the direction of attitude, (attitude of the main rotor) can be very fast, which does not mean the model will turn completely on this attitude, but it's important that the landing gear does not catch on an obsticle on the ground.

Basic Rule No. 7

Practice hovering first.
This rule is important because it will save a lot of disappointment. Hovering must be practiced until the pilot is completely sure of himself, because, hovering is the start and finish of every flight manoeuvre. Furthermore, when hovering at a low altitude, any mistake you make can be corrected by simply setting the model back on the ground. If the landing gear ever catches on something and the model turns over, the worst that can happen is damage of a rotor blade.

Basic Rule No. 8

On touch-down at wrong attitude, cut throttle.
Especially while practicing hovering. In the beginning, control mistakes will happen, when it does, let the model down from low altitude. Cut the throttle slowly until the main landing gear reaches the ground. Even if the touch-down is made with model at wrong attitude, the model will fall back on its three landing pods if you cut the motor immediately (a good engine idle will now be appreciated). The reason for a sudden engine cut can be explained the following way: The model has a total flight weight of 4500 grams. Now you decrease the throttle and the rotor rpm's have a lift of only 4400 grams. The model lowers itself now 100 grams overweight. If the 'copter touches the ground with only one landing gear, the part of the models weight will rest on this one landing gear, for example, 300 grams. If the same rotor rpm's are kept, the main rotor then has an overlift of 200 grams. At a tilted position of the model, this would lead to the main rotor lifting the 'copter again and would pull it to one side. Added to this, comes the additional lift caused by it's being closer to the ground. (Ground effect). Again the suggestion: After a tilted touch-down, in case of emergency, cut the throttle so the 'copter will fall on its landing gear and not tip over.

Basic Rule No. 9

Watch the attitude of fuselage and main rotor.
The main rotor of a helicopter is controlled by the swashplate. This means the main orients itself according to the position of the swashplate. It is unimportant whether the swashplate is tilted by the control stick, or inclined because of a fuselage inclination. Consequently, the main rotor does not know the difference between a movement of the swashplate as a result of control, or by the fuselage attitude. This means: If the fuselage is level (horizontal), and the swashplate is dipped 3 degrees to the nose, the main rotor will also dip 3 degrees to the nose. This will lead to a remarkable acceleration forward. As a result of this forward acceleration, the fuselage will dip its nose. This dip can, as example, be 2 degrees. If you leave the original swashplate front dip, the 2 degree dip of the fuselage nose is added to this causing the swashplate now to dip 5 degrees to the front. (When you think of the original level before the control command was given). Therefore the rotor will follow the original swashplate movement, and from the original 3 degrees, will reach a dip of 5 degrees, which again would lead to a more, and normally undesired acceleration. To stop the forward movement now, it is not enough to bring the swashplate back to its original position. (Transmitter stick neutral). With the 2 degree forward dip of the fuselage, the swashplate also has a 2 degree forward dip. The main rotor will set itself now to the 2 degree dip, and the model will keep a slower, but forward, acceleration. In order to bring the model back into a neutral flying position, the swashplate must now overcome the 2 degree dip of the fuselage. To neutralize, it has to be moved 2 backwards. Not until now do you move the swashplate back to its original horizontal position. The main rotor will also be horizontal now, and not create further acceleration. To stop the forward movement, the main rotor also must be moved backwards. Let's assume the necessary move backwards is 3 degrees, and the fuselage has a forward dip of 2 degrees, the swashplate must be moved back 5 degrees by the transmitter stick.

Basic Rule No. 10

Don't be afraid.

Don't let the previous explanations confuse you. To control a model helicopter is a little complicated, but it sounds worse than it actually is. Hardly anybody today has a serious thought about the different forces working on a normal fixed wing model. When, for example, up elevator is given. The difference is only that today, in general, not much is known about the flying technique of a model helicopter and sometimes imagination exists which is altogether wrong. These detailed explanations are purposely made to make you very familiar with your helicopter.

PRACTICING

The training landing gear is installed. The rotors etc. are properly checked and adjusted, the engine runs, the main rotor level is correct. The tail rotor is already roughly trimmed.

It is suggested to make the first flying tests on a large obstacle free area, a flat surface is desirable. The wind should not be too gusty, but a easy steady breeze is of advantage. The models nose points into the wind and you yourself are positioned 3 meters behind the model. Now accelerate the engine very, very slowly until the clutch engages properly and rpm's of the main rotor increase steadily. After a short stop at the reached rpm's, slowly accelerate again until the ship starts to "swim". Now the first thing to check, is any turning around vertical axis (flight direction), and if necessary correct the trim of the tail rotor. After the model keeps the direction with the nose against the wind, slowly accelerate a little bit, but only a little, since the main rotor rpm's take awhile to increase, after which it builds up rather fast because of ground effect. Now observe the model (the middle part of the fuselage, and not the tail) and try to find out, whether the ship wants to dip to one particular side. (In most cases it tries to move diagonally forward to the left side). Such a movement should now be corrected by moving the trim lever for the main rotor on the transmitter until a rough vertical lift is obtained. If you have the feeling that the model does not move into this direction anymore, (observe dip of the fuselage) slowly accelerate again until the model hovers at an altitude of about 20 to 50 cm. In this altitude, the model will sit on an aircushion, however it may try to go in any direction. This direction must be remembered and you must try to counteract by controlling the main rotor to neutralize this movement. Do not remain on one spot, follow the ship by trying to hold the same position in regards to the wind. It is also not important to move the ship back to its starting point, instead it is important to try to stop movement of the ship in any kind of unwanted direction. Remember, that a stop does not happen suddenly, instead it will have a necessary delay, the same as experienced while accelerating. Repeat this first lift and counteract the flight movement for awhile. Do not be tempted to accelerate more to bring the ship into higher altitude. The flying outside of ground effect is easier, however, if a control mistake is made, it is better to make the mistake at an altitude of 50 cm, then you can bring the ship down without damage. A control mistake at a two meter altitude is already a much bigger problem.

A correction of the main rotor should not be too timid, instead, slow but prominent, short countermotion should be made. Always observe the fuselage position. If a not too drastic control mistake is made, do not bring the model down suddenly, instead try to correct your mistake. Always walk with the model and keep it in front of you with the nose into the wind.

As soon as you stop making the basic control mistakes, leave your safety altitude of 50 cm, and try to fly at a 2 to 3 m altitude. Under no circumstances in the beginning, try circular flights or turn the model too much around its vertical axis and reach a position in crosswind, or even worse, in tailwind. This would lead, at the beginning, to a complete malcontrol. At the previously mentioned altitude of 2 to 3 m, try not only to prevent unwanted flight movements, also try to stay in one place. At the beginning it is absolutely unimportant whether you hover over an exact certain point. Important is only that you do not loose your ship. The hovering position should be tried again and again. Do not be tempted to start flying around. Even so, at this stage there would be no difficulty, since the ship is very stable when flying forward. However the landing will be very difficult since one has to go out of forward movement into hovering. It would be better now to try to move the ship crosswise to the right and the left side and always the nose has to be kept into the wind. Later on, you can even cross your airfield side ways, but don't forget to walk with your ship and keep it in front of you at a couple of meter altitude. After you reach the point where you are sure that you have a tight control over your ship, there is no reason why you cannot, by slowly accelerating your engine, climb to 8 or 10 m altitude. This additional acceleration has to be done carefully so the helicopter does not gain altitude too fast. The same way when lowering your model, the throttle has to be cut very slowly to prevent a fast drop in altitude. On one side you need relatively high motor efficiency to stop the drop which could cause a strong acceleration, and a turning of the fuselage. On the other side the danger exists that at fast decend, the ship hits his own rotor turbulence and then you lose all the lift.

When making these flights, please remember to make prominent, but relatively short corrective movements on your stick, observe the position of the model and wait for the reaction of the movement. You should always be aware that the model needs time for stopping after a certain movement.
Example: Model hovers at 2 m altitude. The fuselage starts, hardly noticeable, to dip tailwards. Later on you will realize that this movement will lead to backwards flight and therefore you would, by making a forward correction, not let this movement start. At the beginning however, this reaction will be made too late, and the model will start a backwards flight. Immediately dip the main rotor forward. (By pushing the stick for the swashplate forward), until the fuselage is not on the leveled horizontal pattern, but shows a slight forward dip. This way, you not only stop the backwards acceleration, you also stop the backwards movement. At a standstill of the model, the nose has to be lifted again, and the fuselage leveled horizontally. Probably, the model now hovers two meters behind its previous point, but it hovers. Now you can move forward those 2 m by lowering the nose with a short movement of your stick forward. The model moves slowly forward now. Before you reach the point where you want to stop the model, again lift up the nose, wait for the model to stand still, and immediately put it in horizontal position again.

All possible flight directions will be controlled by following the rules

a: stop movement
b: initiate corrective move
c: stop corrective move
d: hold new position

This corresponds exactly with the control of any full scale craft.

ADVANCED TRAINING

If you master hovering as previously explained in practicing, and if you haven't made a flight around by mistake, now it's time to start the advanced training, and this includes controlled flying around.

Lift the model (naturally with the training landing gear) to a hover at 2 m altitude. In this hovering position, trim your model again and get used to hovering by moving crosswise. If you have done that for 2 or 3 minutes without failure, bring the model to a standstill and start flying forward by dipping the nose slightly. This you have done many times already while hovering, however, you stop this motion immediately in order to prevent flying away. You leave your acceleration in this position (at the slow start of forward flight, additional acceleration is not necessary). The model will now accelerate forward and you will observe if the 'copter is trying to fly at a wide right turn. At a slow speed this right turn is very wide. If you want to be really sure, then let the model fly in this manner and it will return automatically after a perfect circle back to the starting point with the nose against the wind. Condition for this is, that there is only a light breeze so the ship will not drift away. If you want however fly straight out, you must be sure, the ship does not get too fast. Should this be the case, lift up the nose of the model by pulling on your main rotor stick and the ship will come to a stop not too far away from you, since you are forced now to make an exact hovering position again. This hovering at a bigger distance will be very unusual for you and will not be easy. Therefore, try to keep moderate forward speed with an appropriate dip of the main rotor. The tendency to turn to the right will be counteracted by

a: left control of tail rotor and
b: left control of the main rotor

At the beginning the model will swing back and forth. This plays no important role, since you have a lot of time for corrections. The following reasons for correction in a proper straight out flight: The main rotor and the tail rotor have been trimmed for hovering position. The tail rotor for example has to balance the total torque of the main rotor and is not assisted by the fin. This will change at a forward flight, since now the stabilizing effect of the fin will be added. Consequently with the help of the fin, the tail rotor oversteers causing a right turn of the fuselage around the vertical axis. Therefore the pull of the tail rotor has to be decreased by changing the pitch on the tail rotor with the appropriate stickmovement to the left.

shortly before the final touch-down, like one does with the elevator on a normal model, you pull on the main rotor stick and lift the nose up. Be sure, the craft starts to lift immediately. Furthermore, you must realize that with decreasing forward motion, the lift will also decrease and force the pilot to slowly open the throttle and hold the craft in a hovering position before the touch-down. It is important to do the touch-down in such a way, that when hovering, the pilot is in the same position as before, when he was practicing hovering.

The touch-down approaches should be tried again and again. It is also important that you don't neglect the hovering training. After one is familiar with the flying around technique, you will notice that these manoeuvres are much easier than hovering, and can lead to fast flights across the field, with bad touch-downs. There is another advantage to hover practice, because eventual malefunctions will appear, and are not dangerous at the low hovering altitude. For example, if the engine is too lean it will show when hovering, since the highest possible engine performance is required.

It is definitely more dangerous when making a fast flight with an improperly adjusted engine, when a touch-down fails, because the engine is too lean.

After you can hover the model out of any situation, then you can remove the training landing gear and install the better looking landing skids. Flying with the landing skids is no more difficult than flying with the training gear. The landing skids however, require a precise touch-down. While flying with the landing skids you will notice, that the BELL HUEY COBRA has become remarkably faster since the training gear has a considerably higher air-resistance.

MAINTENANCE TIPS

The parts of the drive mechanism of the helicopter are in general maintenance free. Only in the main gearbox, the oil must be checked and the breatherhole on top of the main gearbox must remain open. Should there be a small loss of oil in the gearbox due to improperly sealed ball bearings, it is unimportant.
Oil can be added without difficulty. The oil however should never be above the mark. If you want to do something worthwile, then change the oil after one or two hours of actual running time.

Regreasing the tail rotor shaft after the first grease is applied, is normally unnecessary, however, it would not hurt. In the beginning, the set screws that fasten the tail rotor shaft to the clutch have to be checked and most of the time tightened one or two turns.

The tail rotor gearbox, which is filled with grease, is practically set for a lifetime. An overfilling of the gearbox with grease is improbable, however, it is suggested to often apply small drops of oil into the slot of the tail rotor controlplate, the joints of the tail rotor, and the small ball bearings of the pitchcontrol.

The main rotor system will now have a certain amount of aileron effect to the right side. The reason for this is that the clockwise turn of the rotor will find the rotor blade on the left side being against the wind and the rotor blade on the right side will practically turn with tailwind. Therefore the blade on the left side will have more lift than the blade on the right side. In order to balance the aileron effect on the right, the main rotor must be also tilted toward the left side to correct this (this effect you will find exactly in the same typical manner on a full scale craft). It is quite obvious that as faster forward movement exists, the bigger the correction on the tail rotor, as well as the main rotor has to be made. Now you reached already a distance of 20 to 30 meters away and you wish to start turning around. If this should be a righthand turn you only have to neutralize the tail rotor as well as the crossposition of the main rotor. The model will then fly almost by itself a righthand turn.

Should you wish a lefthand turn, decrease the tail rotor pitch, and at the same time increase the main rotor to the left.

Now you should be capable of teaching at least a 0 degree pitch on the tail rotor, otherwise a lefthand turn cannot be made. While flying a turn, the helicopter, the same as a fixed wing model, has a tendency to lose altitude. To balance this you pull up the nose, the same as you would do with an elevator, by changing the main rotor. These control operations can be done without problems since they happen very slowly and there is enough time for thinking.

At this point it is necessary to make the following remarks: It is not easy to judge the exact flying position of a helicopter if you look at it from the side, since the helicopter has no wings. Orientation on the tilted wings of the conventional model, does not exist, and it will be hard to judge from the sideview whether the helicopter is turning towards you or away from you. In case of doubt, a very heavy steer, preferable to the left, will identify the position of the craft.

After the first turn is made, the ship now will be flying at a rather high level if you haven't cut the throttle somewhat. This altitude must be maintained by adjusting the throttle. The deceleration of the engine on the helicopter will surprise you at the beginning since, from hovering you are used to flying with relatively high engine performance. While flying forward however, you reduce the engine performance remarkably. One flies the normal forward flight speed, on the average, with half open throttle.

Preparing for the touch-down, the throttle will be further reduced. One would hardly believe that the helicopter is capable of staying airborne with such a small engine performance. At the beginning, one is normally hesitant to try such an extreme cut of the throttle, causing the craft to be too high on the final approach. It will be necessary to try for another touch-down, or lower the helicopter vertically from the high altitude. Attention must be given again, that when you lower the ship it is not done too fast, and hits its own rotor turbulence, while coming down. Should it happen, you can only get out of the turbulence with a heavy dive and acceleration. While on the touch-down approach, your craft should not be moving forward too fast. The course of approach will be controlled by the side rotor and main rotor stabilizers. One lets the helicopter approach for a touch-down almost like a conventional model, and

The top ball bearing for the main rotor shaft, the ball bearing of the swashplate, and the ball in the middle of the swashplate would also appreciate small drops of oil occasionally. The same should be done for the four ball bearings of the main rotor. Also the slot in the swashplate key could use oil once in awhile. We don't have to mention that the fuel system should be kept clean. To prevent flooding the engine after stopping, the fuel line must be disconnected from the tanks!

To protect the engine, it is suggested that you not stop the engine immediately after hovering. As explained previously, while hovering a relatively high engine performance is necessary. If the engine is stopped too soon after hovering, it does not have a chance to cool and therefore, a sudden overheating exists, since the engine inside the model receives very little cooling air. After hovering, the engine should be left running at idle for a short time, so it cools before it is stopped.

If you have studied these instructions carefully up to now, the first milestone has been laid for the flying fun with your BELL HUEY COBRA.

May we wish you success.

D. SCHLÜTER and SCHUCO-HEGI

LIST OF MATERIALS

BELL HUEY COBRA - HEGI 201 410

Part No. on plan	Designation	Amt. req.
1	fibreglass fuselage BELL HUEY COBRA	1
2	bottom longeron (pine)	2
3	rear tail former	1
4	former behind fuel tank	1
5	guide tube for tail rotor shaft	1
6	fuselage nose former	1
7	middle longeron (balsa)	2
8	fuselage former, end of top longeron	1
9	top longerons (balsa)	2
10	fuselage former (motor)	1
11	fuselage former (back of canopy)	1
12	reinforcement former for tank cut out - left	1
13	reinforcement former for tank cut out - right	1
14	reinforcement in fuselage dome	1
15	mounting for tail rotor gearbox	1
16	reinforcement for tail wheel gear	1
17	landing gear for tail wheel (piano wire)	1
18	guide tube for tail rotor control rod (plastic)	1
19	longeron (back end of fin)	1
20	rib (top part of fin)	1
21	side longeron for canopy (balsa)	2
22	former (canopy rear)	1
23	former (canopy front)	1
24	reinforcement gusset (front canopy former)	2
25	reinforcement gusset (rear canopy former)	2
26	dowels (for fastening canopy to fuselage)	3
27	snap fastener for canopy	1
28	canopy	1
29	tubes (for fastening nose training gear)	2
30	support former (for drive shaft guide tube)	1
31	elevator	1
32	cover (optional)	-
33	control rod for tail rotor	1
34	rubber bumpers (for fastening training gear to base plate) with nuts, bolts, and washers	4
35	mounting bracket with nuts, bolts, and washers (for fastening training gear to fuselage top)	1
36	landing gear for skids (plywood)	2
37	landing skids	2
38	fasteners (skids to landing gear) with nuts, bolts, and washers	4
39	rod for coil springs	2
40	top strut for training landing gear	2
41	bracket for fastening axle to landing gear struts	2
42	rear bottom strut for training gear	2
43	front bottom strut for training gear	2
44	axle for training gear	2
45	collar with set screw (for axle 44)	6
46	coil spring	2
47	collar with set screw (for coil spring 46)	2
48	piano wire strut (for nose gear)	2

List of Materials (Page 2)

Part No. on plan	Designation	Amt. req.
49	brace for nose training gear	1
50	head piece for fastening nose wheel	2
51	nut and bolt for nose gear	1
52	bushings for nose gear	1-2
53	collar with set screws for nose gear	2
54	tail rotor blades, glued and shaped	2
55	main rotor blades, glued and shaped	2
56	pitch gauge	1
57	pitch gauge mounting	1

<u>Accessories:</u>

binding wire for nose gear, cotter pins for tail gear, nuts, bolts, and washers M 2 x 10, nuts, bolts and washers M 3 x 20 and M 3 x 30, rubber fuselage grommet for fuel line.

<u>Also:</u>

Self adhesive foil for main rotor blades	2
self adhesive foil for tail rotor blades	1
set of decals	1
lg. package Stabilit-Express	1
full sized plan	1
building and operating instructions with photo section	1
parts list for mechanical kit 201 400	1
replacement parts list for mechanical kit 201 400	1
parts list for fast building kit 201 410	1
replacement parts list for fast building kit 201 410	1

The <u>photos 83 and 84</u> show the packed contents of the HEGI fast building kit BELL HUEY COBRA, No. 201 410

LIST FOR MECHANICAL PARTS KIT 201 400

Quantity	Designation	Part No.
2	stabilizer	203 508
1	stabilizer rod	203 505
1	main rotor plate	203 501
1	main rotor hub	203 500
2	cardan shell	203 502
1	wheel block without hub	203 320
1	wheel block with hub	203 321
1	tail rotor gear housing	203 310
1	swashplate collector fork	203 403
1	main rotor shaft	203 400
1	flexible drive shaft	203 301
1	fan belt	203 109
1	fan housing	203 108
1	swashplate complete	203 410
1	bearing ring with	203 401
	ball bearing	203 402
1	centrifugal clutch	203 106
1	needle bearing	203 107
1	cooling fan	203 105
1	main gear housing left	203 200
1	main gear housing right	203 201
1	top wheel block complete	203 230
1	middle wheel block complete	203 220
1	bottom wheel block complete	203 210
1	base plate left	203 100
1	base plate right	203 101
1	Stabilit-Express	257 890

Small parts container No. 1

single parts for rotorhead with cardan shell, stabilizer hub, 4 ball bearings, rotor hub, stabilizer rod with control linkage and stabilizers, 3 socket head wrenches.

Quantity	Designation	Part No.
4	ball bearing	203 503
1	control arm with joint	203 507
1	collar	203 506
4	socket head bolt M 3 x 55, 20 mm long	203 032
2	socket head screws M 4 x 10	203 033
2	washer 4 mm ø	203 002
4	nuts M 3	203 011
4	lock nut M 3	203 012
4	socket head set screw	203 041
1	socket head wrench 1,5 mm	203 060
1	socket head wrench 2,5 mm	203 061
1	socket head wrench 3,0 mm	203 062

Small parts container No. 2

parts for fastening the main rotor blades on the rotor plate.

Quantity	Designation	Part No.
4	mounts	203 504
10	socket head bolts M 3 x 15	203 031
10	lock nuts M 3	203 012

List for Mechanical Parts Kit 201 400 (Page 2)

Quantity	Designation	Part No.
	Small parts container No. 3	
	parts for installing motor and clutch mounting bolts for gear assembly, oil plug for gear box.	
1	cone	203 104
2	spacer rings for motor	203 103
2	socket head screws M 4 x 15	203 034
6	bolts M 3 x 10	203 022
6	nuts M 3	203 011
1	bolt M 5 x 6	203 025
	Small parts container No. 4	
	parts for mounting motor, housing and gear box on the base plate.	
2	supports for motor	202 102
4	socket head bolt M 3 x 15	203 031
4	bolt M 3 x 10	203 022
4	bolt M 3 x 8	203 021
4	washer 3 mm Ø	203 001
4	lock nuts M 3	203 012
4	nuts M 3	203 011
	Small parts container No. 5	
	all parts for tail rotor including tail rotor controls.	
2	blade mounts without arm	203 318
2	blade mounts with arm	203 317
1	control plate	203 315
1	control link with ball joint	203 312
1	control guide	203 313
1	cover for tail rotor housing	203 311
2	collar 2 Ø	203 314
2	ball bearing	203 316
2	washer 2 mm Ø	203 000
8	washer 3 mm Ø	203 001
6	nuts M 2	203 010
2	lock nuts M 3	203 012
8	bolts M 2 x 10	203 020
2	bolts M 3 x 15	203 023
2	socket head screw M 3 x 8	203 030
2	set screw M 2, 4 x 3	203 040
4	self tapping screw 2, 2 x 6	203 042
4	self tapping screw 2, 9 x 13	203 043
2	ball joint with separate balls	203 050
2	socket head set screws M 3 x 3	203 041
	Small parts container No. 6	
	coupling for flexible shaft, assembly pieces for swashplate, bolts for main rotor shaft and bolt for collector key.	
2	coupling	203 300
3	control arm with ball joint	203 404
1	holding rod for swash plate	203 405

List for Mechanical Parts Kit 201 400 (Page 3)

Quantity	Designation	Part No.
1	control rod for main rotor	203 406
2	washer 2 mm Ø	203 000
1	nut M 2	203 010
3	nut M 3	203 011
3	lock nut M 3	203 012
2	bolt M 2 x 10	203 020
8	socket head M 3 x 15	203 031
2	ball joint with balls	203 050
3	socket head set screw M 3 x 3	203 041

Small parts container No. 7

bolts for fastening the top main rotor shaft guide and power unit to fuselage.

8	bolts M 3 x 20	203 024
4	bolts M 3 x 15	203 023
12	nuts M 3	203 011
4	washer 3 mm Ø	203 001
8	washer 4 mm Ø	203 002

REPLACEMENT PARTS LIST
FOR QUICK BUILDING KIT BELL HUEY COBRA 201 410

Order No.	Designation	Amt. req.
203 800	fibreglass fuselage BELL HUEY COBRA	1
203 801	canopy	1
203 805	rubber shock absorbers for fastening landing gear with 2 washers and 2 nuts	4
203 806	training landing, complete	1
	consisting of:	
	2 piano wire struts, 1 reinforcement brace, 2 head pieces, 1 sleeve bushing, 1 nut and bolt, 2 spacer bushings, 2 m binding wire, 2 collars with set screws for nose gear assembly	
203 807	coil springs for training landing gear	2
203 808	bracket for fastening wheels to training gear with axles, 3 collars incl. set screws	1
203 811	landing gear support for landing skids	2
203 812	landing skids (shaped)	2
203 813	fasteners for landing skids, with 2 bolts, washers, and nuts	4
203 816	guide tube for tail rotor drive shaft	1
203 817	pushrod for tail rotor, with guide tube	1
203 821	pair of main rotor blades, glued and shaped with 2 sheets self adhesive foil, 4 blade mounts (203 504) and 1 stabilizer rod (203 505)	1
203 824	pair tail rotor blades, glued and shaped with self adhesive foil	1
203 827	set of decals	1
203 828	building and operating instructions	1
203 829	plan	1

Suggested Accessories

215 150	VECO 61	
216 331	muffler for VECO 61 with extension, and downward directed exhaust manifold (fitted for helicopter)	
217 961	fuel tank, 500 ccm	
217 855	ARAL-glow fuel G, 5000 ccm can	
217 995	fuel pump for ARAL can	
216 384	glow plug clip with control light	

REPLACEMENT PARTS LIST
FOR MECHANICAL BUILDING KIT 201 400 (HELICOPTER)

Order No.	Designation	Dimension	Amt. req.
203 000	washer	2 mm ø	20 ea.
203 001	washer	3 mm ø	20 "
203 002	washer	4 mm ø	20 "
203 010	nut	M 2	20 "
203 011	nut	M 3	10 "
203 012	lock nut	M 3	10 "
203 020	bolt	M 2 x 10	10 "
203 021	bolt	M 3 x 8	10 "
203 022	bolt	M 3 x 10	10 "
203 023	bolt	M 3 x 15	10 "
203 024	bolt	M 3 x 20	10 "
203 025	bolt	M 5 x 6	10 "
203 030	socket head bolt	M 3 x 8	2 "
203 031	socket head bolt	M 3 x 15	10 "
203 032	socket head bolt	M 3 x 36, 20 long	5 "
203 033	socket head bolt	M 4 x 10	2 "
203 034	socket head bolt	M 4 x 15	2 "
203 040	set screw	M 2, 4 x 3	10 "
203 041	socket head set screw	M 3 x 3	10 "
203 042	self tapping screw	2, 2 x 6	5 "
203 043	self tapping screw	2, 9 x 13	5 "
203 050	ball joint with ball		1 "
203 060	socket head wrench	1,5 mm	1 "
203 061	socket head wrench	2,5 mm	1 "
203 062	socket head wrench	3,0 mm	1 "
203 100	base plate - left		1 "
203 101	base plate - right		1 "
203 102	support for motor		2 "
203 103	washer for motor		2 "
203 104	cone for cooling fan	8 mm ø	1 "
203 105	radial cooling fan		1 "
203 106	centrifugal clutch		1 "
203 107	needle bearing for clutch guide		1 "
203 108	fan housing		1 "
203 109	fan starter belt		1 "
203 200	main gear housing - left		1 "
203 201	main gear housing - right		1 "
203 210	bottom wheel block complete		1 "
	consisting of:		
	203 211 clutch bell with spread for 210		1 "
	203 212 pin for 211		1 "
	203 213 coupling shaft for 210		1 "
	203 214 gear, 14 teeth for 210		1 "
	203 215 pin for 214		1 "
	203 216 sealed front ball bearing for 210		1 "
	203 217 sealed rear ball bearing for 210		1 "

Replacement Parts List
for Mechanical Building Kit 201 400 (Helicopter) (Page 2)

Order No.	Designation	Dimension	Amt. req.
203 220	middle wheel block complete		1 ea.
	consisting of:		
	203 221 hypoid gear for 220		1 "
	203 222 pin for 221		1 "
	203 223 middle shaft for 220		1 "
	203 224 gear, 42 teeth for 220		1 "
	203 225 pin for 225		1 "
	203 226 ball joint for 220		1 "
	203 227 sealed ball bearing for 220		1 "
203 230	top wheel block complete		1 "
	consisting of:		
	203 231 crown gear for 230		1 "
	203 232 pin for 231		1 "
	203 233 upper shaft for 230		1 "
	203 234 spacing tube for 230		1 "
	203 235 connecting tube for 230		1 "
	203 236 pin for 235		1 "
	203 237 open ball bearing for 230		1 "
	203 238 sealed ball bearing for 230		1 "
203 300	coupling for flexible drive shaft		1 "
203 301	flexible drive shaft	1030 mm long	1 "
203 310	tail rotor gear housing		1 "
203 311	cover for tail rotor gear housing		1 "
203 312	pushrod with ball and joint		1 "
203 313	pushrod guide		1 "
203 314	collar	2 mm dia.	1 "
203 315	control plate		1 "
203 316	ball bearing		1 "
203 317	blade mount with control arm		1 "
203 318	blade mount without control arm		1 "
203 320	wheel block complete without hub		1 "
203 321	wheel block complete with hub		1 "
	consisting of:		
	203 322 hypoid gear for 320/321		1 "
	203 323 shaft for 320/321		1 "
	203 324 ball bearing on hypoid gear		1 "
	203 325 outer ball bearing for 320/321		1 "
	203 326 spacing ring for 320/321		1 "
	203 327 tail rotor hub for 321		1 "
203 400	main rotor shaft		1 "
203 401	bearing ring for main rotor shaft		1 "
203 402	ball bearing for above		1 "
203 403	collector key for swashplate		1 "
203 404	control arm for swashplate, 30 mm long, with ball joint		1 "
203 405	holding rod for swashplate		1 "
203 406	control rod to main rotor		1 "

Replacement Parts List

for Mechanical Building Kit 201 400 (Helicopter) (Page 3)

Order No.	Designation	Dimension	Amt. req.
203 410	swashplate complete		1 ea.
	consisting of:		
	203 411 outer ring for 410		1 "
	203 412 ball bearing for 410		1 "
	203 413 inner ring for 410		1 "
	203 414 ball and socket joint		1 "
	203 415 tube for 410		1 "
	203 416 pin for 410		1 "
203 500	stabilizer hub		1 "
203 501	main rotor hub		1 "
203 502	cardan housing		1 "
203 503	ball bearing		1 "
203 504	blade mounts		4 "
203 505	stabilizer rod		1 "
203 506	collar	4 mm dia.	1 "
203 507	control arm for stabilizer with ball		1 "
203 508	stabilizer		2 "

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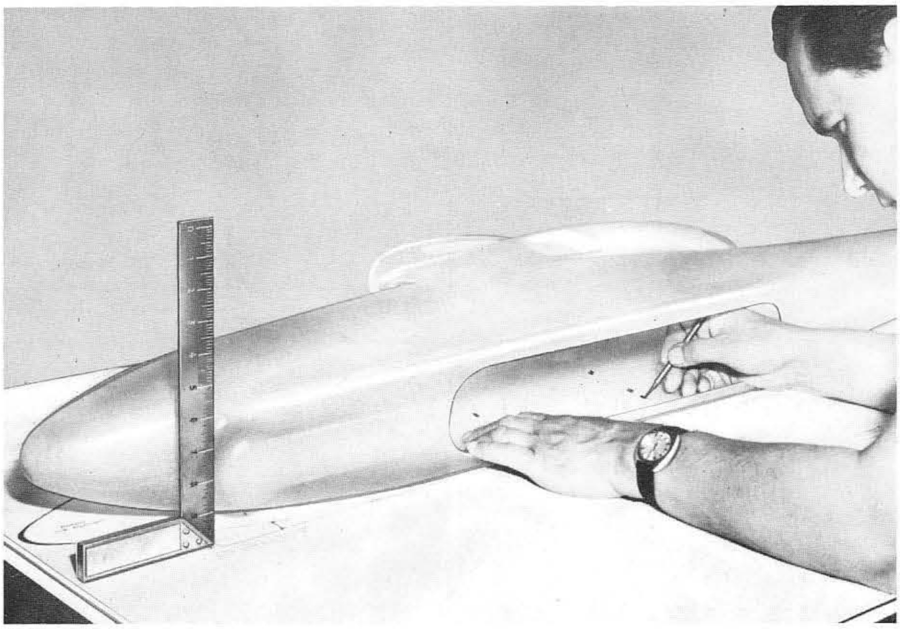
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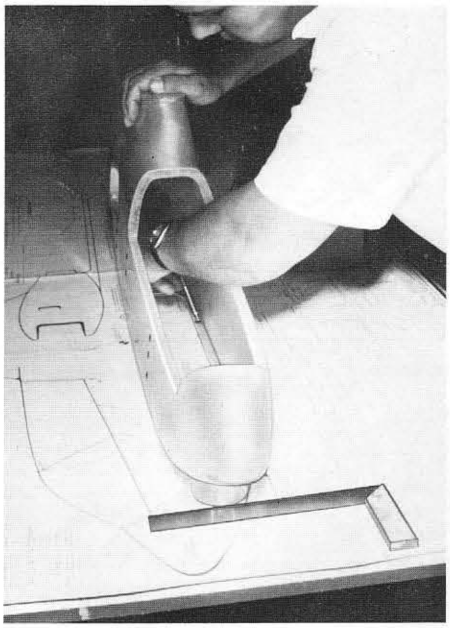
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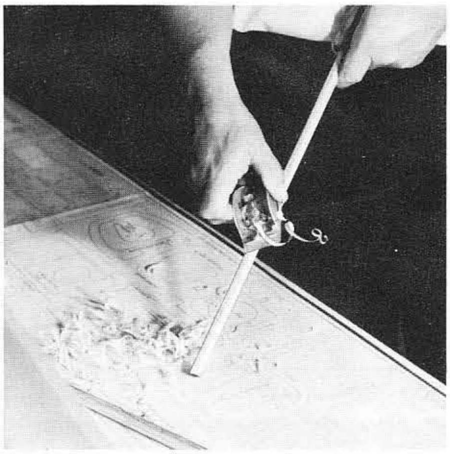
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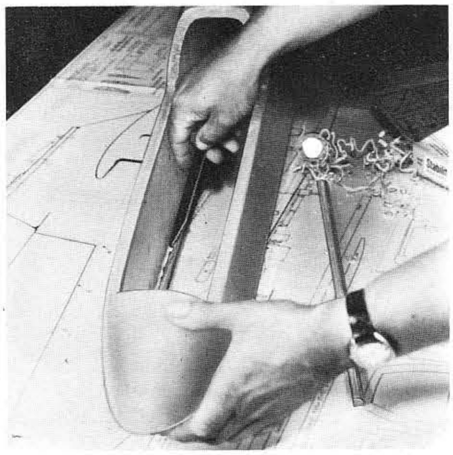
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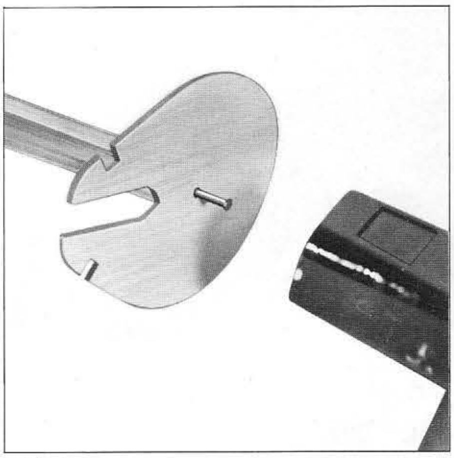
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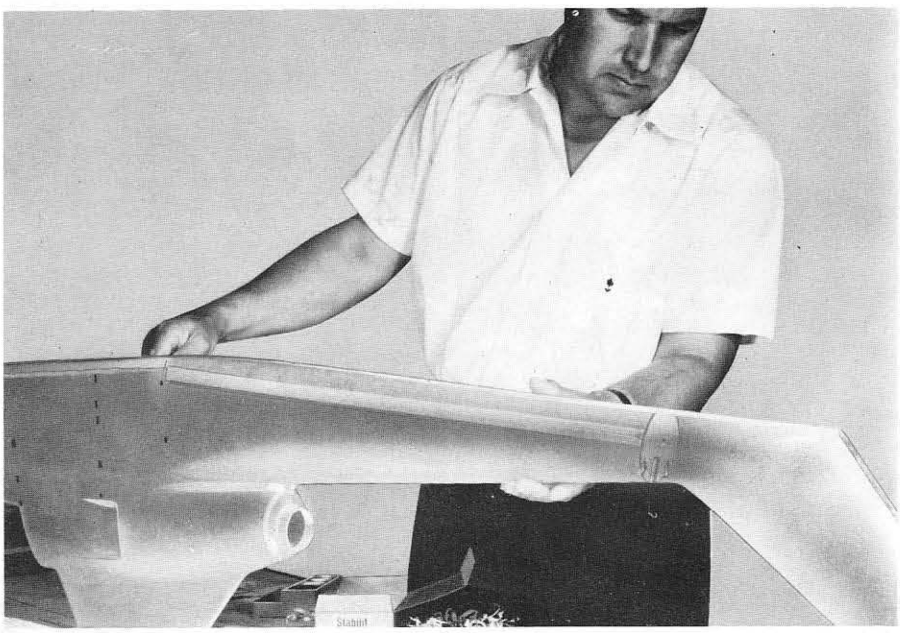
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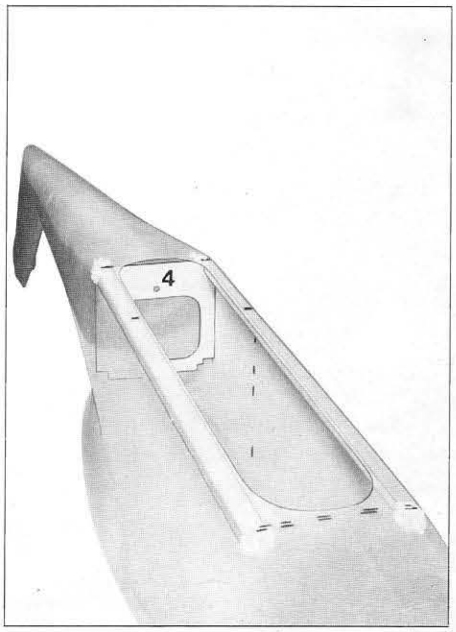

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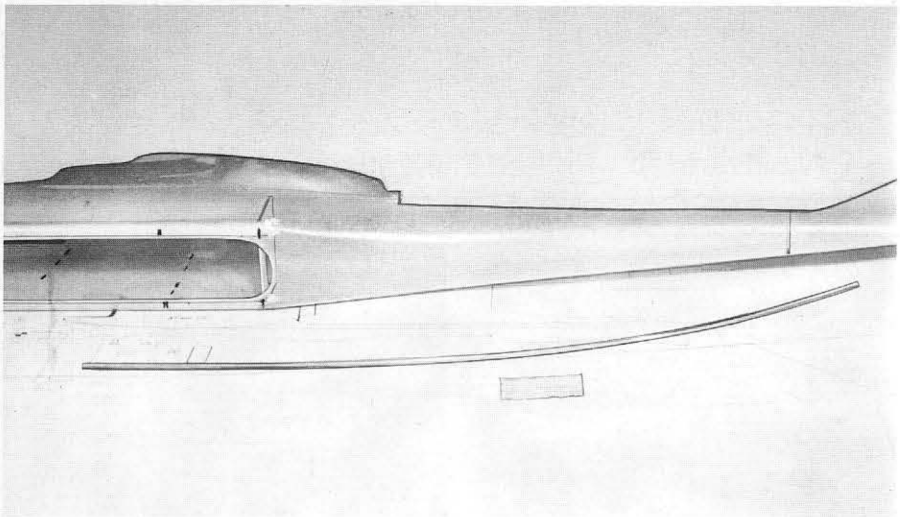
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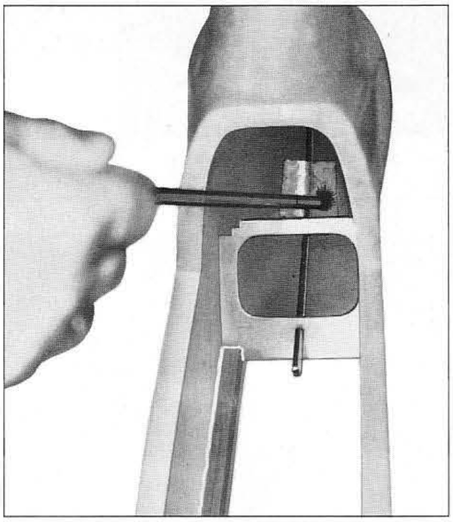
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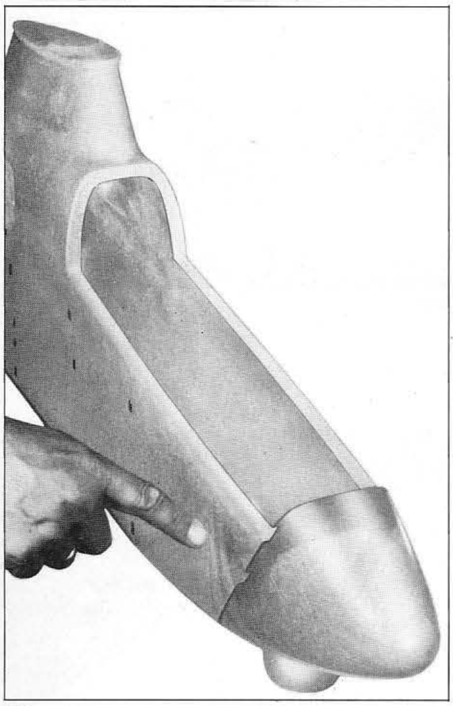
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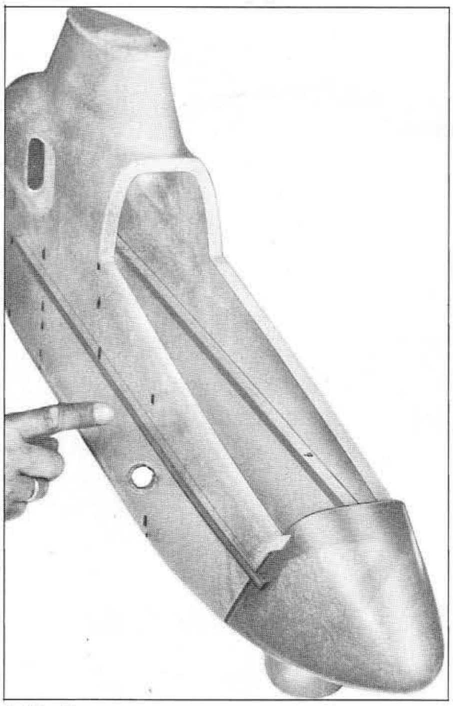
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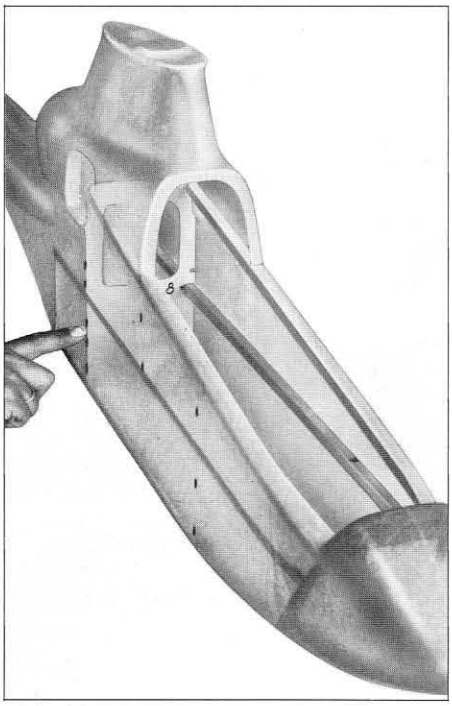

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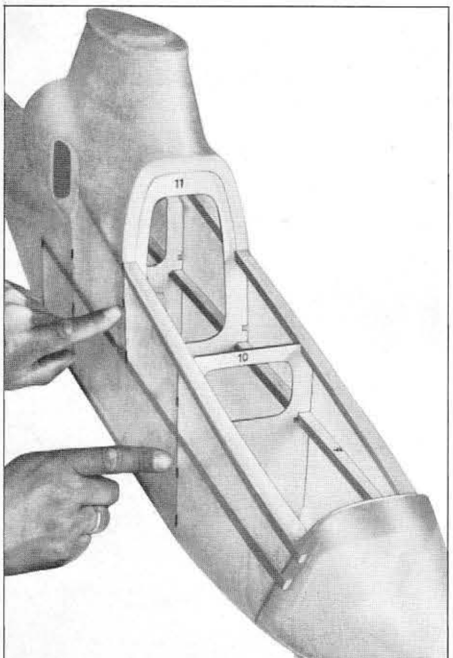

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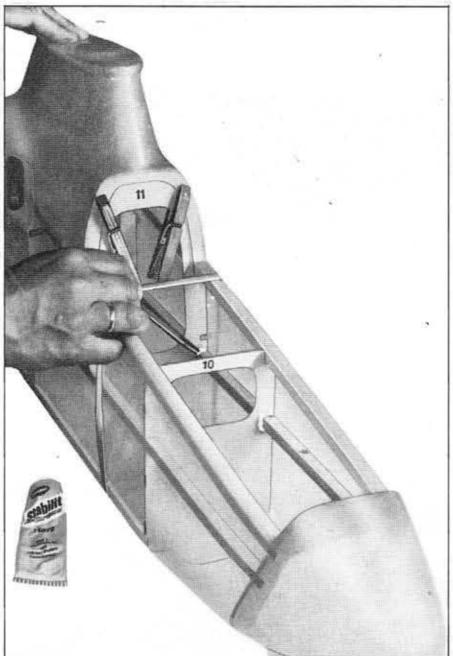

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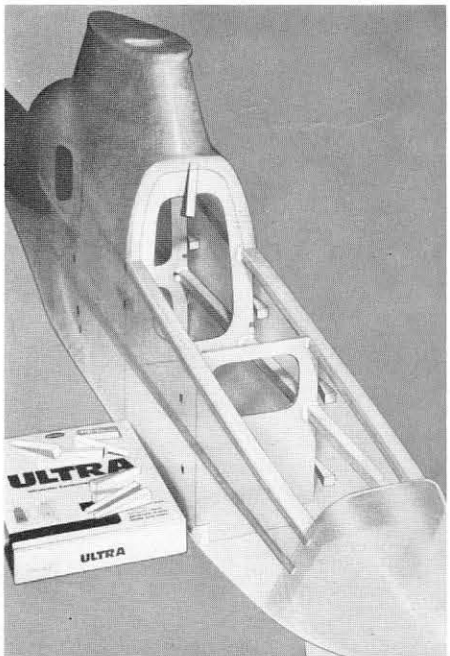

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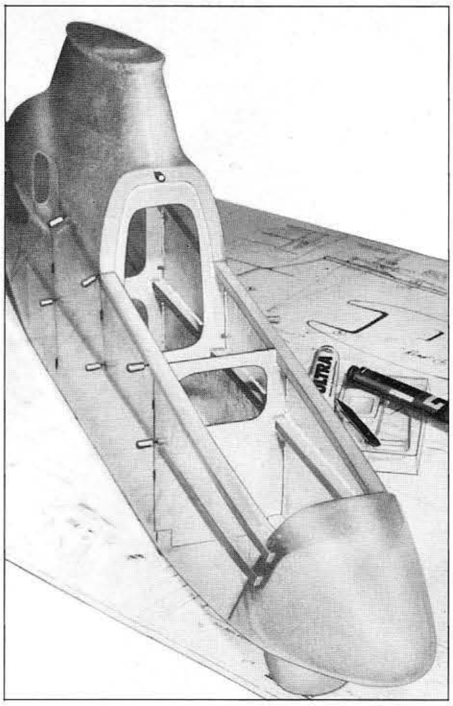

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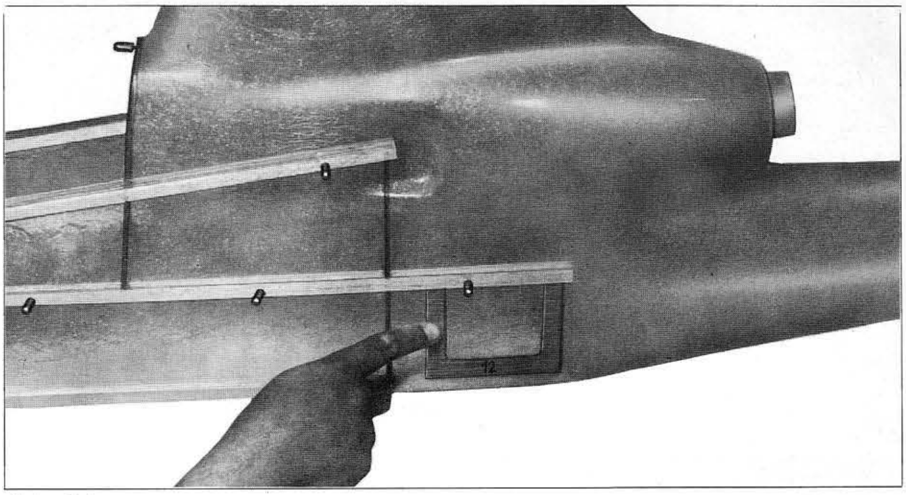

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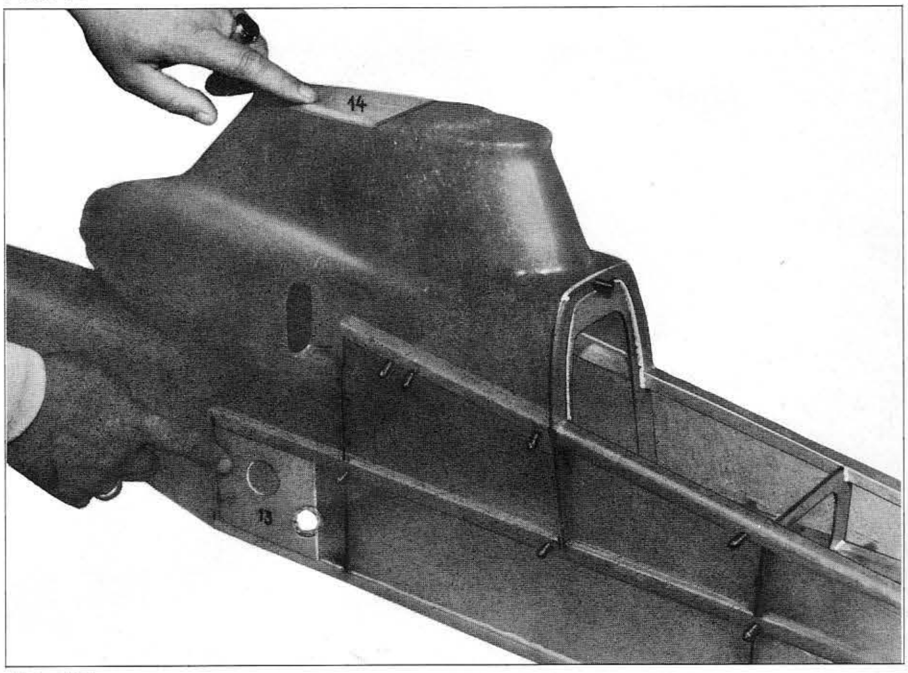

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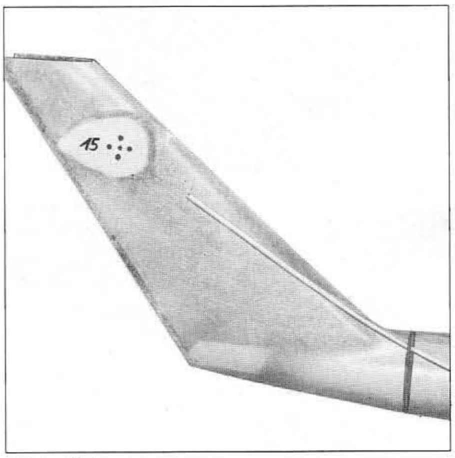

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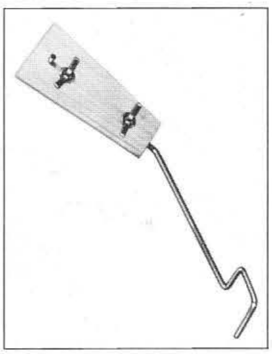

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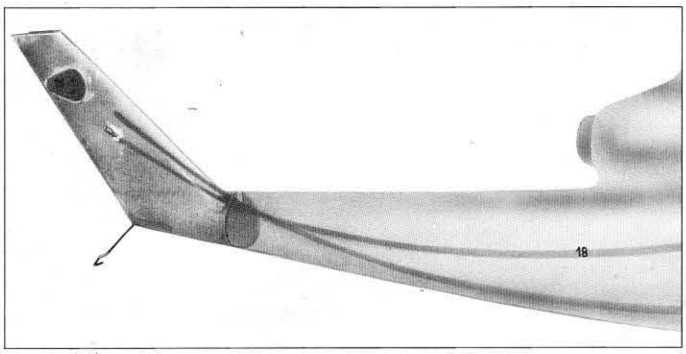

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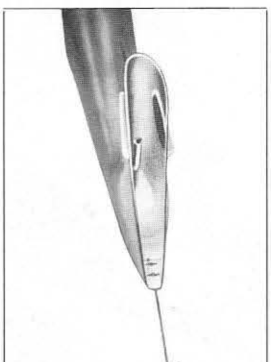

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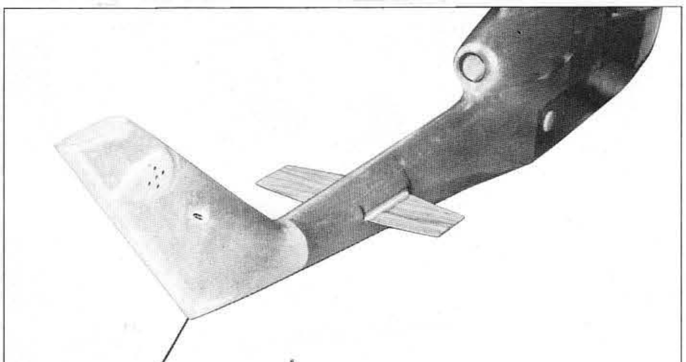

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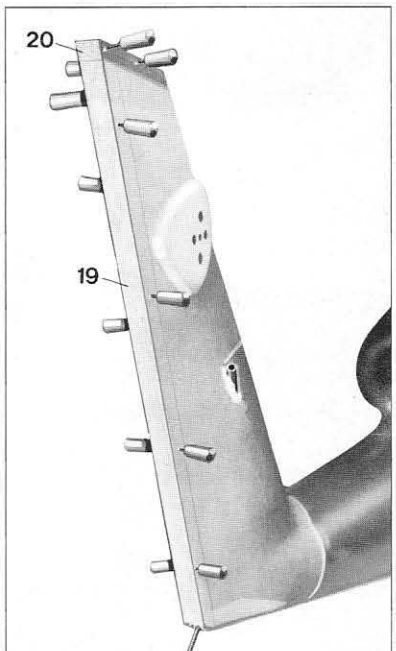

Abb. 23

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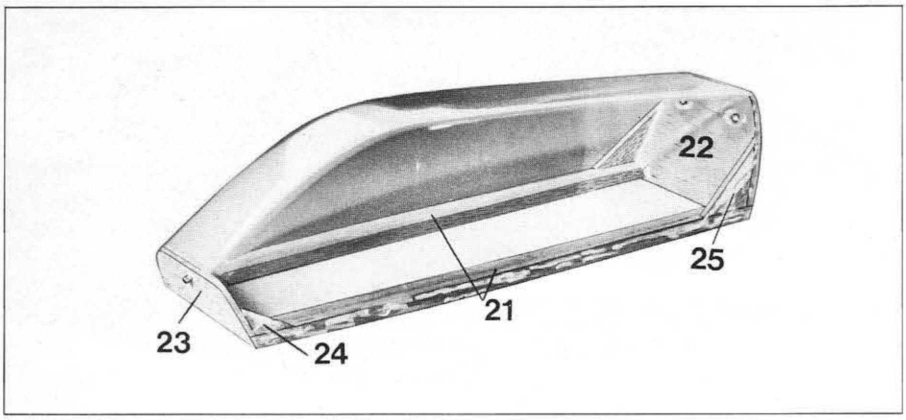

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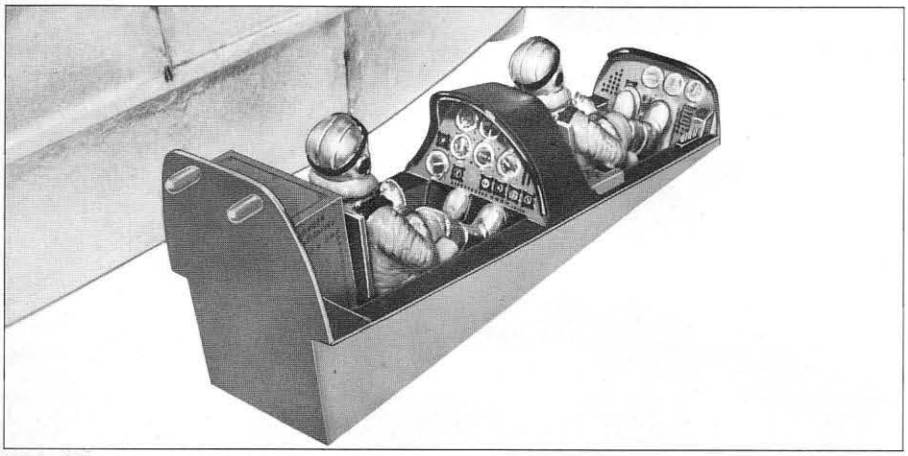
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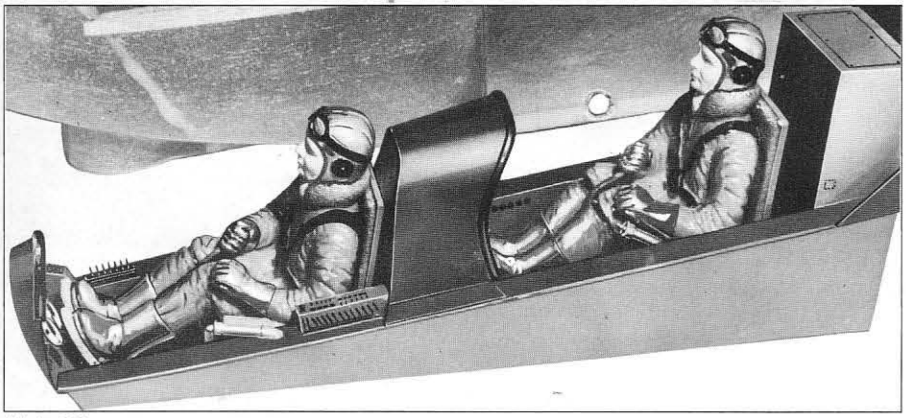
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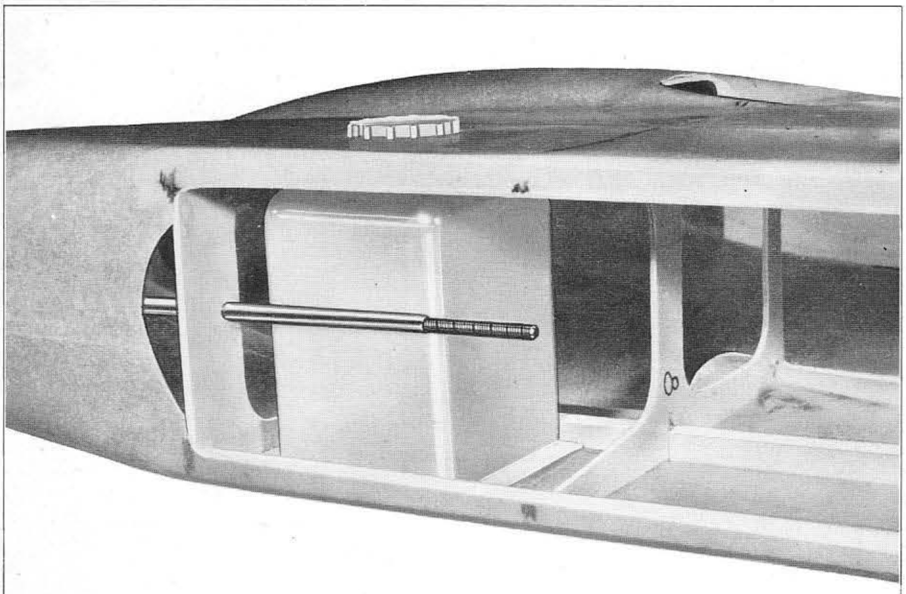
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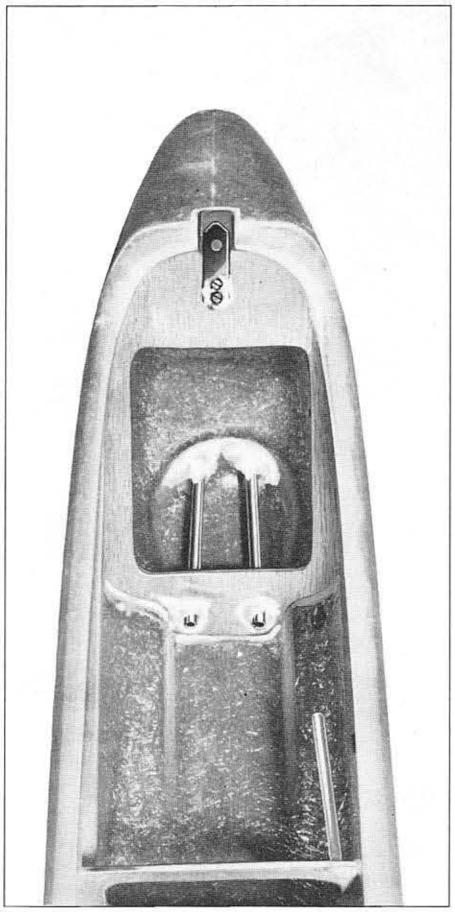
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BELL HUEY COBRA

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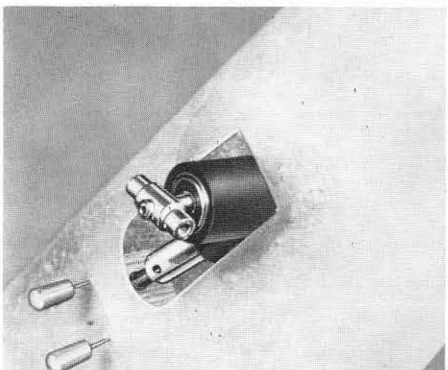
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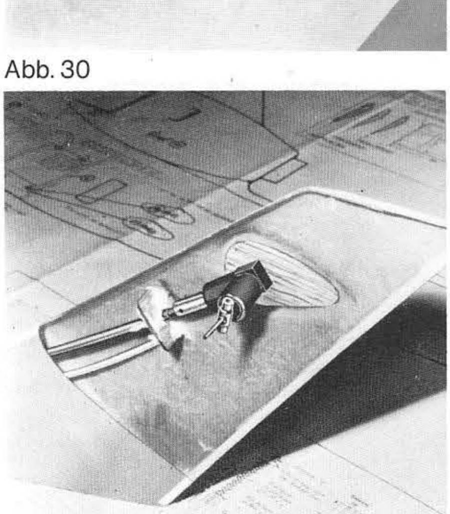
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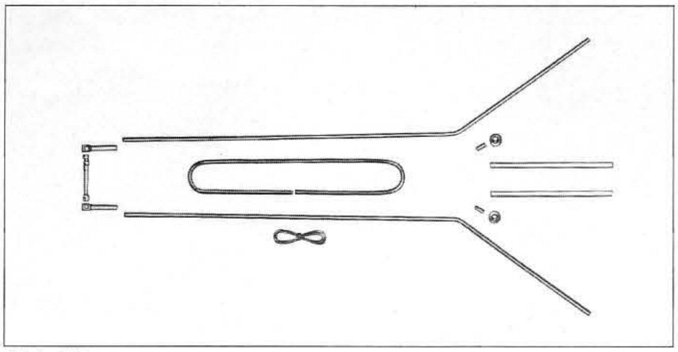
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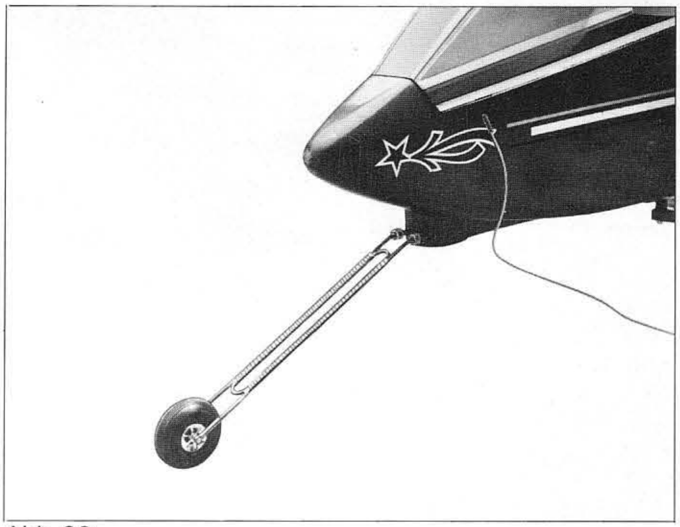
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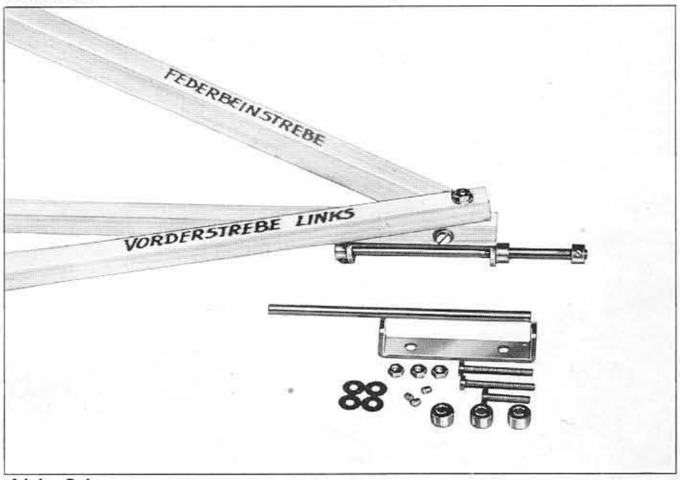

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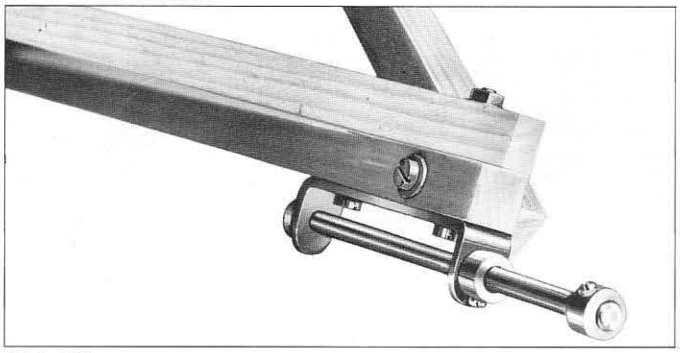
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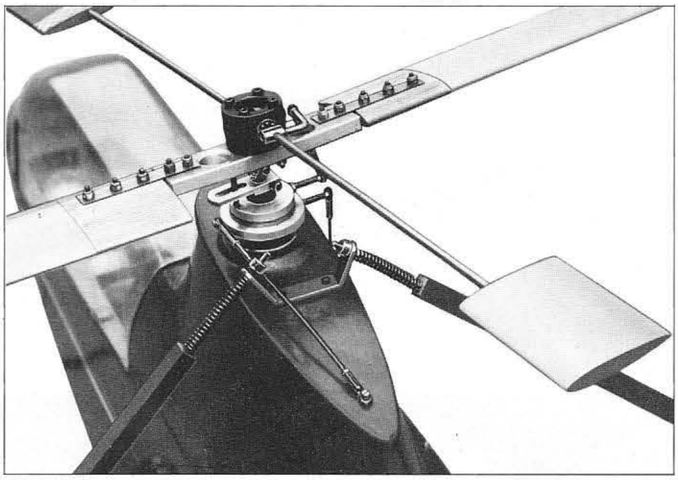
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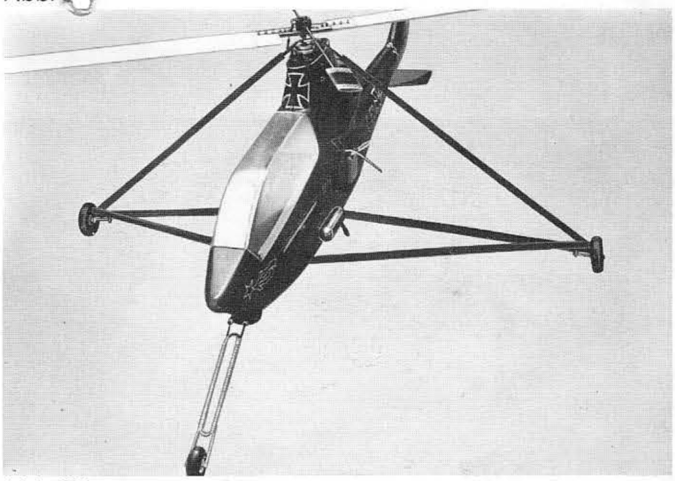
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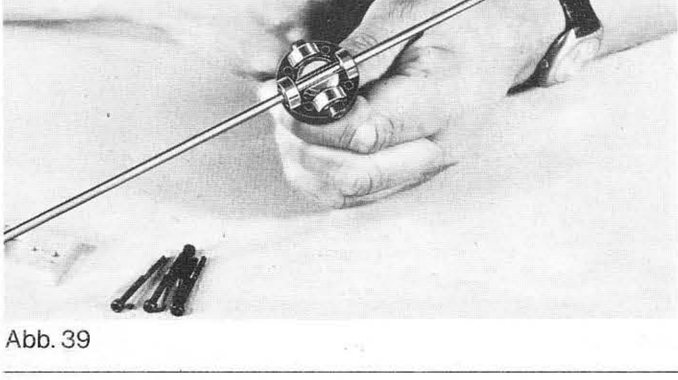
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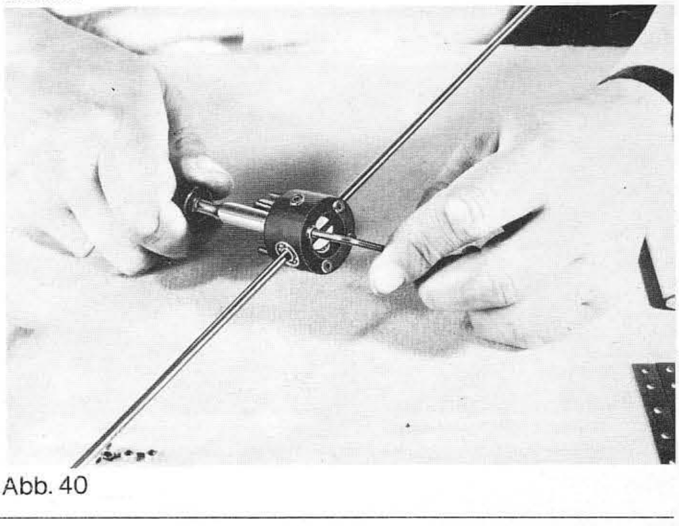
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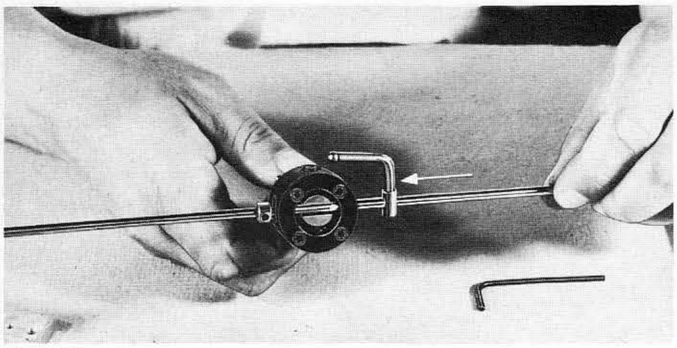
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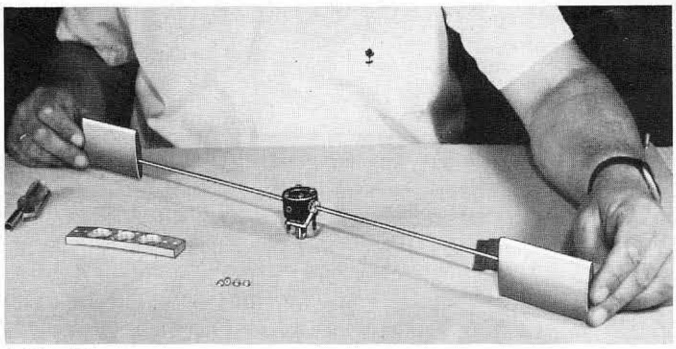
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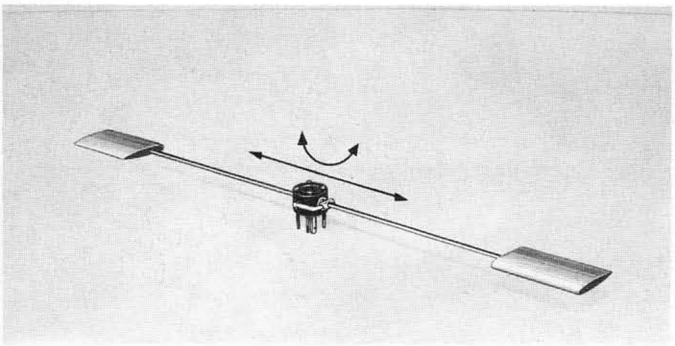
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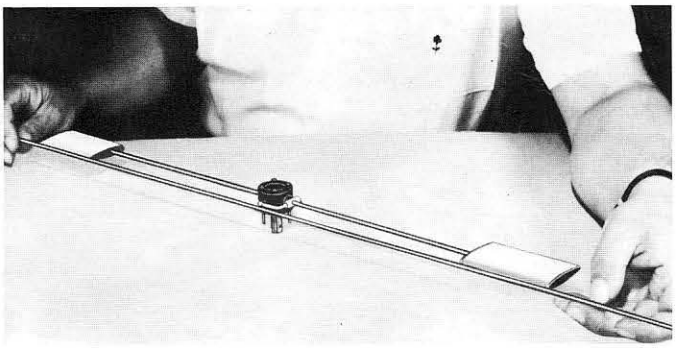
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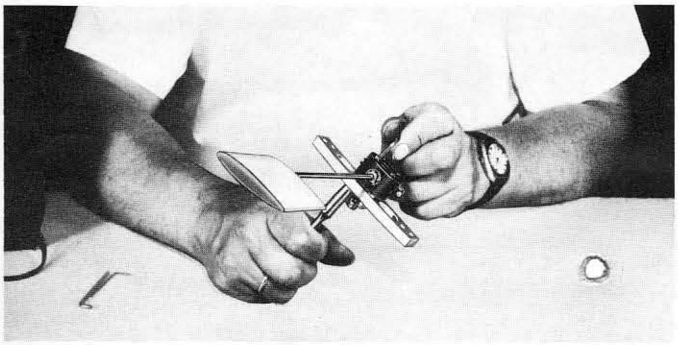
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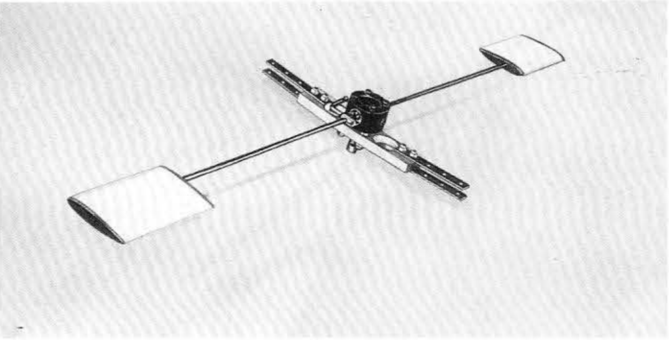
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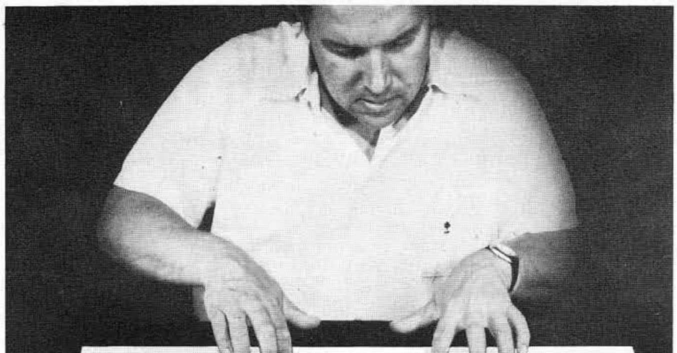
Abb. 47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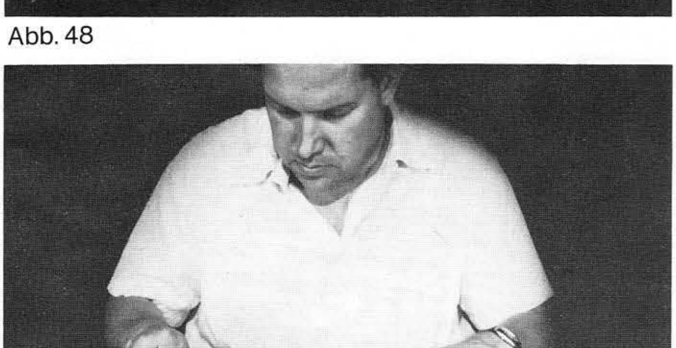
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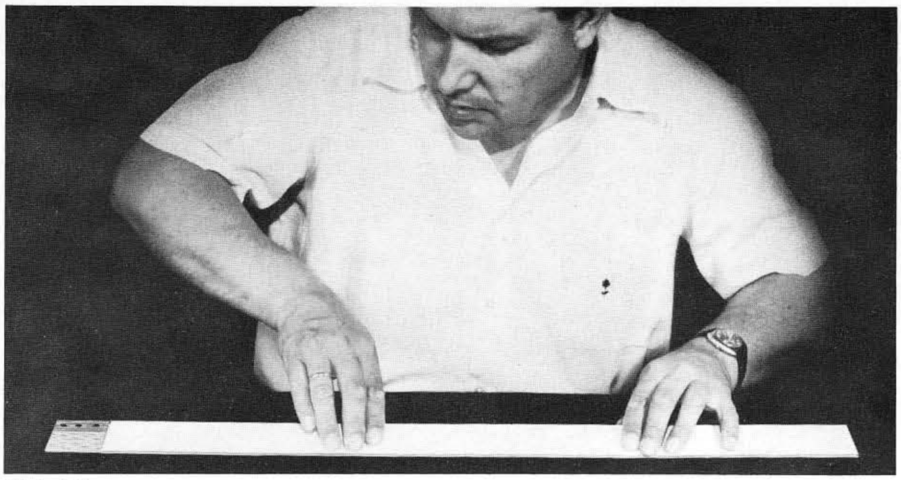
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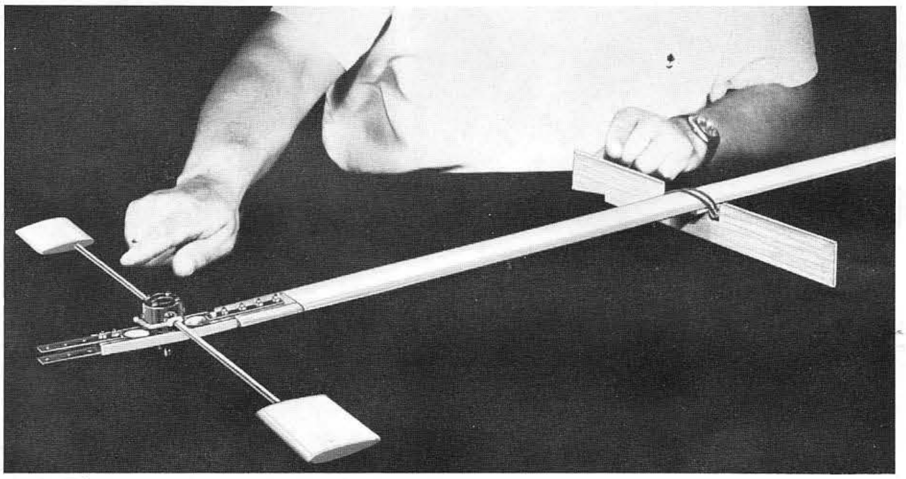
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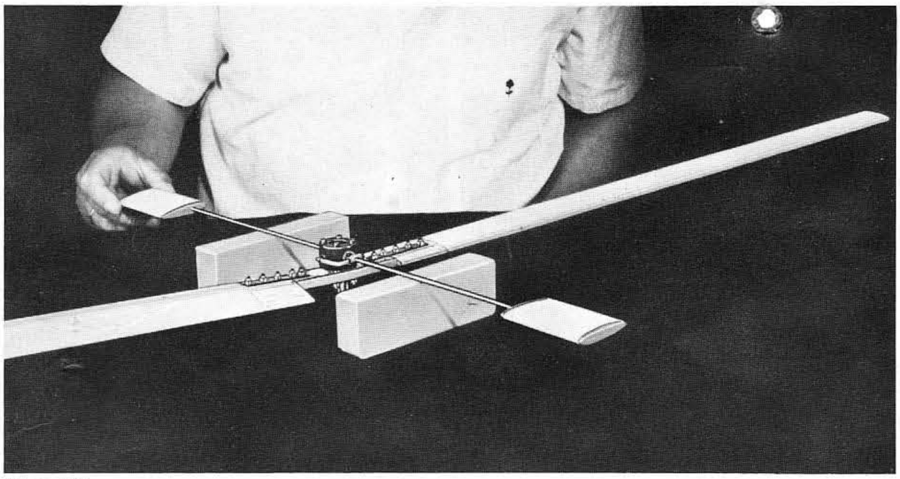
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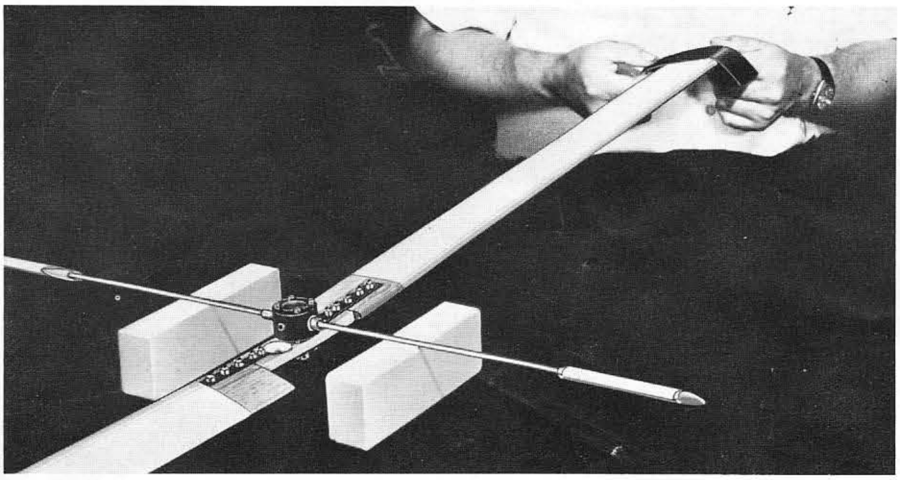
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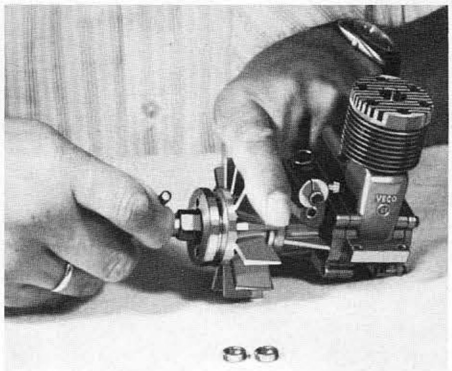
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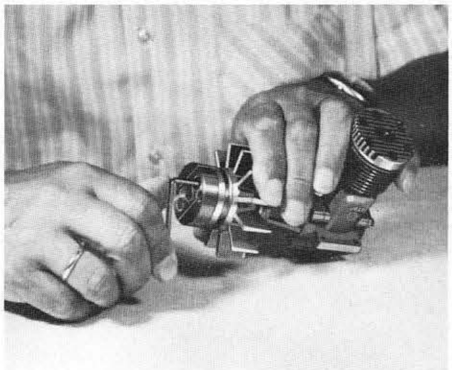
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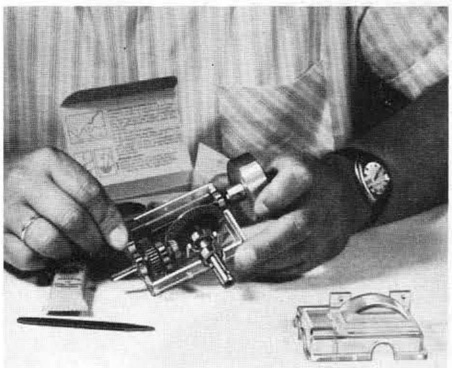
Abb. 57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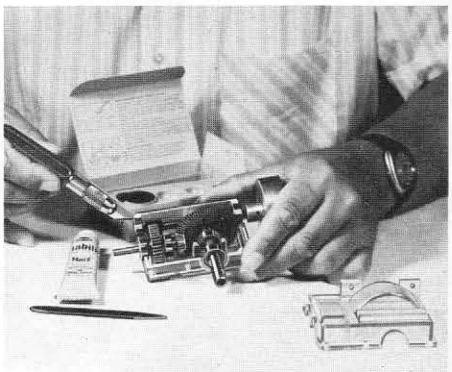
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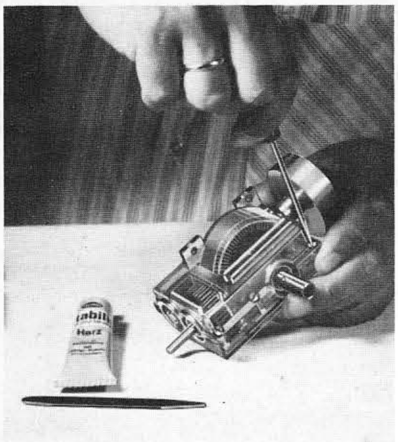

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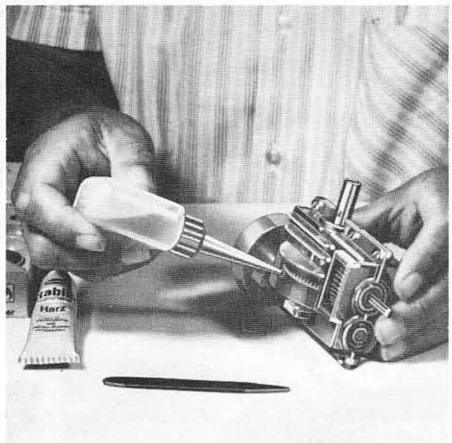

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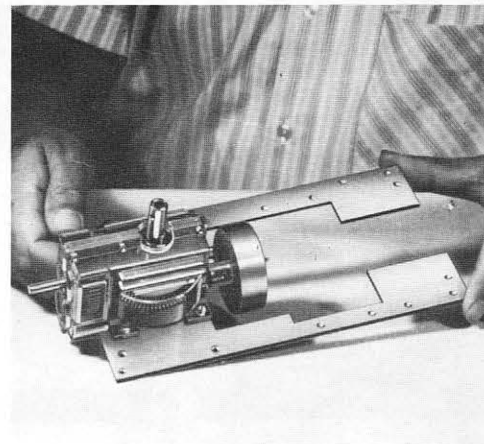
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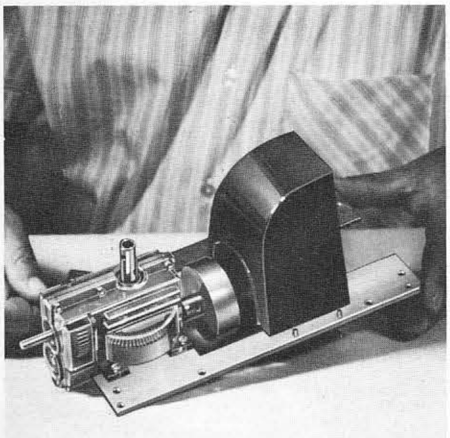
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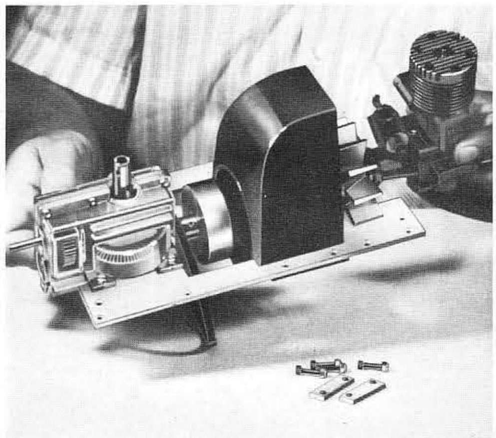
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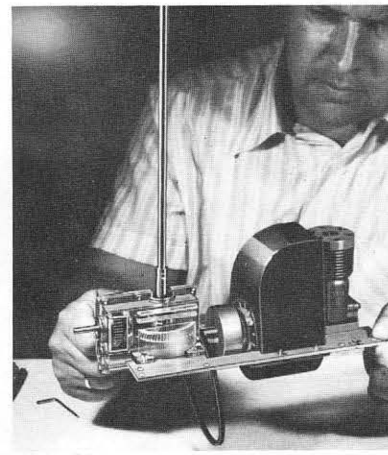
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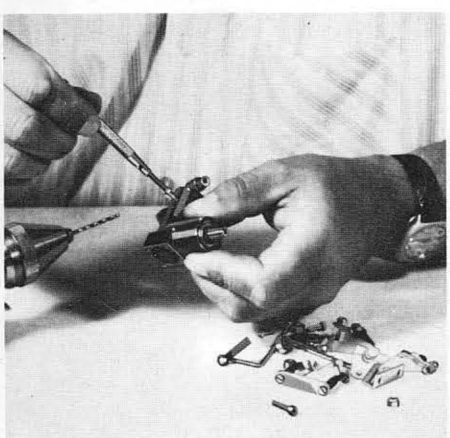
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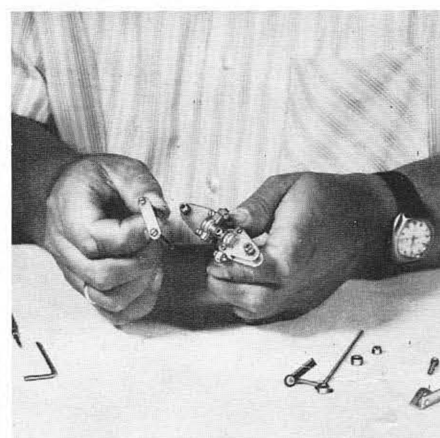
Abb. 67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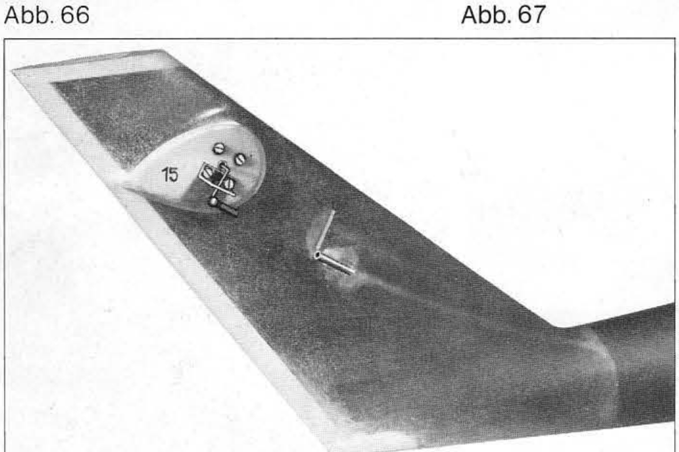

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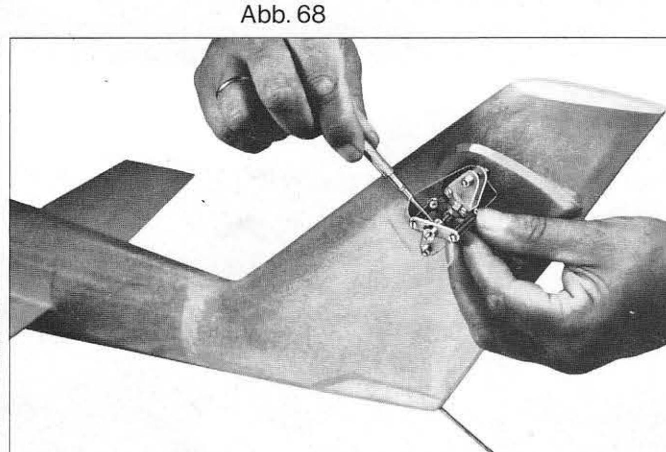
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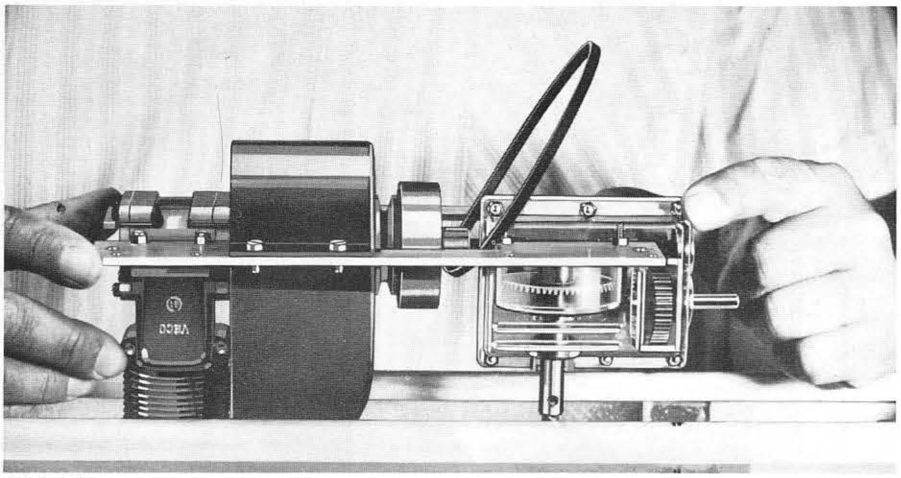

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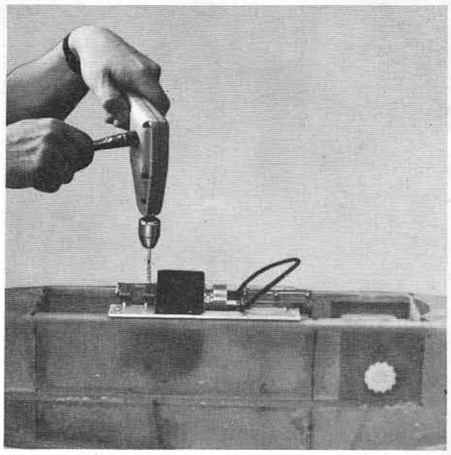

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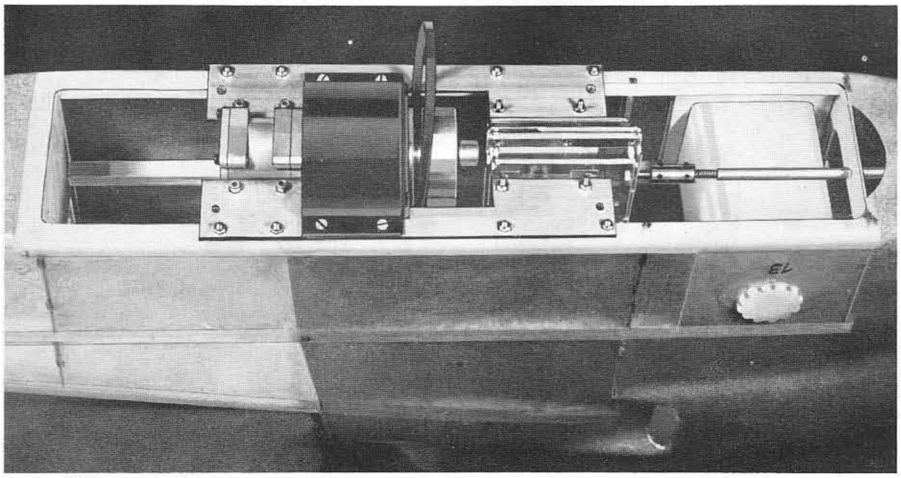

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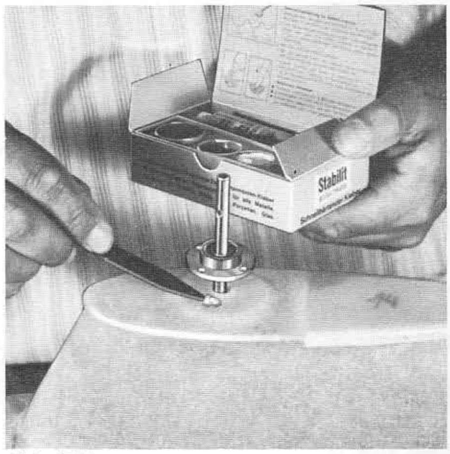

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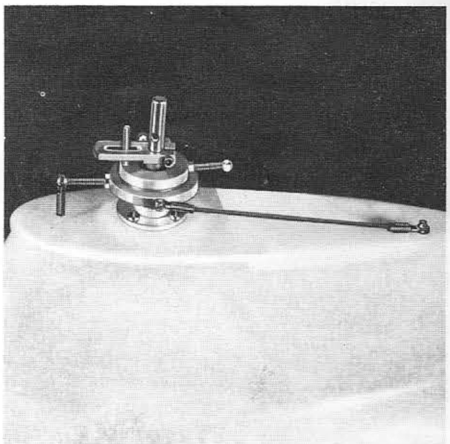

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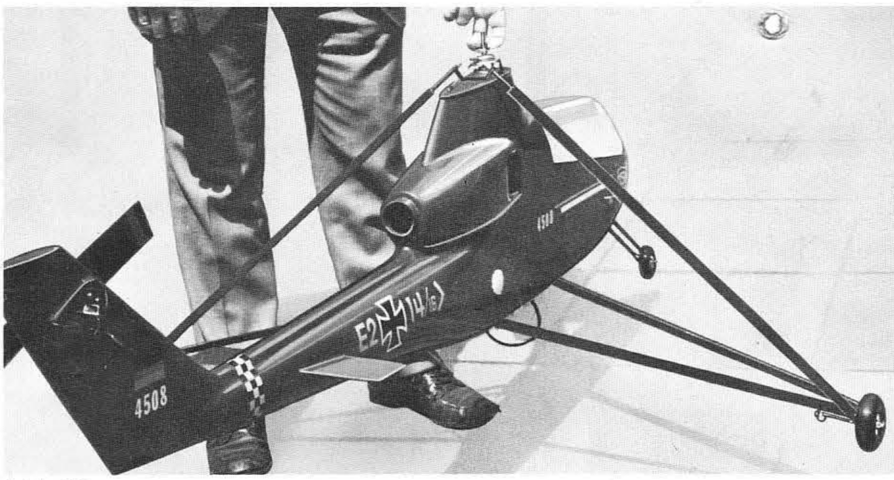


Abb. 76

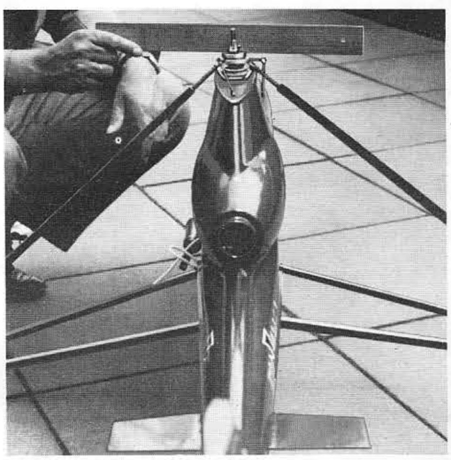


Abb. 77

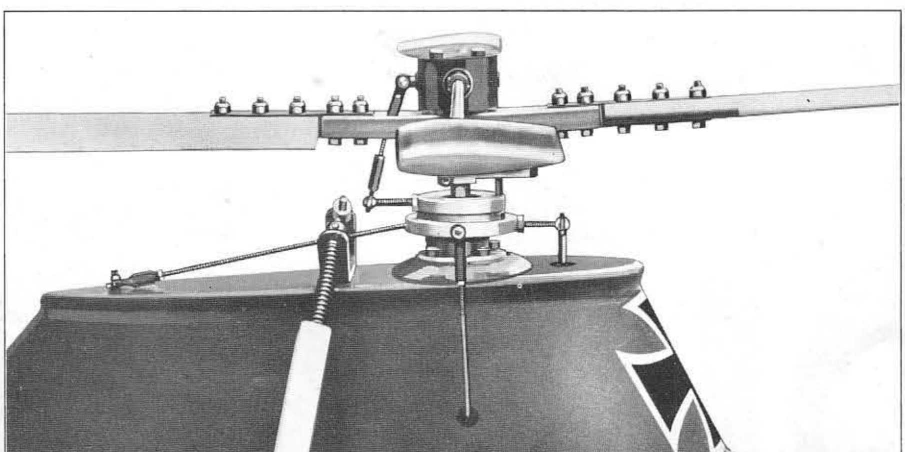


Abb. 78

Hubschrauber · BELL · HUEY · COBRA

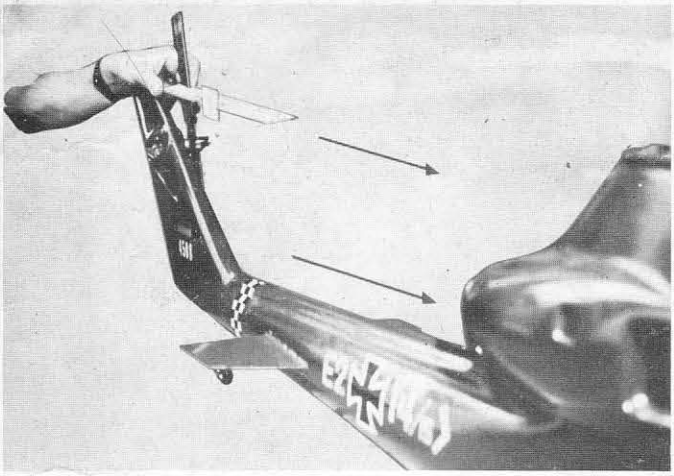


Abb. 79

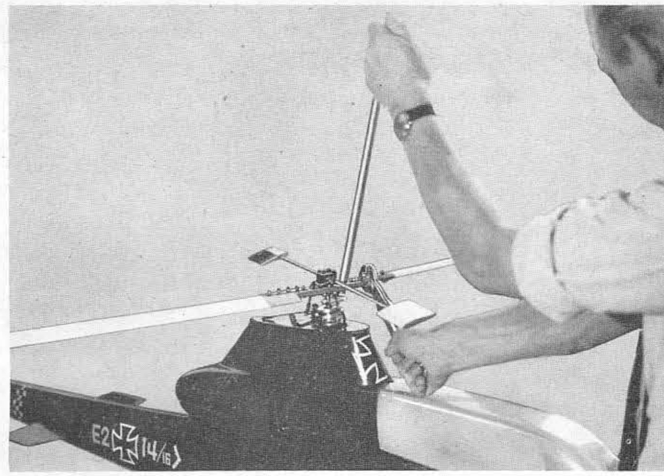


Abb. 82

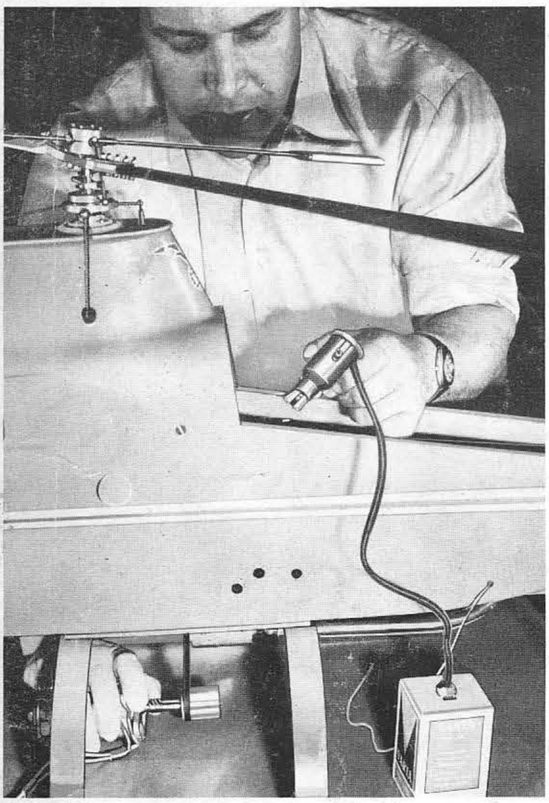


Abb. 80

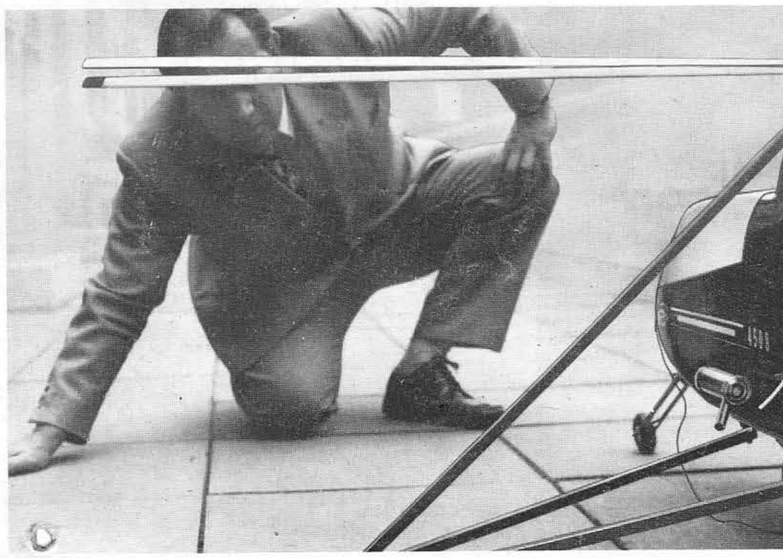


Abb. 81

BELL HUEY COBRA

von Ing. Dieter Schlüter
im Schuco Alleinvertrieb

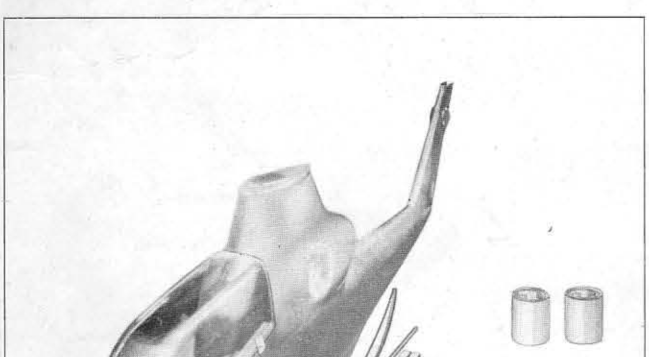


Abb. 83

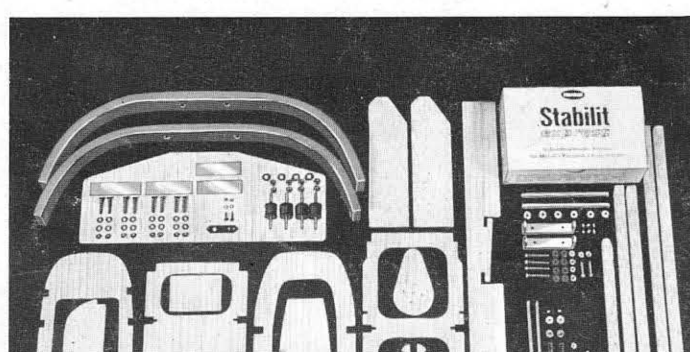
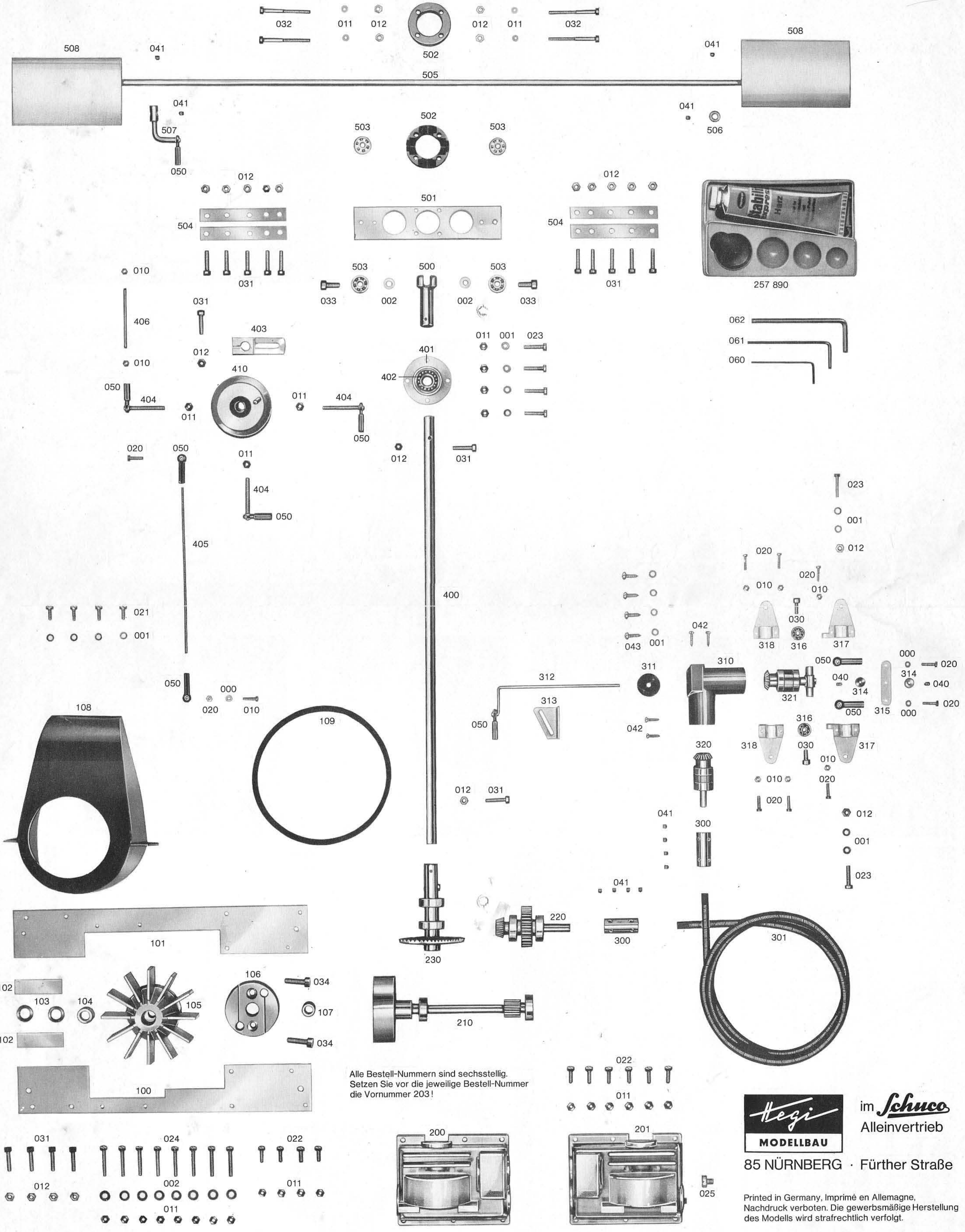


Abb. 84



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Hegi MODELLBAU im Schuco Alleinvertrieb

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