TELAVAL 31

Inverted Transmitted- light Microscope

Operating Instructions

Product liability

The TELEVAL 31 microscope in its original setup or with accessories may only be used for the microscopy techniques described in these operating instructions. The manufacturers do not accept liability for any applications involving other assemblies or components. This restriction also applies to any service or repair work not performed by an authorised service technician.
In this case all claims under guarantee or warranty are rendered null and void, including for those components not directly affected by the repair.

Important note
Please read the following advice carefully:

The TELEVAL 31 microscope was designed and tested in accordance with the IEC publication 1010-1 "Safety Regulations for electrical measurement, command, control and laboratory instruments" and has been supplied in a safe condition. These operating instructions contain essential information and advice for the operator.

TELEVAL 31 is a light microscope for visual and photo-micrographic examination of microscopic objects and is designed on the most advanced scientific and technical principles. The instrument should only be used for the applications prescribed herein. It is not intended for unsupervised routine use!

The microscope is not equipped to protect users against the effects of corrosive, toxic or radioactive or otherwise harmful specimens. The permitted object weight (< 5 kg) should not be exceeded.
Please check whether the mains voltage corresponds to the rating given on the rear of the instrument.
TELAVAL 31 belongs to Safety Classification 1. The plug should only be inserted in an earthed socket. This safety measure must not be invalidated by using an extension cable without safety contact. If connection to the mains is made with a low voltage transformer, it must not be allowed to break the connection. Any breaking of the safety contact inside or outside the instrument or interruption of the earth connection is dangerous to the user and therefore forbidden.

When the microscope is connected to the mains supply, internal connection clamps can carry dangerous charges and the opening of cover plates or removal of components, where this is not essential, can expose live parts. If the adjustment, maintenance or repair is necessary when the instrument is live, it must be undertaken by a qualified technician who is fully aware of the consequences.

Air vents on the lamp housing must not be covered up. If the lamp is to be changed, allow to cool to room temperature first.

When the lamp is on the housing may overheat and should not be touched. If the lamp housing is opened when hot avoid touching the lamp or any adjacent parts.

Care must be taken that only fuses of the correct type and rating for the nominal current are used. The use of makeshift fuses and the short circuiting of the fuse clamps are forbidden.

If it is suspected that the safety devices are not working, the instrumenht must be taken out of service and unauthorised use avoided. In this case please contact the manufacturer or an authorised service workshop. To avoid exposing the eyes to glare a filter should be left in the beam path. It should only be removed if the light intensity is too low.

The items marked with * refer in part to accessory equipment.

1. General description

1.1 Main features

TELAVAL 31 is a transmitted light microscope of inverted design (inverted microscope) and serves primarily for routine observations of cell and tissue cultures and deposits in culture vessels, petri dishes, microtitration plates etc.

Its outstanding features are:
- Compact design, convenient stage height of 230 mm

- Flexible stage function with use of stage extensions, object shifters, micromanipulators and microinjectors

- Use of plate inserts and marker strips for various culture dishes and position display with reference to their grids

- Upright and non-reversed image reproduction

- Fixed Kohler illumination with 0.4 n.a. and working distance of 55 mm; brightfield low-power illumination for large object fields and vessels up to 175 mm high (see Fig. 2)

- User-friendly phase contrast with two annular diaphragms in a slide

- Brightness adjustment for glare-free change from phase contrast to brightfield illumination

- Photomicrography via T2 port with any 35 mm SLR camera

- Easily adjustable hand and arm rests

1.2 Alternative setups

Depending on the type or range of applications the following microscope setups are recommended:

- TELAVAL 31 for brightfield and phase contrast to 200x magnification
- TELAVAL 31 for brightfield and phase contrast to 400x magnification including specimen shifter (suitable also for microtitration plates)
- TELAVAL 31 for brightfield and phase contrast to 100x magnification including object shifter and suitable for microtest plates (HLA assay)

Other accessories are available and magnification ranges can of course be extended upwards and downwards with objective and eyepiece attachments.

1.3 Technical specifications

1.3.1 Dimension

Width : 235 mm
Depth : 500mm
Height : 550 mm
Weight : ca. 6 kg

1.3.2 Power supply ratings

The instrument is rated for either 230 V +6%/-10% (220 V/ 230 V/240 V) or 110 V + 6%/-10% (100 V/100 V/127 V) and for frequencies of 50 and 60 Hz according to customer specification.The relevant voltage range is marked on the rear of the stand.

2 Operation

2.1 Unpacking, assembly and start-up

The polystyrene case should be set down with the markings uppermost and the outer case removed.

- Remove the stand from its case and set up on the work-bench.

- Remove dust covers from the stand and binocular tube, insert the eyepieces, mount the tube into the viewing opening in the stand and screw tight.
- Screw the objectives into the nosepiece (clockwise from the lowest magnification). Depress and rotate the sprung nosepiece each time. Keep the empty nosepiece openings covered with dust caps.

Remove the dust excluder slide from the slide holder (2 Fig. 1), insert the annular diaphragm slide T 31 pH (21 Fig. 4) with inscription legible from the right and engage in centre position (brightfielod setting).

Warning!
Do not connect the plug to the mains socket without checking
the voltage rating. The mains voltage must correspond to the operating voltage marked on the rear of the instrument.

- Switch on the built-in illuminator with rocker switch at the side (9 Fig- 2) and adjust to desired brightness with the voltage regulator (8 Fig. 2).

- Insert attenuation or green filter in the filter slide (1 Fig. 1) and switch into the beam path.

- Set the arm rests to the sides of the microscope and arrange so that they support the arms comfortably when working.

2.2 Hints on operation and function

2.2.1 Use of binocular tube and compensation of visual handicaps

The binocular tube and internal optical system of the instrument have a magnification factor of 1. The total magnification in the visual range is the product of the magnifications of objective and eyepiece. The right-hand eyepiece mount is fixed and takes the focusing eyepiece. The scale on the eyelens is set at "O". The left eyepiece mount focuses to compensate for any variation in the visual acuity of the eyes, ensuring restful working with relaxed gaze. This mount takes the fixed eyepiece. For viewing with spectacles the rubber eyecups are turned down.

Visual defects are compensated as follows:
- Focus the object with the focusing knob (6 Fig. 1) viewing with the right eye through the right eyepiece; then focus the same object with the left eye through the left eyepiece with the diopter ring (3 Fig. 1) leaving the position of the focusing knob unchanged. Adjust the eyepieces to the appropriate eye distance by tilting the mounts symmetrically together or apart. The resulting value corresponds to the pupil distance and can be set on and read off a scale (11 Fig. 2).

2.2.2 Nosepiece safety mechanism

The purpose of this mechanism is to protect the objectives when exchanging them. For routine work with cell and tissue cultures focusing planes are sometimes required which are considerably higher than the stage surface. The focusing range is therefore about 10 mm so that object structures up to 9 mm above the stage top focus reliably. In such cases it is not always possible to switch easily from one objective to another without colliding with the bottom of the stage. To avoid collisions when changing objectives an automatic lock prevents movement of the nosepiece in all focusing positions. The lock only releases when the objective nosepiece, which is sprung, is depressed. Once thus lowered it can be rotated in any direction without danger to the objectives. As soon as it is released it returns automatically to the previous focusing position.

Note
If the nature of the work being done or the objectives being used preclude such collisions with the underside of the stage, this lock can of course be made inoperative. To do this remove the screw to the right of the nosepiece (not illustrated).

2.2.3 Use of LDN objectives

When working with microscopes of the inverted type vessels are often used (plates, dishes etc.) where the thickness of the base is much greater than the 0.17 mm of the standard cover glass.

The working distances of weak objectives bridge these distances without difficulty:

A 5x/0.12 working distance (air) 26 mm
A 10x/0.25 working distance (air) 9.2 mm

But even in the medium magnification range these distances are frequently reduced to values at or below 1 mm and thus cannot be used for large base thicknesses. Special LDN objectives avoid this drawback. They have a relatively large working distance and at the same time the normal 45 mm parfocality of all other objectives (Long Distance Normal parfocality).

The Achromat LDN 20x/0.35 ∞/1.20 Achromat has a free working distance of at least 8.5 mm with a base thickness of 1.2 mm/ The objective is optimised for this thickness and can be used for thicknesses from 0.1 to 2 mm without loss of quality.

The Planachromat objective LDN 40x/0.60 ∞/1.2 corrected has a free working distance of at least 4 mm with a base thickness of 1.2 mm. The objective is optimised for this thickness and can be used for thicknesses of 0.5 to 1.6 mm (scale on graduated ring) without loss of quality. If the base thickness exceeds this loss of image quality must be reckoned with.

For particularly difficult objects and vessel thicknesses of less than 0.5 mm image quality is improved by screwing on the 0.7 mm thick front plates supplied.

Note
When the front plate is screwed on, it increases the default parfocal distance for other objectives. So when objectives are changed refocusing is necessary.

The following procedure is recommended when using the PA LDN 40x:
- Set the thickness of the vessel base on the correction ring. When using the front plate in conjunction with vessel thicknesses less than 0.5 mm, the value set on the ring is the sum of the plate thickness (0.7 mm) and the vessel thickness.

For the thickness scale on the correction ring of the objective, the refractive index of the vessel material is assumed to be ca. 1.5. If other vessel materials have different refractive indices, this leads to negligible differences which lie within the tolerance of + 2 scale divisions.
Thereafter the focusing knob on the microscope is used to sharpen focus. If the front plate is not used, a weaker objective can be used first to set the focusing plane - in line with common practice. When the PA LDN is moved in the focus holds.
- With a little practice the optimum correction can be found by systematic trial and error even if the vessel thickness is unknown. In this case the best way to find out exactly what the effect of the objective is is to rotate the correction ring in minimum increments and in the same direction through the whole range, simultaneously adjusting the fine focus.

After each adjustment on the correction ring refocusing is necessary. If the correction ring only is adjusted while the focus remains unchanged, improved image quality will be achieved but on the whole not the optimum. The image may be sharp but still dim, a clear sign of the wrong setting on the correction ring.

As this method is quite time consuming, it is advisable to measure the thickness of the vessel base before starting.

2.2.4 Brightfield viewing

Open the aperture diaphragm with knurled ring (18 Fig. 3). Place the specimen on the stage and at low magnification, say with the Achromat 10x objective, bring to focus with the focusing knob (6 Fig. 1). The aperture diaphragm is not used to regulate the image brightness. This results in impaired image quality. If necessary change the lamp voltage on the voltage regulator (6 Fig. 3) or place an attenuation filter in the filter slide (4 Fig. 1) and switch into the beam path. In order to obtain full illumination of object fields at lower magnification 5x, disengage the condensor 0.4 with the slide opening and aperture diaphragm and push to the back (Fig. 2). When using exceptionally high culture dishes or similar, this procedure will also be necessary to increase the free working distance to 175 mm. Without the condensor only simple low-power illumination is effective.

2.2.5 Phase contrast viewing

Switch the phase contrast objective into the beam path and open the aperture diaphragm fully. Possibly insert a green filter into the filter slide (4 Fig. 1) and switch into the beam path, focus the specimen. Instead of using an eyepiece, insert the auxiliary microscope P (not illustrated) into a tube mount and by focusing its eye lens the objective's phase annuli become visible. Instead of the dust excluder slide insert the ring diaphragm slide T 31 Ph (21 Fig. 4) into the opening from the right and engage it where the correct diaphragm for the objective is in the beam path:

1. Annular diaphragm for A LDN 20x and A 10x

2. Annular diaphragm for PA LDN 20x and PA LDN 40x.

After engaging the right diaphragm its image also appears in the auxiliary microscope P. The phase annuli and annular diaphragm are now concentered with centering screws on the ring diaphragm slide (21 Fig. 4). Finally the auxiliary microscope is again replaced by the eyepiece. The middle position of the annular diaphragm slide T 31 Ph allows brightfield illumination, and the brightness can be adapted for the phase contrast image by an attenuation filter.

Note:
When using the objective PA 5x/0.10 ∞/Ph. the annular diaphragm PA 5x must be used for phase contrast observation. It should be substituted for one of the existing diaphragms in the slide T 31 Ph as follows: loosen the two centering screws for one of the diaphragms until it can be removed and the other (for the PA 5x) inserted. The mount is conical in shape and the larger diameter should be to the bottom. Tighten the centering screws again and later center the diaphragm exactly as described above.

2.2.6 Darkfield viewing

The object is focused as for brightfield viewing (para. 2.2.4) and the aperture diaphragm fully opened. Darkfield observation is best performed with the 5x and 10x brightfield objectives.

Insert the darkfield slide (22 Fig. 4) into the slide opening from the right till it engages so that the appropriate darkfield diaphragm is in the beam path.

It may be necessary to adjust for the darkest background with the centering screws on the slide, especially with the Achromat (5x/0.12). The contrast can then be improved by reducing the aperture diaphragm opening.

2.2.7 Viewing with oblique illumination

This form of contrasting phase objects is achieved with an azimuth diaphragm (19 Fig. 4). The degree of contrast depends on how precisely the opening of this diaphragm aperture corresponds to the objective aperture. The azimuth diaphragm has, therefore, an adjustable aperture-limiting diaphragm which is controlled by an extending tongue (20 Fig. 4).

The object is focused as for brightfield observation (para. 2.2.4). Open the aperture diaphragm fully, place the azimuth diaphragm (19 Fig. 4) in the slide opening (2 Fig. 1) from the right and pull out the lever to shift the centre diaphragm. Then gently push in again while observing the image until optimum contrast in the specimen is achieved.

2.2.8 Polarized light viewing

The polarizer slide 1 (25 Fig. 4) is inserted in the slide opening (2 Fig. 1) from the right. The analyzer slide T (23 Fig. 4) is pushed into the lower opening on the right hand side of the stand (16 Fig. 3) as far as it will go.

Find a blank area on the specimen holder and set to maximum darkness with the knurled ring. Then locate the object area of interest and focus. Anisotropic structures are highlighted by the brightness contrast. To enhance the contrast effect and for topographic analysis the lambda compensator T (24 Fig. 4) is inserted into the upper opening on the right of the instrument (16 Fig. 3). To obtain optimum contrast rotate the compensator with the ring.

2.2.9 Working with object shifters, plate inserts and marker strips

The object shifter (12 Fig. 2) is mounted on the stage plate from the right and fastened with two sunk screws underneath. The shifter, with a travel range of 126 x 82 mm, is used on the one hand to accept and direct microtiter and tissue culture plates.

But it can also hold other inserts (Fig. 6) specially designed for other commercially available test plates and dishes, such as Terasaki microtest plates, Hamax plates, tissue culture plates, Petri dishes of various sizes and specimen holders of 26 x 76 mm and 52 x 76 mm. These various test plates and inserts are held in place on the right hand shorter arm of the shifter. The longer left hand arm is pressed lightly against the object using the lever and stays in place without further pressure.

Note
Care should be taken when aligning lengthwise that the front left hand corner of a plate touches roughly the centre of the oblique surface of the specimen holder arm. When scanning the cellular specimen plates, marker strips may be inserted to identify which particular well is currently in the field of view. The standard equipment, includes marker strips for microtiter plates, black with white marks A to H and 1-12 and two white strips for individual identification (Fig. 6). For the plate insert for microtest plates black strips marked A - F and 1-10 are supplied.
The strips are inserted as follows: move the object shifter as far as possible backwards to the right so as to expose the guide grooves. Select the marker strips corresponding to the numbering of the object plate and insert in x and y directions so that the pin in the groove engages in the pinhole (13/15 Fig. 3). The interval between two lines on the strip corresponds to the distance between wells. To ensure keeping to one row when scanning the wells in x direction the y-direction travel range can be reduced to the diameter of a single well. This is done with a knurled screw (14 Fig. 3) on the coaxial drive of the shifter which rotates through about 90 and can be arrested in the desired position.

2.2.10 Attaching the stage extension or a micromanipulator

The standard stage plate dimensions of 230 x 180 mm can be enlarged by the attachment of extension plates on both sides (17 Fig. 3). They are fixed like the object shifter with two sunk screws on the right and left hand sides underneath the stage.

If the object shifter is already installed the stage only takes an extension on the left hand side which is supplied as standard with the shifter. Other means of extending the stage versatility are provided by a range of micromanipulators and injectors supplied by Marzhauser Wetzlar GmbH & Co. KG.
A threaded adapter is supplied for connection. Like the stage extension plates this is fixed underneath the TELAVAL stage with two sunk screws.

2.2.11 Connecting an SLR camera

Commercial 35 mm SLR cameras are connected using a special T2 mount. These mounts are camera specific and available either from photographic retailers or the camera manufacturers. Then the T2 adapter (4 Fig. 1) is screwed to the T2 mount and camera. Remove the dust cap from the TELAVAL 31 camera port (10 Fig. 2) and attach the adapter with camera and mount. Select the object area to be photographed with the binocular tube. To determine the image frame and get a perfect focus the focusing eyepiece GP P 10x supplied (18) must be used with an MF-AKS framing graticule (see para. 2.2.12). When the knob (5 Fig. 1) is turned to the symbol "Fotografie" the light path is switched over, allowing 100 percent of the light to reach the camera. The scale of the resulting micrograph is the product of the objective magnification used and the 3.2 projection magnification of the built-in projection lens 3.2:1. For operation of the 35 mm camera itself refer to the manufacturer's instructions.

2.2.12 Using the focusing eyepiece

For microscopic measuring and counting procedures and photo-micrography various measuring and framing graticules are necessary. These are inserted into the focusing eyepiece as follows:

- Unscrew the knurled ring at the lower end of the eyepiece
- Place the eyepiece graticule in the ring (making sure it is clean) so that it reads unreversed, i.e. with the graticule pattern lowermost.

- Screw the eyepiece together and insert in the right tube mount.
- Focus the eyepiece graticule with the focusing lens of the eyepiece
- Now focus the image of the object on the stage using the focusing drive
- Now that the microscopic image and the graticule are both sharply focused in the right eyepiece, the image is focused for the left eye with the diopter adjuster (3 Fig. 1).

3 Tips on care and maintenance

3.1 General

If correctly handled the TELAVAL 31 will last a long time. Servicing and maintenance are simple if the following points are observed.

- The instrument should not be exposed to temperatures above 50 C, frost, damp corrosive vapours and substances or dust. Please use dust excluder caps and slides and the dust hood.

- Remove dust on optical surfaces by a puffer or with a pure hairbrush dipped in alcohol and then dried. Remove obstinate marks and fingerprints with a dust free cloth or chamois, breathing on the surface first. Clean the top surface of the objectives with spirit, not alcohol!

- Avoid getting xylene on objective caps and other plastic containers.

- All work on optical or electrical components or moving parts inside the instrument should only be carried out by qualified service technicians or specially authorised personnel.

For service contact:

Carl Zeiss JENA GmbH	Telefon: (03641)	588 3137
Produktbereich Mikroskopie		od. 2068
Tatzendpromenade 1	Telefax:	588 3139
O - 6900 JENA	Telex :	587 452
Bundesrepublik Deutschland		

or your regional representative.

3.2 Exchanging the lamp

- Loosen the lamp housing (7 Fig. 1) by a small anti-clockwise rotation and remove.

- Take the 6V 25 W halogen lamp on its holder out of the case and insert in the lamp housing. The tip of the mount (28 Fig. 5) must engage in the centering notch of the holder (28 Fig. 5).

- Tighten the lamp and holder with knurled screws (27 Fig. 5).

Warning! Do not finger the bulbs. It if happens inadvertently, clean with spirit.

- Replace the lamp housing and lock in.

3.3 Motion of binocular tube and focusing drive

Binocular tube: If after a time the eyepiece distance should change of its own accord, the problem can be solved by adjusting the internal brake.

- Bring the eyepiece mounts as close together as possible. This reveals two groups of three screws each. For stiffer motion tighten the small screws with a screwdriver. For easier motion, loosen them.

- The larger screws fix the brake in the housing and should not be altered.

Focusing drive:
This is so designed that no adjustment is necessary and is not possible without causing damage.

3.4 Consumable items

HLW S5A 6V 25 W halogen lamp	Cat. No. 105.859)
Incandescent unit 19195-400 mA for 230	(Cat. No. 602.10837/5)
Incandescent unit 19195-500 mA for 110	(Cat. No. 602.10841/3)

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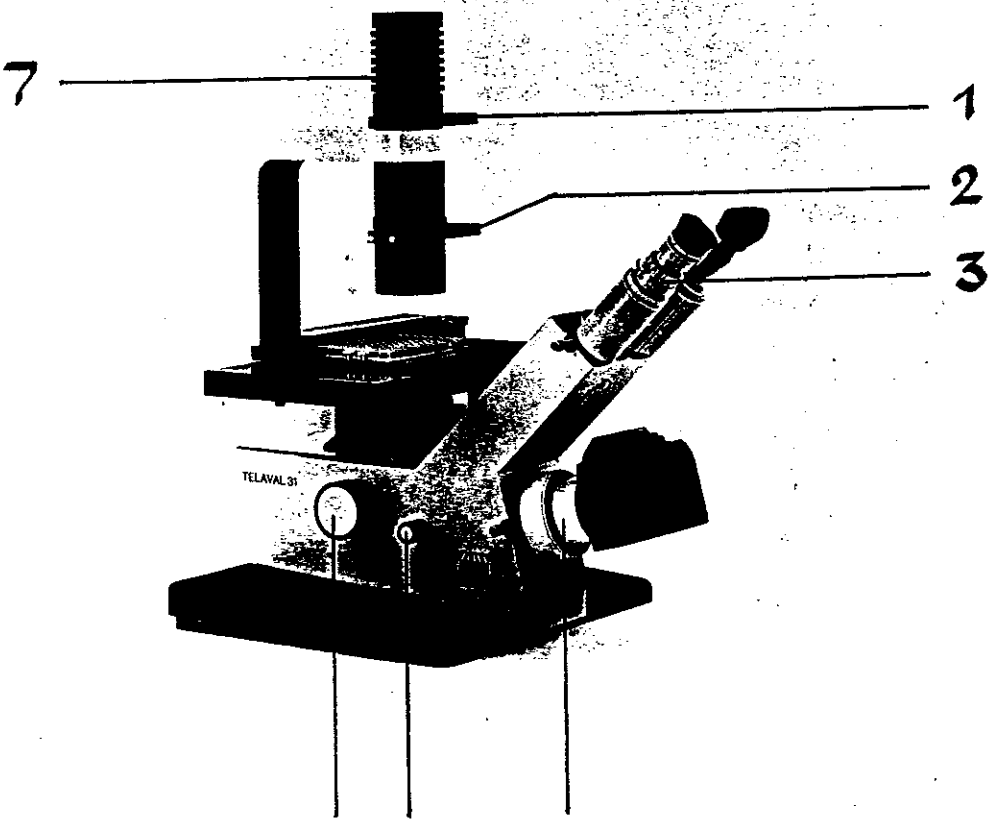

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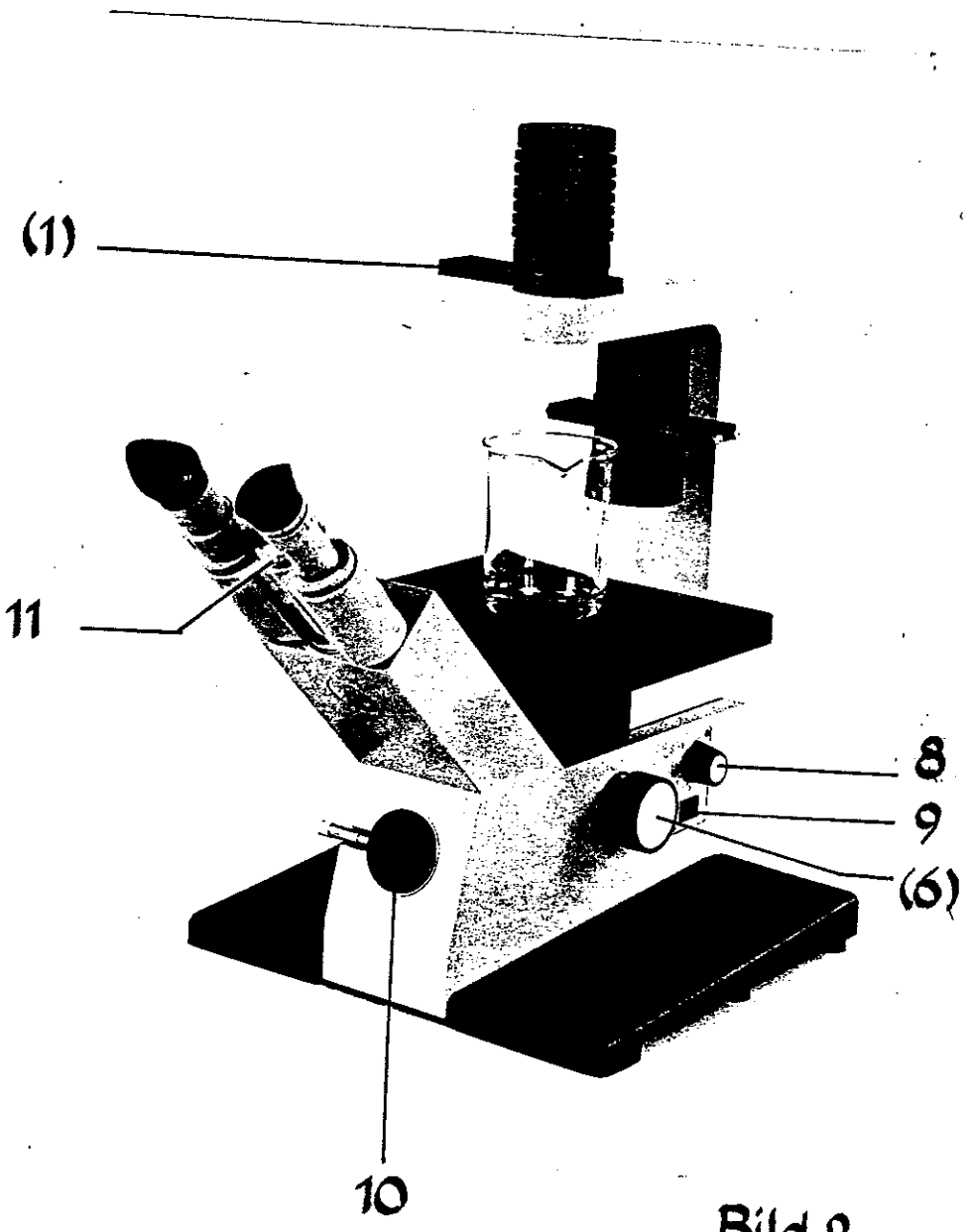

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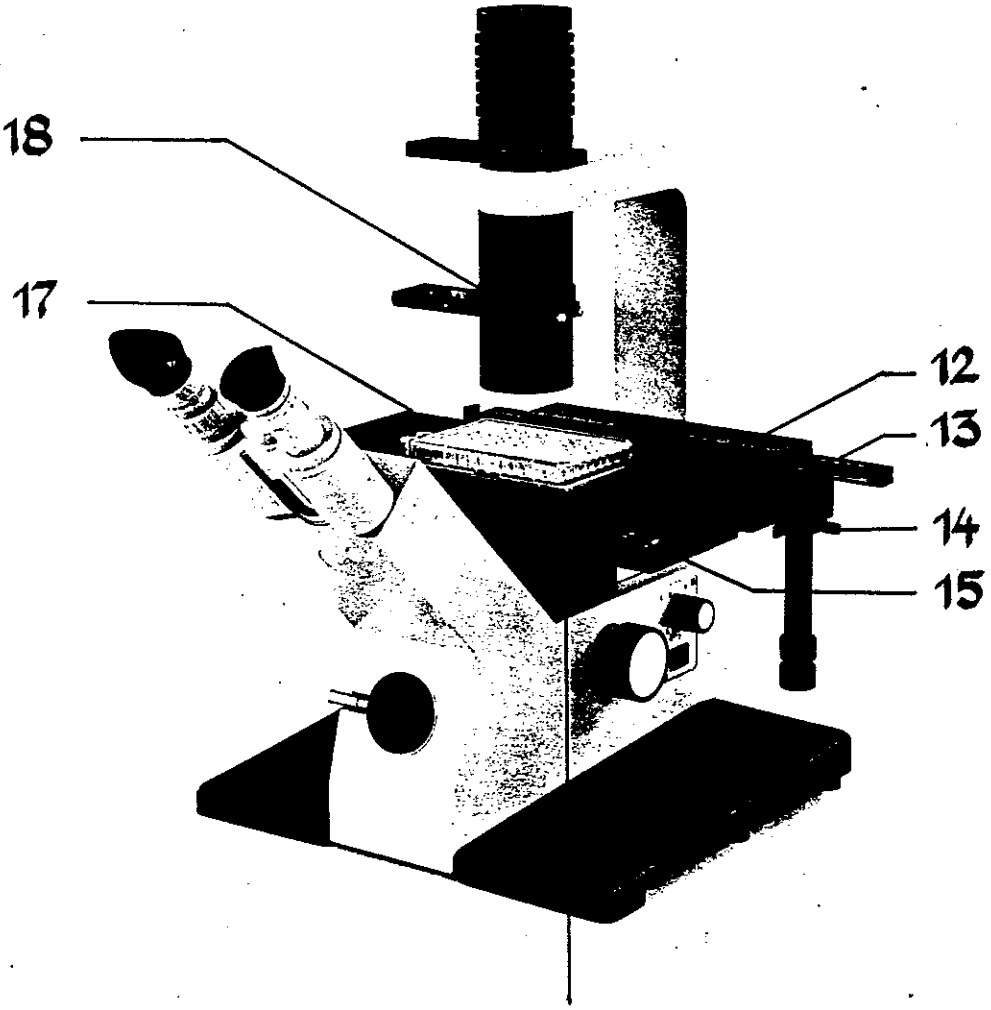

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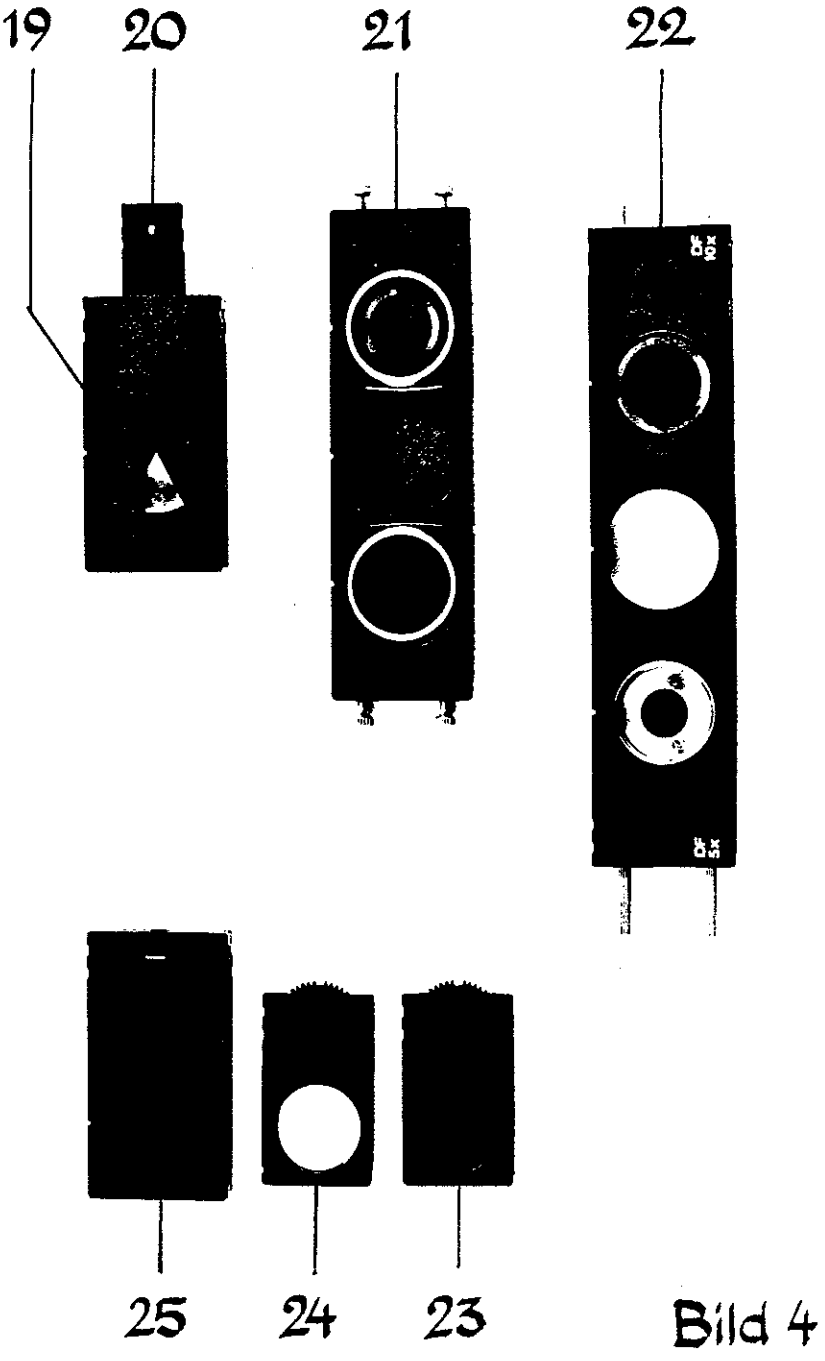

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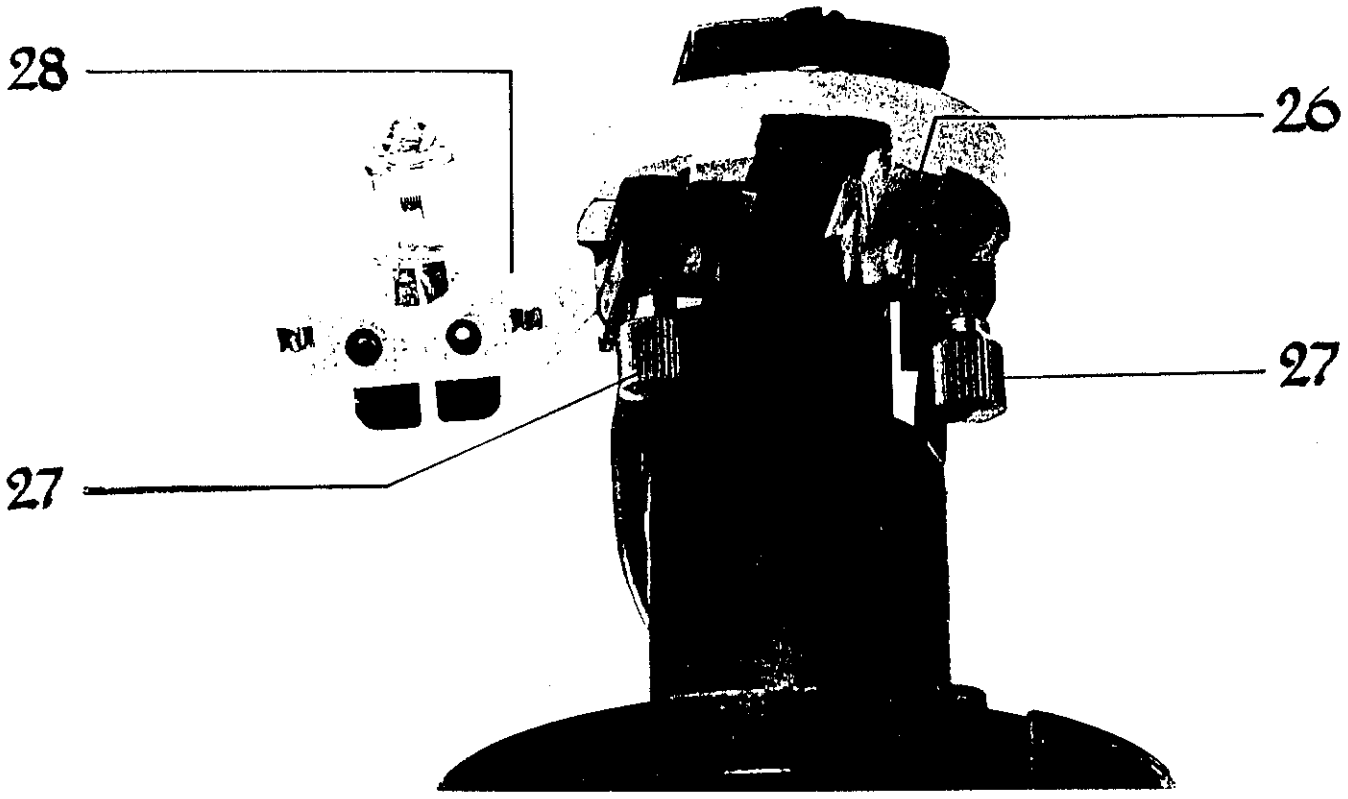

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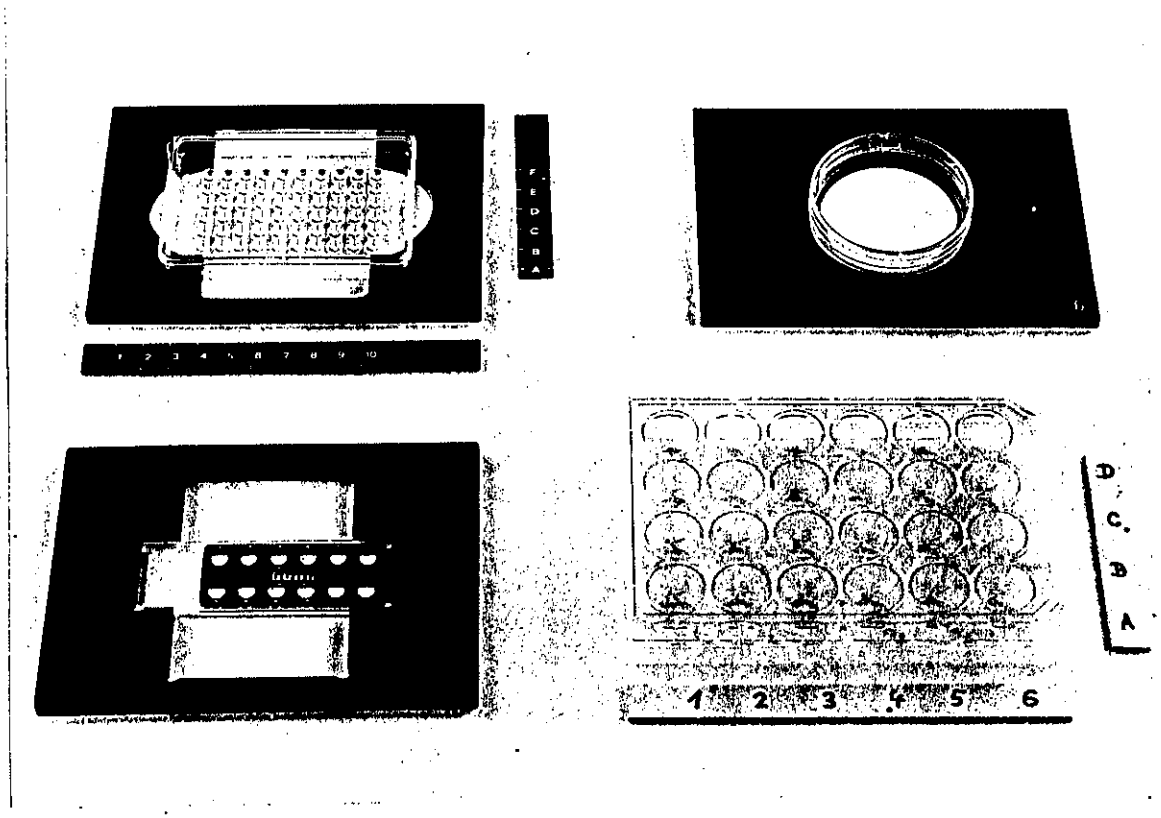

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TRANSMISSION REPORT

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