



Phipps & Bird, Inc. *Manufacturers of Scientific Instruments*/8741 Landmark Road/P.O. Box 27324/Richmond, VA 23261/(804) 264-7500

## **STUDENT TAMBOUR**

7066-901

## **RESEARCH TAMBOUR**

7071-000

## **PNEUMOGRAPH**

7093-000      7093-500

## **OPERATING INSTRUCTIONS**

The equipment described in this manual is not designed or intended for clinical or diagnostic use.

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## TAMBOUR

The tambour is a device which converts changes in pressure in a closed system to mechanical motion. This mechanical motion is transmitted by means of a lever and pivot to produce a recording on a kymograph.

Various pressure transducers may be used to produce the pressure changes to operate the tambour. These include the large Pneumograph (7093-000), the small Pneumograph (7093-500) and Plethysmographs (7090-000 and 7090-100).

### Assembly Instructions for Student Tambour (7066-901)

Mount the tambour to the kymograph's support rod (7011-000) using a double right angle clamp (7026-000). Align the bowl of the tambour so it is parallel with the table top (see Fig. 3 & 4). Loosen thumbscrew (4) and adjust the clamp block so it is perpendicular to the top of the bowl or table top (see Fig. 3 & 4). Retighten thumbscrew.

Unscrew the small knurled screw (8) on the swivel so the hole (10) is visible. Insert the stylus or pen stem through the fulcrum (2) and into the swivel's opening (10), making sure the stem does not protrude more than  $1/16''$ . Align the stylus or pen tip so it is perpendicular to the kymograph's writing surface (see Fig. 3). Tighten swivel.

The stylus or pen when at rest should be parallel to the stem of the tambour (see Fig. 2). If not, adjust thumbscrew (1) on the stylus carrier assembly by turning the thumbscrew until it is parallel. The stylus or pen should then be centered at a point of rest on the fulcrum thus allowing an equal amount of movement in a vertical plane.

The amplitude of the stylus or pen movement can be increased by positioning the clamp block assembly closer to the fulcrum, or decreased by moving it farther from the fulcrum.

### Using the Tambour for Ink Writing

Fill the reservoir with ink (7021-000). Take the pen starter (7028-000) and push the plunger all the way in. Insert the tip of the pen into the opening at the end of the pen starter. Slowly draw the plunger out until the ink flows through the pen. Be careful when drawing the plunger out, it should not take more than  $1/4''$  movement. At this point, the tambour is ready to be used.

### Cleaning the Pen and Reservoir

After using, the pen should be flushed with water followed by isopropyl alcohol or acetone. Failure to do so will only result in a clogged, unserviceable pen.

### Replacing the Diaphragm, Student Tambour

Remove the pen or stylus and clamp block from the tambour. Peel the fulcrum (2) off the diaphragm and remove all excess glue. Remove the O-ring (3) from the bowl and peel off the diaphragm making sure there is no foreign material which may still be attached to the edge of the bowl. Select a piece of rubber dam (P & B 7097-200) which is at least 1" larger in diameter than the size of the bowl. Very lightly stretch the new diaphragm over the bowl, just enough to create surface tension. Replace the O-ring and cut off excess rubber dam. Apply white glue to the ring of the fulcrum and place it so it is centered on the bowl with the stylus or pen holder parallel to the swivel (Fig. 1.). Allow the new diaphragm to dry for a few hours before using.

### Helpful Hints

The diaphragm is made of material that will deteriorate with time and handling. To extend the life of the diaphragm, sprinkle it with talcum or baby powder after use.

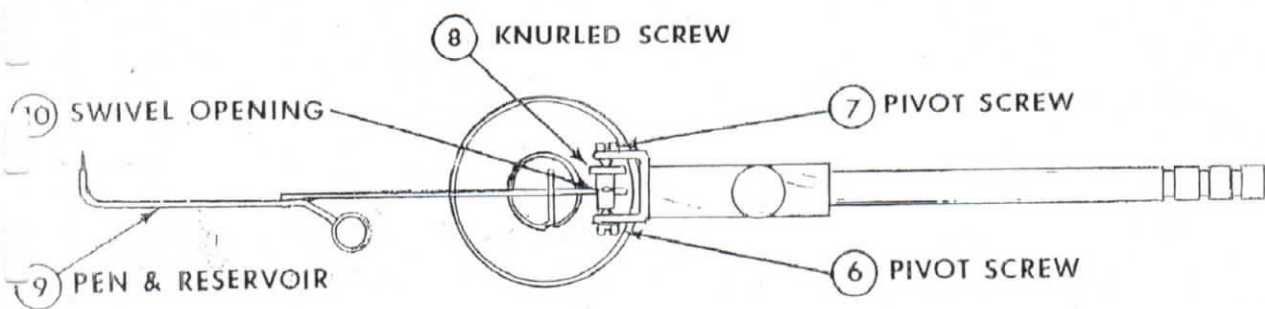


FIG. 1 7066-901 STUDENT TAMBOUR (SHOWN WITH INK WRITING PEN)

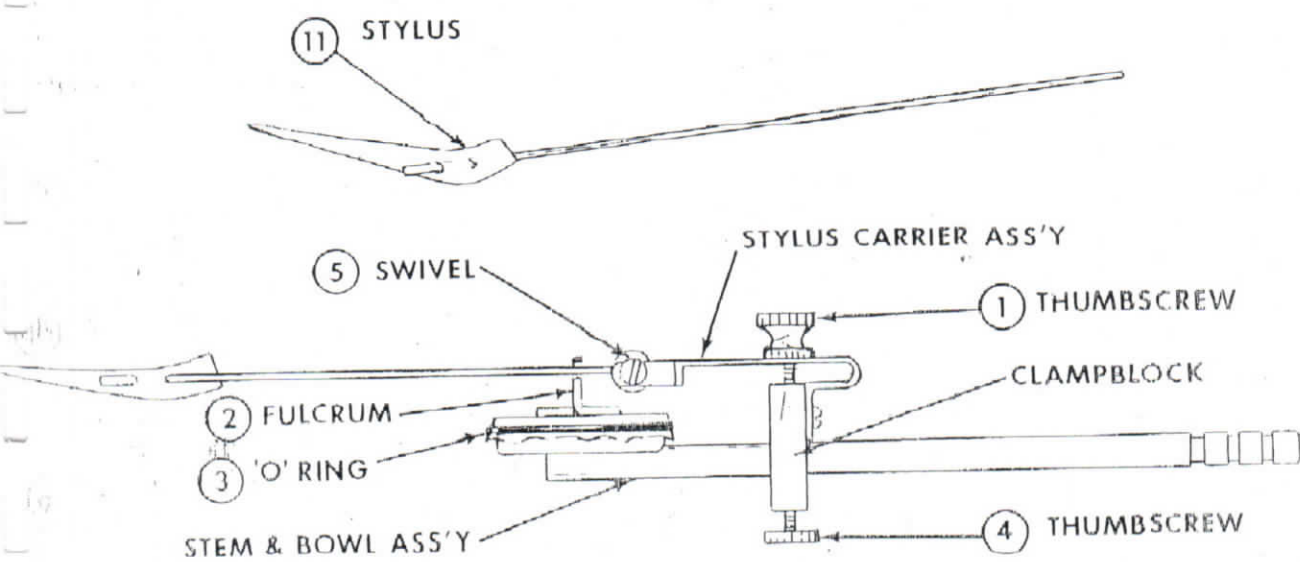


FIG. 2 7066-901 STUDENT TAMBOUR (SHOWN WITH SMOKE WRITING STYLUS)

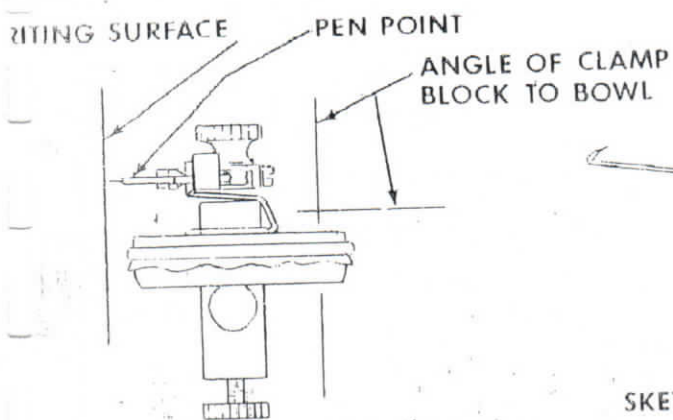


FIG. 3

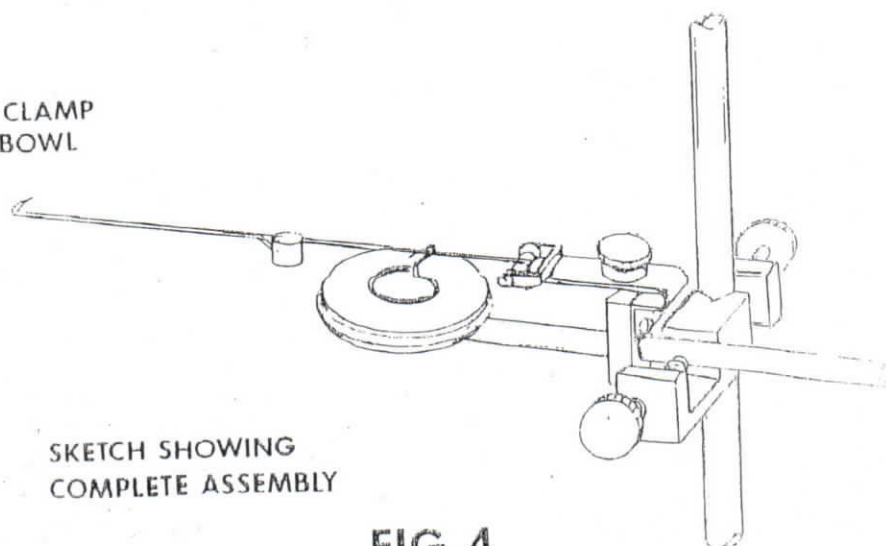


FIG. 4



## INSTRUCTIONS FOR RESEARCH TAMBOUR (7071-000)

The 7071-000 Research Tambour is equipped for gravity pressure writing. The stylus for smoke writing, or the pen for ink writing, are interchangeable in the swivel clamp (12). This clamp is carried in the gimbal (11). Its axis is not perpendicular, but the swivel clamp is inclined toward the writing surface. The weight of the pen or stylus causes its tip to fall toward the writing surface, providing substantially constant writing pressure ideally adapted to making an accurate line on a cylindrical surface such as the vertical drum of a kymograph.

### SET-UP AND ADJUSTMENT

The frame (1) can be clamped to a vertical rod. The coarse adjustment of the base line on the recording surface is accomplished by moving the entire assembly up and down on the support rod and clamping it in position with the thumb screw (13).

The adjustment of the position of the writing device is made by loosening the screw (3) and moving the carrier (4) up and down until the pen and driving lever are substantially horizontal at the mid point of the excursion. Fine adjustment of the base line is provided by rotating the knurled thumb nut (2).

The amplitude of the motion of the writing device is altered by shortening or lengthening the driving lever which is clamped in the tubular element of the gimbal by the screw (14). Whenever the position of this lever is changed, the screw (5) should be loosened and the bowl assembly (6) slid back or forth as required in the carrier (4) to keep the link (9) vertical.

### INK WRITING

When a pen is used instead of a stylus, the ink well (18) must be installed in a hole (not shown) in the frame and clamped by a thumb screw. Adjust the ink well vertically to a position that clears the intake end of the pen. When the adjustment is correct, the intake end of the pen will not touch either the bottom or sides of the ink well during the entire pen excursion.

When using siphon pens, the pen must always be adjusted in the swivel clamp (12) so that the tip of the pen is as nearly perpendicular to the writing surface as possible.

See notes under Student Tambour on filling, starting and maintaining pens.

### REPLACING THE DIAPHRAGM

The diaphragm (23) is secured to the bowl assembly (6) by an "O" ring (7). The link (9) is attached to the diaphragm by a stud and clevis.

When it becomes necessary to replace the diaphragm (23) proceed as follows: First, loosen thumb screws (5 and 14) and remove the link (9) and bowl assembly (6) from the tambour. Next, remove the ring (7) to free the old diaphragm from the bowl. Remove the nut (22) and washer (21) to free the link and stud assembly (9 & 10).

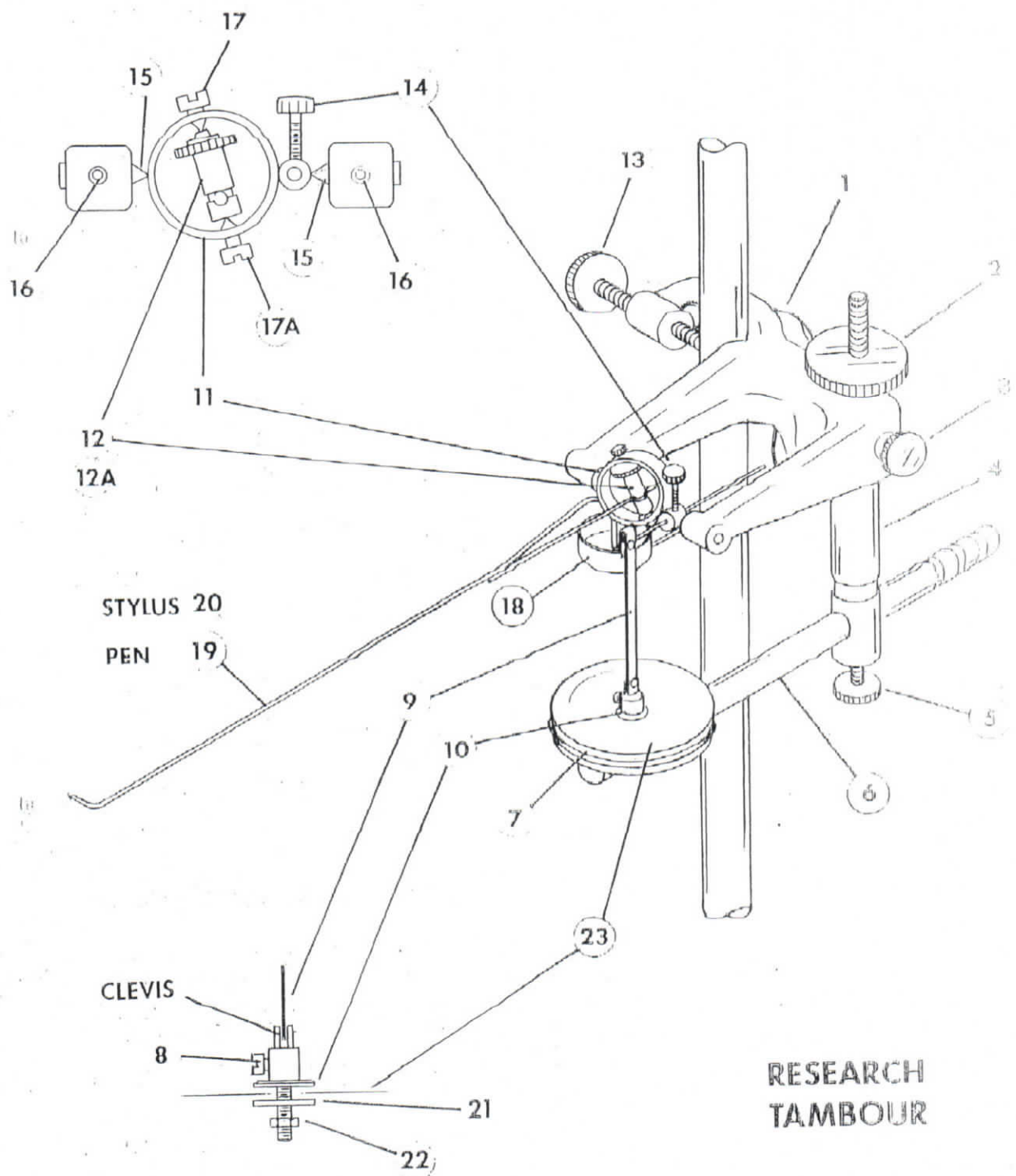
To fit the new diaphragm cut a piece of material one inch larger than the bowl diameter. Pierce the center and replace the link, clevis and stud (9 & 10). Put the washer (21) in place and install and tighten nut (22). When tightening the nut, hold the assembly by the clevis not the link. Take care not to distort the link during this operation. Loosen the screw (8) and remove the clevis and linkage assembly (9) from the stud (10). This allows more freedom of action during the installation of the new diaphragm on the bowl.

Place the new diaphragm over the lip of the bowl, and with the stud (10) carefully centered on the bowl, press the "O" ring down to hold the diaphragm in place. Cut the excess diaphragm material away below the ring. Replace the clevis on the stud and the assembly in the tambour, making sure that the bowl and driving lever are secured in position so that the link is always nicely aligned and not twisted or bound in its forks.

### OTHER ADJUSTMENTS

The pivot screws (17) that hold the swivel clamp in the gimbal must be properly adjusted for adequate gravity writing. If these screws are too tight the pen will not rest against the writing surface as it should. If they are too loose the pen will not follow the motion of the diaphragm as it should.

In like manner, the gimbal pivots (15), held in place by the set screws (16), will be a source of friction if they are too tight or damaged by misuse.





## INSTRUCTIONS FOR PNEUMOGRAPH (7093-000 and 7093-500)

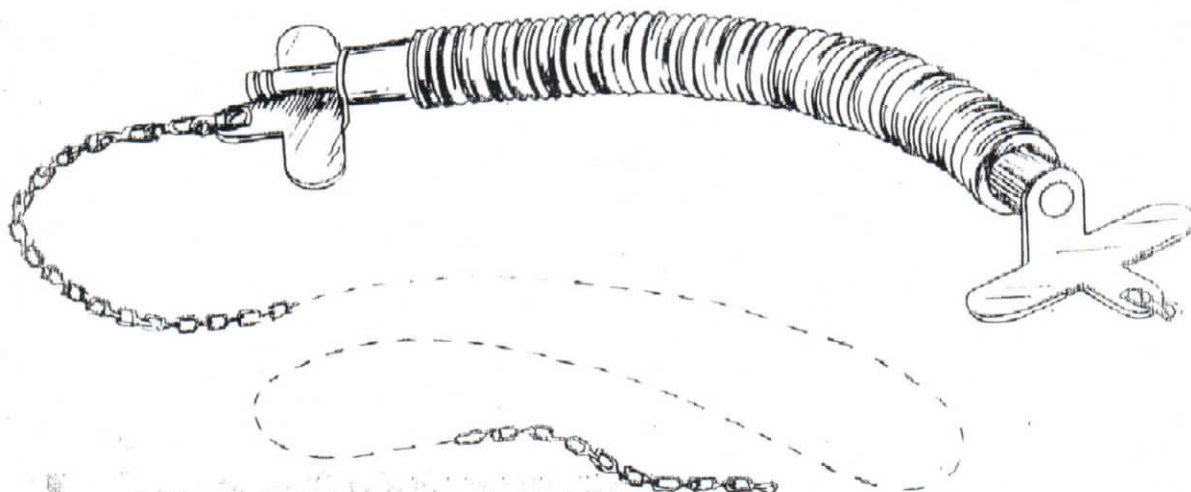
The pneumograph responds to changes in the size of an object, as the air volume in the pneumograph increases and decreases when the pleated rubber tube of the pneumograph is stretched and contracted.

For studies of respiration, the pneumograph is strapped around the subject's chest in a position on the median line just below the armpits. When a mature female is the subject, place the pneumograph above (not across) the breasts, thus reducing the chance of slippage of the instrument during the experiment.

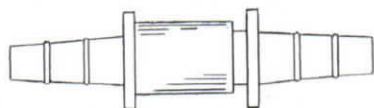
Attach a length of rubber tubing (3 to 4 feet long) to the pneumograph outlet, and one part of the plastic Quick Disconnect (8820-401) to the tubing.

The pneumograph is used in conjunction with the tambour (7066-901) or (7071-000). The tambour is mounted on a stand next to the Kymograph. Attach a short length of tubing to the tambour and the other part of the Quick Disconnect to its free end.

Strap the pneumograph in place on the subject. The pneumograph should be partially stretched, but not too tightly. Join the plastic Quick Disconnect and trap the volume of air in the closed pneumograph-tambour system. When the pneumograph collapses (during expiration) the pressure in the closed system will increase, bulging the rubber diaphragm of the tambour, which will in turn raise the tambour writing arm. If upon inspiration the rubber diaphragm hits the bottom of the bowl, the peak of inspiration will appear as a plateau on the Kymograph record rather than a pointed peak. If this occurs, open the Quick Disconnect and trap more air in the system. This may be done by having the subject partially inhale and, hold his breath; then join the Quick Disconnect.



(7093-000 & 7093-500) PNEUMOGRAPH



8820-401 QUICK DISCONNECT

## EXPERIMENTAL TOPICS

A variety of experiments can be performed using a pneumograph, tambour, and kymograph. Such experiments may be carried out by students working in groups, or may be set up as demonstrations. These topics and experiments may include:

- Normal Respiratory Patterns
- Respiratory Inhibition while Drinking Water
- Comparison of Patterns of Various Subjects
- Delayed Rate Change after Onset of Exercise
- Rate and Amplitude after Exercise
- Respiratory Rate with Sensory Stimuli
- Breath Holding after Inhaling vs. after Exhaling
- The Role of Carbon Dioxide in Respiration
- The Role of Oxygen in Respiration
- Effects of other Stimuli on Respiration
- Heart Rate and Respiration Rate

Further information on physiology experiments may be found in A Physiology Manual for the Biology Teacher, by Dr. Alfred Chaet and Robert Morton; Phipps & Bird catalog number 7005-406.

## RECOMMENDED EQUIPMENT FOR RESPIRATION EXPERIMENTS

KYMOGRAPH	7006-000
SUPPORT ROD	7011-000
KYMOGRAPH PAPER	7016-000
TAMBOUR	7066-901 or 7071-000
CLAMP, DOUBLE RT. ANGLE	7026-000
SIGNAL MAGNET	7081-001
PNEUMOGRAPH	7093-000
QUICK DISCONNECT	8220-401
TIMER	7110-000
RUBBER TUBING, 3/16 I.D. x 3/16 Wall, 5ft.	
BATTERY, DRY CELL 1½ Volts	
HOO-K-UP WIRE	

## REPLACEMENT PARTS AND ACCESSORIES

ITEM NO.	ORDER NO.	DESCRIPTION
STUDENT TAMBOUR 7066-901 (Figures 1 & 2)		
1	30.004	THUMBSCREW, KNURLED
2	30.005	FULCRUM
3	11.3014	RUBBER "O" RING
4	SP24	THUMBSCREW, KNURLED
5, 8	SP8A/B	SWIVEL WITH KNURLED SCREW
6	SP9	PIVOT SCREW (Medium)
7	SP13	PIVOT SCREW (Short)
9	7049-001	PEN WITH INK RESERVIOR
11	7033-000	STYLUS
12	7097-200	DIAPHRAGM, RUBBER DAM
RESEARCH TAMBOUR 7071-000		
7	11.3014	RUBBER "O" RING
9	12.200	LINK ASSEMBLY
10	SP25/26	STUD AND NUT ASSEMBLY
11	28.200	GIMBAL ASSEMBLY
12, 12A	SP8A/B	SWIVEL WITH KNURLED SCREW
14	SP12	KNURLED SCREW
17	SP13	PIVOT SCREW (Short)
17A	SP9	PIVOT SCREW (Medium)
18	SP16	INKWELL
19	7060-000	PEN
20	7033-000	STYLUS
23	7097-200	DIAPHRAGM, RUBBER DAM
PNEUMOGRAPH, LARGE 7093-000		
	7093-100	BELLOWS ONLY
PNEUMOGRAPH, SMALL 7093-500		
	7093-600	BELLOWS ONLY
ACCESSORIES		
	7005-406	MANUAL: A PHYSIOLOGY MANUAL FOR THE BIOLOGY TEACHER (CHAET)
	7011-000	ROD, SUPPORT (FOR KYMOGRAPH)
	7021-000	INK, BLUE, 4 oz. BOTTLE
	7026-000	CLAMP, DOUBLE RIGHT ANGLE
	7028-000	PEN STARTER
	7029-000	PEN CLEANER
	8220-401	QUICK DISCONNECT

Instructions, diagrams, parts and prices are correct as of the publication date of this manual, but are subject to revision without notice.