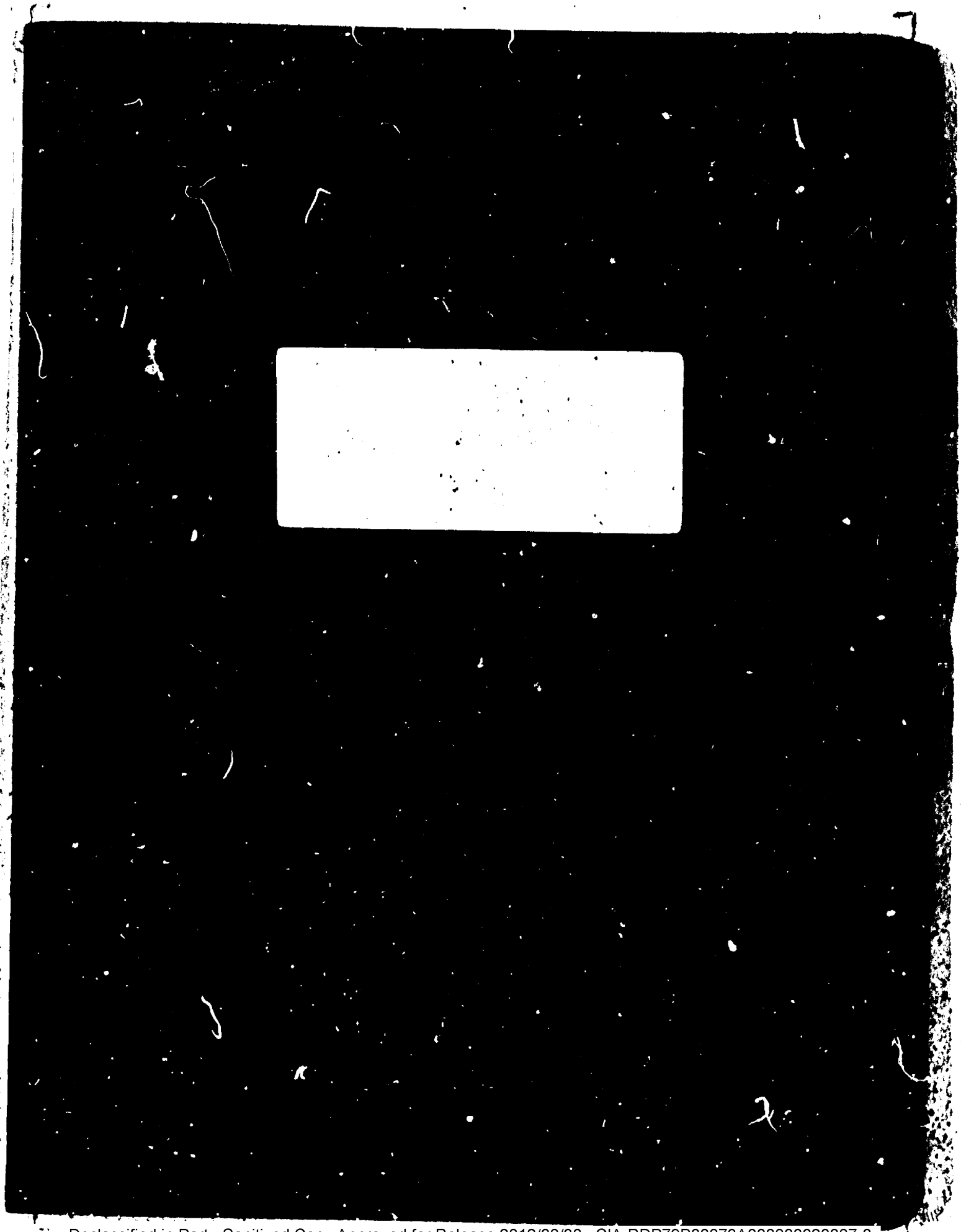


Project No. 70-197

C0000710

UNITED STATES GOVERNMENT
WASHINGTON, D.C.

APPENDICES A AND B
INVESTIGATION OF PRESENT AND FUTURE VIBRATION ENVIRONMENT

STAT

STAT

JUNE 1971

STAT

TABLE OF CONTENTS

APPENDIX A
DATA AND DETAILED DESCRIPTIONS OF EACH GROUP OF MEASUREMENTS

STAT

LOCATION AND DESCRIPTION
OF VIBRATION DATA

STAT

LOCATION AND DESCRIPTION OF VIBRATION DATA

LOCATION A

Ambient vertical and horizontal (west) floor vibrations were recorded in Room 1N627-N. These data are documented as Record 1. The top trace represents vertical motion and the bottom horizontal motion near the center of the bay bounded by Column Lines 7 and 8 and Column Lines G and H.

LOCATION B

Ambient vibratory motions of the foundation block located in the [redacted] room (first floor) were recorded at various positions on the foundation to evaluate vertical, translational and rocking motion. Data were also recorded on the foundation and the adjacent floor to evaluate the ambient motion of the foundation with respect to the floor. These data are documented as Records 2 through 9. A description of each record is as follows:

STAT

Record 2 - Vertical vibratory motion of the northeast (top trace) and northwest (bottom trace) corners of the foundation.

Record 3 - Vertical vibratory motion of the northeast (top trace) corners of the foundation.

Record 4 - Vertical motion of the northeast (top trace) and southeast (bottom trace) corners of the foundation.

Records 5 and 6 - Vibratory motion of the foundation block and the adjacent floor were recorded at the northeast corner of the foundation. The top trace represents the vertical movement of the foundation and the bottom trace the vertical movement of the floor. Record 6 is a repeat of Record 5 with the velocity transducers interchanged to check that they are functioning properly.

Record 6a - Same as Record 6.

Record 7 - Horizontal vibrations in the north (top trace) and east (bottom trace) directions were recorded at the centerline of the north end of the foundation block.

Record 8 - Horizontal vibrations of the foundation block and the floor were measured and recorded. The top trace is a record of vibratory motion of the foundation block in an easterly direction measured at the center of the north end of the block. The floor horizontal motion (bottom trace) in an easterly direction was measured at the northeast corner of the foundation.

Record 9 - Same as Record 8, except that the motions were recorded in a northerly direction.

LOCATION C

Vibrations were measured in the room where the Fastran Mass Storage Units are located. Records 10, 11, 12 and 13 were taken at the southeast corner of the unit adjacent to Column C-11. In these records, the top trace is vibration of the floor and the bottom trace of the unit.

Record 10 - Horizontal vibrations were recorded in a westerly direction. Monitoring the vibrations prior to obtaining a record indicated that Record 10 is a transient vibration and not typical of the ambient vibrations.

Record 11 - Same as Record 10, except that it is a measure of ambient vibration.

Record 12 - Same as Record 11, except that the horizontal vibrations are in a northerly direction.

Record 13 - Same as Record 11, except that vibrations are measured in the vertical direction.

LOCATION D

Ambient floor vibrations were recorded on the first floor corridor at the north end of the building in the bay bounded by Column Lines 1 and 2 and Column Lines F and G. These measurements are documented as Records 14 through 18.

Record 14 - Ambient floor vibrations were measured near Column F-1 (top trace) and at approximately mid-bay (bottom trace) in the vertical direction.

Record 14a - Same as Record 14.

Record 15 - Floor vibrations were measured in the vertical (top trace) and horizontal (bottom trace) directions near Column F-1. The direction of the transducer for the horizontal vibration was to the north.

Record 16 - Same as Record 15, except the direction of the horizontal (bottom trace) transducer was to the west.

Record 17 - Ambient horizontal vibrations (north) were measured near Column F-1 (top trace) and at approximately mid-bay (bottom trace).

Record 18 - Same as Record 17, except the direction of the transducers was to the east.

LOCATION E

Ambient floor vibrations were recorded on the first floor corridor at the south end of the building in the bay bounded by Column Lines 18 and 19 and Column Lines J and K.

Record 19 - The top trace of the record represents vertical vibration at approximately mid-bay. The bottom trace is horizontal vibration at approximately mid-bay in a northerly direction.

Record 20 - Same as Record 19 except the horizontal direction was to the east.

LOCATION F

Floor and equipment vibrations were measured at the north end of the clean room (2N420-A) bounded by Column Lines 3 and 4 and Column Lines A and B.

Record 21 - While equipment was turned off, vertical measurements (top trace) were recorded on the floor adjacent to the Densitometer and on top (bottom trace) of the Densitometer glass plate.

Record 22 - Same as Record 21 with equipment turned on.

Record 23 - Vertical measurements were recorded on the base plate (top trace) of the Densitometer and on top of the glass plate with the equipment on.

Record 24 - Same as Record 23 except the vertical measurement represented by the bottom trace was taken atop the Densitometer table with the equipment off.

Record 25 - Same as Record 21.

LOCATION G

Ambient floor and equipment vibrations were recorded in the Enlargement Room located on the second floor near Column A-17.

Record 26 - Vertical floor vibrations were recorded at Column A-17 and approximately 6 feet from Column A-17. The top trace represents motion at the column and the bottom trace motion 6 feet from the column.

Record 27 - Vertical vibrations were recorded on top of the paper support (top trace) and near the lens (bottom trace).

LOCATION H

Floor and equipment vibrations were recorded in the second floor Mensuration Area, Room 2N620. These vibrations are documented as Records 28 through 39.

Record 28 - Vertical floor vibrations were recorded at Column H-5 (top trace) and at approximately mid-bay (bottom trace) with all equipment turned off.

Record 29 - Same as Record 28.

Record 30 - Vertical vibration (top trace) and horizontal vibration (bottom trace) in a northerly direction were recorded on the floor at Column H-5 with all equipment off.

Record 31 - Same as Record 30, except that the direction of horizontal transducer was to the east.

Record 32 - Same as Record 31 except that all equipment was turned on.

Record 33 - Same as Record 28 except that all equipment was turned on.

Record 34 - Vertical vibrations were measured at Column H-5 (top trace) and on the main lower frame of a Mensuration Unit (bottom trace). Both traces were recorded with all equipment on.

Record 35 - Same as Record 34 except the direction of vibration of the bottom trace which is horizontal to the north.

Record 36 - Same as Record 35, except that the horizontal direction (bottom trace) is to the east.

Record 37 - Same as Record 35 except that all equipment was turned off.

Record 38 - The natural frequency of the floor system was approximated by thumping the floor to excite the system and is represented by the vertical vibration recorded on the top trace with the velocity transducers located at approximately mid-bay. The bottom trace represents vibration recorded in the same direction and location as Record 37.

Record 39 - Same as Record 38 except that the horizontal direction (bottom trace) was to the east.

LOCATION I

Floor vibrations were recorded in the second floor Mensuration Area, Room 2N621.

Record 40 - Ambient vertical vibration (top trace) and ambient horizontal vibration to the north were recorded at approximately mid-bay.

Record 41 - Location and direction the same as Record 40. The floor was thumped and its natural frequency recorded.

LOCATION J

Floor and equipment vibrations were measured on the fourth floor in Room 4N411-L. Records 42 through 47 were taken with the table in the down position.

Record 42 - The floor system bounded by Column Lines 2 and 3 and Column Lines F and G was excited by thumping the floor and the approximate natural frequency recorded. The top trace represents the response in the vertical direction and the bottom trace in the horizontal direction (north). Both velocity transducers were located at approximately mid-bay.

Record 43 - Same as Record 42 except that ambient vibrations were recorded.

Record 44 - Same as Record 43 except that the horizontal direction (bottom trace) was to the east. Ambient vibrations were recorded.

Record 45 - Floor vibration in the vertical direction (top trace) was recorded at approximately mid-bay. The bottom trace velocity transducer was placed on top of the glass of the latest model portable light table and vertical vibration was recorded to evaluate magnification of vibration from the floor system to the top of the light table. The light table was located at approximately mid-bay. The light table fan was turned off to eliminate the high frequencies.

Record 46 - Vertical vibrations (top trace) were recorded atop the light table binoculars. The bottom trace is the same location and direction as the bottom trace in Record 45. The light table fan was off.

Record 47 - Horizontal vibrations were recorded in the same locations as Record 46. The orientation of the velocity transducers was to the front of the light table which corresponded to building north.

Record 48 - The table was raised and a counterweight was added to the beam which supports the binoculars. Vertical vibrations were recorded on top of the optical arm (top trace) and on top of the binoculars (bottom trace).

LOCATION K

Floor vibrations were measured in the fifth floor Mensuration Area Clean Room bounded by Column Lines 9 and 10 and Column Lines H and J.

Record 49 - Ambient vertical floor vibrations were recorded adjacent to Column J-9 (top trace) and at approximately mid-bay (bottom trace).

Record 50 - The location and orientation of the transducers was the same as Record 49. The floor was thumped and the resulting response of the floor system recorded to approximate the natural frequency of the system.

Record 51 - Ambient vertical vibration (top trace) was recorded at approximately mid-bay and horizontal vibration (bottom trace) in a northerly direction at the same location.

Record 52 - Same as Record 51 except that the horizontal direction (bottom trace) was to the east.

LOCATION L

Floor vibrations were recorded in Room 5S515-F (fifth floor).

Record 53 - Ambient vertical and horizontal floor vibrations were recorded at approximately mid-bay. The top trace represents the vertical vibration and the bottom trace the horizontal vibration in the northerly direction.

Record 54 - Same as Record 53 except that the ambient horizontal vibration was recorded in an easterly direction.

Record 55 - Location and direction of the measurements are the same as Record 54. The floor system was excited by thumping the floor to approximate the natural frequency of the system.

LOCATION M

Floor vibrations were recorded on the fourth floor in Room 4S452-G.

Record 56 - The natural frequency of the floor system was approximated by thumping the floor and recording the response. Vertical floor vibration (top trace) was recorded at approximately mid-bay and horizontal floor vibration (bottom trace) was recorded in a northerly direction at the same location.

Record 57 - Ambient floor vibrations were recorded in the same direction and location as Record 56.

Record 58 - Same as Record 57 except that the horizontal direction was to the east. Ambient vibrations were recorded.

LOCATION N

Floor vibrations were recorded on the third floor in Room 3S316-C.

Record 59 - Ambient floor vibrations were recorded at approximately mid-bay in the vertical direction (top trace) and a northerly direction (bottom trace).

Record 60 - Same as Record 59 except that the direction of the horizontal velocity transducer was to the east.

Record 61 - The natural frequency of the floor syster was measured in the same direction and location as Record 60.

LOCATION O

Floor vibrations were recorded on the third floor at approximately mid-bay between Column Lines 4 and 5 and Column Lines F and G.

Record 62 - Ambient vibrations were recorded in the vertical direction (top trace) and in the horizontal direction (bottom trace) to the north.

Record 63 - Same as Record 62 except that horizontal direction was to the east.

Record 64 - The natural frequency of the floor system was measured in the same direction and location as Record 63.

LOCATION P

Floor and equipment vibrations were recorded on the fourth floor in Room 4N806-B.

Record 65 - Ambient floor vibrations were recorded at approximately mid-bay in the vertical direction (top trace) and in a northerly direction (bottom trace).

Record 66 - Same as Record 65 except that the horizontal direction is to the east.

Record 67 - The natural frequency of the floor system was measured in the same direction and location as Record 66.

Vibrations measurements were taken on top of the slab (rock) of the optical benches and the isolation base or floor to measure the effectiveness of the Barry Isolation Mounts. These measurements are documented as Records 68 through 73.

Record 68 - Vertical vibrations were measured on top of the slab and on the isolation base with the air mounts on. The top trace represents the vibration of the slab and the bottom trace the base of the isolation mount.

Record 69 - Same as Record 68.

Record 70 - Same as Record 68 except that the air mounts were off.

Record 71 - Same as Record 68 except that the vertical transducer, which measured the vibration of the isolation base (bottom trace), was placed on the floor immediately adjacent to the air mount. Note that air mounts were on.

Record 72 - Same as Record 71 except that the vibration was measured in the horizontal direction to the west.

Record 73 - Same as Record 72 except that the direction of the horizontal was to the north.

LOCATION Q

Equipment vibrations were recorded on the fourth floor in Room 4N806-C to evaluate the effectiveness of the isolation mounts.

Record 74 - Vertical vibrations were recorded on the upper and lower slabs with the air mounts on and the auxiliary bench attached. The lower slab is mounted on pads and the air mounts are located between the upper and lower slab. The records were made on the corner closest to Column K-2. The upper trace is a record of the ambient vertical vibration of the upper slab and the bottom trace and the ambient vertical vibration of the lower slab.

Record 75 - Same as Record 74.

LOCATION R

Floor vibrations were measured on the fourth floor in Room 4S473-H.

Record 76 - Ambient floor vibrations were recorded in the center of the bay bounded by Column Lines 16 and 17 and Column Lines J and K. The top trace is a record of the vertical vibration and the bottom trace horizontal vibration in a northerly direction.

Record 77 - Same as Record 76 except that the horizontal direction is to the east.

Record 78 - The direction and location of the velocity transducers were the same as Record 77. The floor system was excited by thumping the floor to measure the natural frequency of the system.

Record 79 - Ambient floor vibrations were measured in the vertical direction (top trace) and the horizontal direction (bottom trace) in a northerly direction. Both velocity transducers were located mid-way between Column Lines 16 and 17 and approximately 4 feet east of Column Line J.

Record 80 - Same as Record 79 except that the horizontal direction was to the east.

LOCATION S

Floor vibrations were measured in Room 45473-H at the wall along Column Line 18 approximately mid-way between Column Lines J and K.

Record 81 - Ambient vertical floor vibration (top trace) and ambient horizontal floor vibration (bottom trace) in a northerly direction were measured.

Record 82 - Same as Record 81.

Record 83 - The direction and location of the velocity transducers were the same as Record 82. The floor was thumped, and the natural frequency of the floor system recorded.

LOCATION T

Floor vibrations were measured at the wall along Column Line K mid-way between Column Lines 18 and 19.

Record 84 - Ambient vertical floor vibration (top trace) and ambient horizontal floor vibration (bottom trace) in a northerly direction were measured.

Record 85 - Same as Record 84.

Record 86 - The direction and location of the velocity transducers were the same as Record 84. The floor was thumped to measure the natural frequency of the floor system.

LOCATION U

Vibration of the heating unit located in Room 4S475-C was measured while the fan was in operation.

Record 87 - The vertical vibration of the heating unit base (top trace) was measured. The bottom trace represents horizontal vibration in an easterly direction of the side of the heating unit nearest Column Line 20.

Record 88 - The velocity transducers were held on the heating unit bearing housing. The top trace is a record of vertical vibration and the bottom trace horizontal vibration in an easterly direction.

LOCATION V

Floor vibrations were measured in a fifth floor room along Column Line G and approximately mid-way between Column Lines 2 and 3. The room is immediately adjacent to the northern-most vertical air duct.

Record 89 - Ambient vertical vibration and ambient horizontal (north) vibration were recorded at the location described above. The top trace represents the vertical vibratory motion and the bottom the horizontal.

Record 90 - Same as Record 89 except that the horizontal direction was to the east.

Record 91 - Location and direction of the velocity transducers were the same as Record 90. The floor was thumped to obtain the natural frequency of the floor system.

LOCATION W

Floor and wall vibrations were recorded on the third floor in Room 3S436-C in the vicinity of Column Line G-13 and the vertical air duct on the west wall with the air system in operation. All measurements recorded are considered to be representative of the ambient vibrations in this area.

Record 92 - Vertical (top trace) and horizontal (bottom trace) vibrations were recorded on the floor adjacent to the north end or side of the vertical air duct. The direction of the horizontal vibration is to the north.

Record 93 - Same as Record 92 except that the horizontal direction was to the east.

Record 94 - The vertical velocity pickup (top trace) was in the same location as Record 92. The bottom trace represents horizontal vibratory motion of the northern air duct wall at approximately mid-height.

Record 95 - Top trace same as Record 92. The bottom trace represents horizontal vibration of the inside of the corridor wall (west end of room) at approximate mid-height.

Record 96 - Top trace same as Record 92. The bottom trace is a record of the horizontal vibration of the front of the air duct wall at approximately mid-height.

Record 97 - Top trace same as Record 92. The bottom trace is a record of the horizontal vibration of the west face of Column G-13 approximately two feet below the ceiling.

Record 98 - Top trace same as Record 92. The bottom trace is a record of the horizontal vibration of the north face of Column G-13 approximately two feet below the ceiling.

LOCATION X

Floor and wall vibrations were recorded on the third floor in Room 3S436-D near and on the north wall mid-way between Column Lines G and H. Only the horizontal wall vibration (bottom trace) documented in Record 103 is not at this location; its location is the south wall. All wall vibrations were taken at mid-height of the room.

Record 99 - Ambient vertical (top trace) and horizontal vibrations (bottom trace) were recorded at the location described above. The horizontal direction was to the north.

Record 100 - Same as Record 99 except that the horizontal direction was to the east.

Record 101 - The location and direction of the velocity transducers were the same as Record 100. The floor was thumped and the natural frequency of the floor system measured.

Record 102 - Top trace same as Record 99. The bottom trace represents horizontal vibratory motion of the north wall.

Record 103 - Top trace same as Record 99. The bottom trace represents horizontal vibration of the south wall.

Record 104 - Both horizontal velocity transducers were placed against the north wall of the room as a check on their calibration.

LOCATION - [redacted]

The operating frequency and/or resulting vibration of operating equipment housed [redacted] were recorded.

Record 105 - Vertical (top trace) and horizontal (bottom trace) vibrations (perpendicular to compressor drive) induced by a DeVilbiss compressor were recorded. The velocity pickups were placed on the compressor base (A-4-5) and the records taken while both compressors were in operation.

Record 106 - The same measurements taken on Base A-4-5 were taken on Base A-4-6 while both compressors were in operation.

Record 107 - The same measurements were taken on Base A-4-4 (base of a Worthington compressor).

LOCATION - BUILDING PARKING AREA

Ambient ground vibration was recorded near the guard shack at the northwest corner [redacted]

Record 108 - The top trace represents vertical vibratory motion and the bottom horizontal (north) with the horizontal pickup oriented in a radial direction with respect to the source of vibration (vehicular traffic on M Street).

Record 109 - Same as Record 108.

Record 110 - Same as Record 108 except that a heavy bus passed.

Record 111 - Same as Record 108, except that the horizontal velocity transducer was oriented transverse with respect to the source of vibration.

LOCATION - [redacted]

Vibration measurements of operating equipment were recorded in Building 213A.

Record 112 - Vertical vibration (top trace) and horizontal vibration (bottom trace) in a northerly direction were recorded on north face of Air Handling Unit No. 2 fan housing.

Record 113 - Vertical vibration (top trace) and horizontal vibration (bottom trace) in a northerly direction were recorded on the north side of the duct work attached to the fan housing.

Record 114 - Vertical vibration (top trace) and horizontal vibration (bottom trace) in a northerly direction were recorded on the north face of Air Handling Unit 2E Supply Room Air. The duct where the measurements were taken is part of the enclosure for a fan.

Record 115 - Vertical (top trace) and horizontal (bottom trace) vibrations were recorded on Unit 2E Supply Equipment Air Duct (north side of Supply Room Air). The direction of the horizontal velocity pickup was to the northeast.

Records 116 and 117 - Vertical (top trace) and horizontal (bottom trace) vibrations in a southerly direction were recorded on the south face of Air Handling Unit No. 2.

Record 118 - Vertical (top trace) and horizontal (bottom trace) vibrations were recorded on the north face of Air Handling Unit No. 1. The direction of the horizontal velocity pickup was to the north.

Record 119 - Same unit as in Record 118. Horizontal vibration (bottom trace) and vertical vibration (top trace) measurements were taken on the east face. Orientation of the horizontal pickup was to the east. The Worthington air compressor was on.

Record 120 - Same as Record 119 with the Worthington air compressor off.

Record 121 - Vertical (top trace) and horizontal (bottom trace) vibrations were recorded on the east face of the Air Handling Unit located at the south end of the building. The horizontal velocity transducer was oriented to the east.

Record 122 - Same as Record 121.

Record 123 - Same unit as in Record 121. The measurements were taken on the east face. The top trace represents vertical vibratory motion and the bottom horizontal vibration to the east.

Note: The numbering of the records stops at Record 123 and begins again with Record 200. Numbers 124 through 199 were not used.

LOCATION R01

Floor vibrations were measured on the fifth floor in Room 5S316-A at the approximate center of the bay bounded by Column Lines 13 and 14 and Column Lines D and E. The top trace represents vertical vibration and the bottom trace horizontal vibration in a westerly direction in Records 200 through 211.

Record 200 - Ambient vibration was recorded.

Record 201 - Same as Record 200.

Record 202 - Same as Record 200.

Record 203 - Jaw-type Rock Crusher on but empty.

Record 204 - Jaw-type Rock Crusher on with rock.

Record 205 - Same as Record 204.

Record 206 - Roller-type Rock Crusher on but empty.

Record 207 - Roller-type Rock Crusher on with rock.

Record 208 - Same as Records 200, 201 and 202.

Record 209 - Ro-Tap Sieve Shaker on.

Record 210 - Table on sixth floor struck with sledge hammer.

Record 211 - The fifth floor was thumped and the natural frequency of the floor system measured.

LOCATION RC2

Floor vibrations were measured on the fifth floor at the bay bounded by Column Lines 14 and 15 and Column Lines G and H. The top trace represents vertical vibration and the bottom trace horizontal vibration (westerly direction) in Records 212 through 216.

Record 212 - Ambient floor vibration was recorded.

Record 213 - Jaw-type Rock Crusher on with rock.

Record 214 - Roller-type Rock Crusher on with rock.

Record 215 - Same as Record 214.

Record 216 - Same as Record 212.

LOCATION - PARKING LOT AREA

Ambient vibration was recorded near the guard shack at the northwest corner

Record 217 - The top trace represents vertical vibration and the bottom horizontal (north) with the horizontal velocity transducer oriented in a radial direction with respect to the source of vibration (vehicular traffic on M Street).

Record 218 - Same as Record 217 except that a bus passed.

Record 219 - Same as Record 218.

Record 220 - Train passed on First Street. The location and direction of the velocity tranducers were the same as Record 217.

LOCATIONS - A1 AND A2

Vibration was measured on the fifth floor in the vicinity of the vertical air shaft located at the north end [redacted] At Location A1, the measurements were taken on the floor adjacent the wall of Room 5N415-D. At Location A2, the measurements were taken on the wall of the air shaft.

Record 221 - Vertical vibration (top trace) and horizontal vibration (bottom trace) in a northerly direction were recorded at Location A1 with the fan on.

Record 222 - Same as Record 221 except that the horizontal direction was to the east.

Record 223 - Vertical vibration (top trace) and horizontal vibration (bottom trace) in a northerly direction were measured at approximately mid-height of the wall (Location A2) with the fan on.

Record 224 - Same as Record 223.

Record 225 - Same as Records 223 and 224 except that the fan was off.

Record 226 - Same as Record 221 except that the fan was off.

Record 227 - Same as Record 226.

LOCATION - COOLING TOWER

Vertical and horizontal vibration measurements were taken atop the cooling tower unit closest [redacted] on the circular frame at the top of the tower. The top trace represents vertical vibratory motion and the bottom trace horizontal vibration with the cooling tower fan on.

Record 228 - Horizontal vibration radial with respect to the source of vibration (cooling tower fan).

Record 229 - Horizontal vibration transverse with respect to the source of vibration (cooling tower fan).

LOCATION III

Vertical and horizontal (north) floor vibrations were measured at the base of the east corridor wall near Room 4N435. These data are documented as Record No 245. The top trace represents vertical vibratory motion and the bottom trace horizontal vibration. These measurements were taken with the air system on. Record No. 256 is the same measurements taken with the air system for [redacted] off (specifically, the supply air, return air and vertical risers were off). Note, however, that the USGS (sixth floor) air system and the 4SE supply fan were on.

LOCATION IV

Vertical and horizontal (north) floor vibrations were recorded at the base of the east corridor wall opposite Room 4S452. The top trace of Record 246 represents vertical vibration and the bottom trace horizontal vibration in a northerly direction with the air system on. Record No. 257 represents the same vibrations at the same location with the air system off (supply and return air off and vertical risers off). The USGS (sixth floor) air system and 4SE supply fan were on.

LOCATION V

Vertical and horizontal (north) floor vibrations were recorded at the base of the east corridor wall near Room 4S463. The top trace of Record No. 247 represents vertical vibration and the bottom trace horizontal vibration in a northerly direction with the air system on. Record No. 258 represents the same vibrations at the same location with the air system off (supply and return air off and vertical risers off). The USGS air system and the 4SE supply fan were on. Record No. 259 is the same as Record No. 258 except that the USGS air system and the 4SE supply fan were off.

LOCATION VI

Vertical and horizontal (north) floor vibrations were measured at the north end of the fourth floor corridor at approximately mid-bay (bay bounded by Column Lines 4 and 5 and Column Lines F and G). The top trace of Record No. 248 represents vertical vibration and the bottom trace horizontal vibration in a northerly direction with the air system on. Record No. 252 represents the same vibrations with the air system off (supply and return air and vertical risers off). The USGS air system and 4SE supply fan were on. Record No. 253 is the same as Record No. 252 except that the horizontal direction was to the west.

LOCATION VII

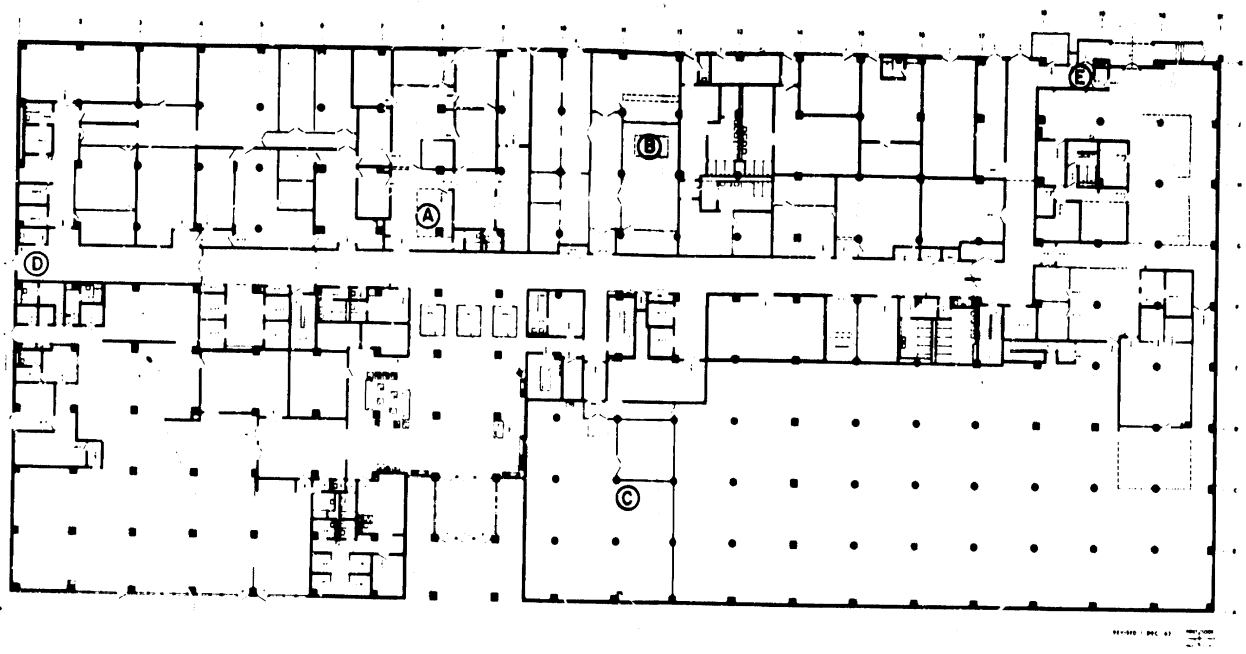
Vertical and horizontal (north) vibrations were measured near the east corridor wall (at approximately mid-bay of area bounded by Column Lines 6 and 7 and Column Lines F and G). These data are documented as Record No. 249. The top trace represents vertical vibration and the bottom trace horizontal vibration in a northerly direction with the air system on. Record No. 250 is a repeat of Record No. 249. Record No. 254 represents the same vibration at the same location with the air system off (supply and return air and vertical risers off). The USGS air system and the 4SE supply fan were on. Record No. 255 is a repeat of Record No. 254.

LOCATION VIII

Vertical and horizontal (north) floor vibrations were measured at the base of the east corridor wall opposite Room 4S470. The top trace of Record No. 251 represents vertical vibration and the bottom trace horizontal vibration in a northerly direction with the air system on. Record No. 250 represents the same vibration at the same location with all air systems off as in Record No. 259.

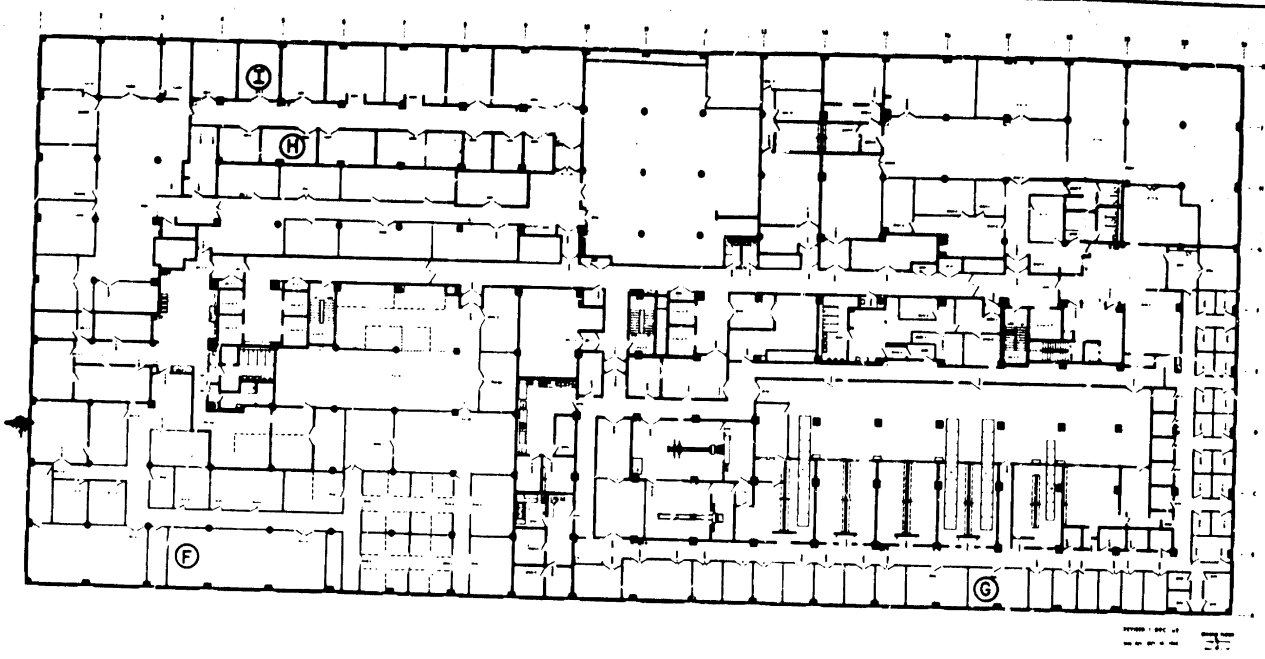
STAT

FLOOR PLANS SHOWING LOCATION OF MEASUREMENTS



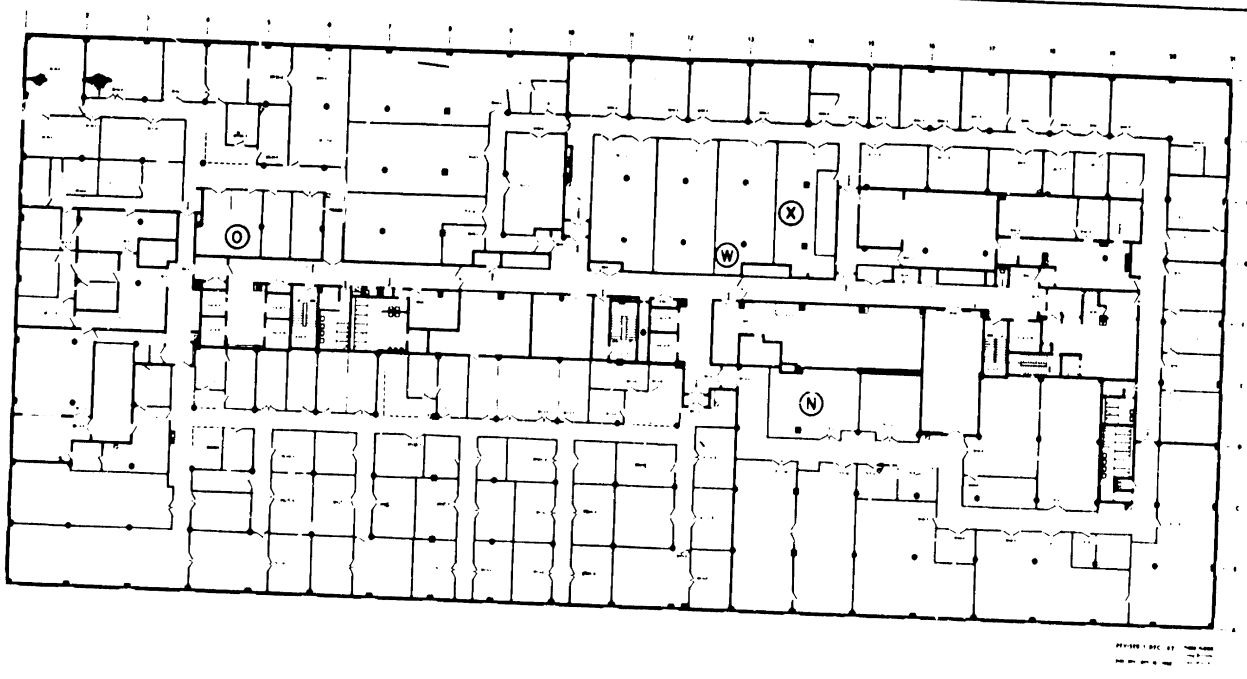
UNITED STATES GOVERNMENT
WASHINGTON, D.C.

STAT

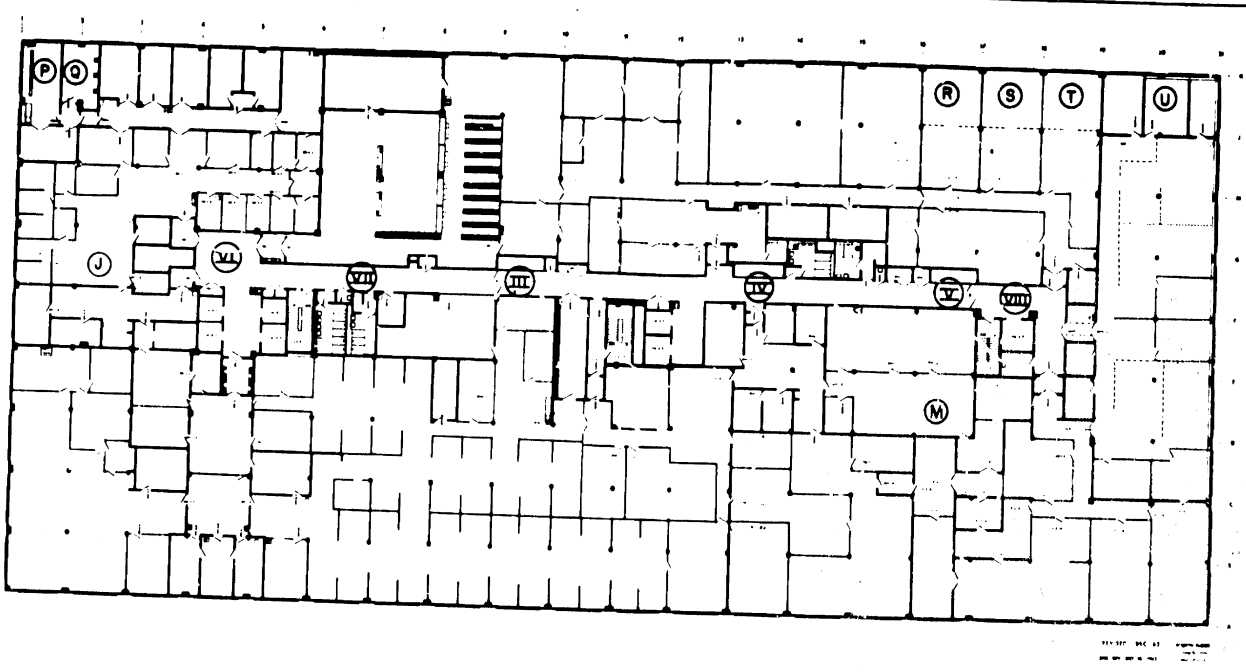


UNITED STATES GOVERNMENT
WASHINGTON, D.C.

STAT

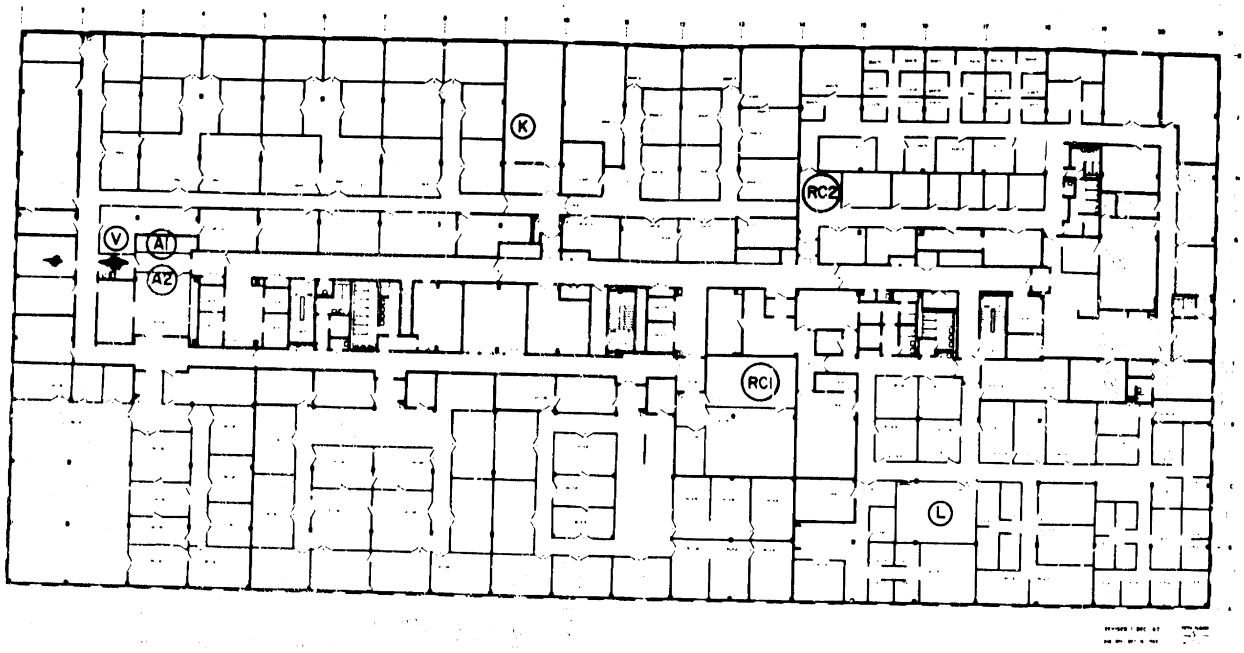


UNITED STATES GOVERNMENT
WASHINGTON, D.C



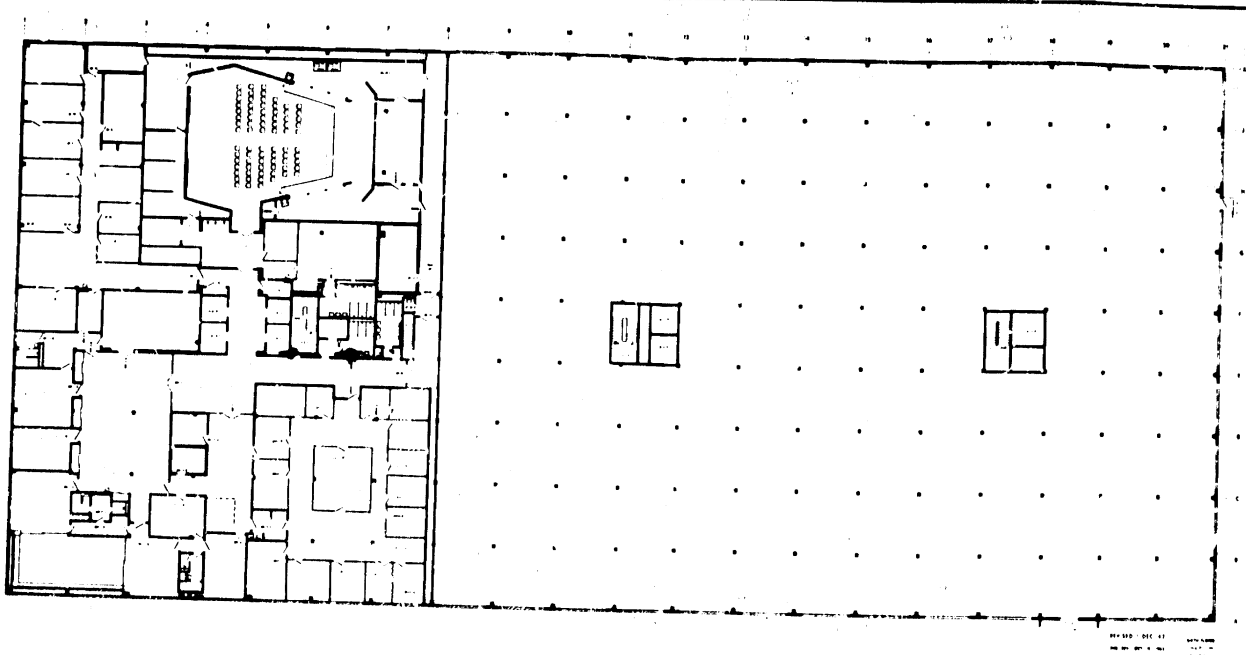
UNITED STATES GOVERNMENT
WASHINGTON, D.C.

STAT



UNITED STATES GOVERNMENT
WASHINGTON, D.C.

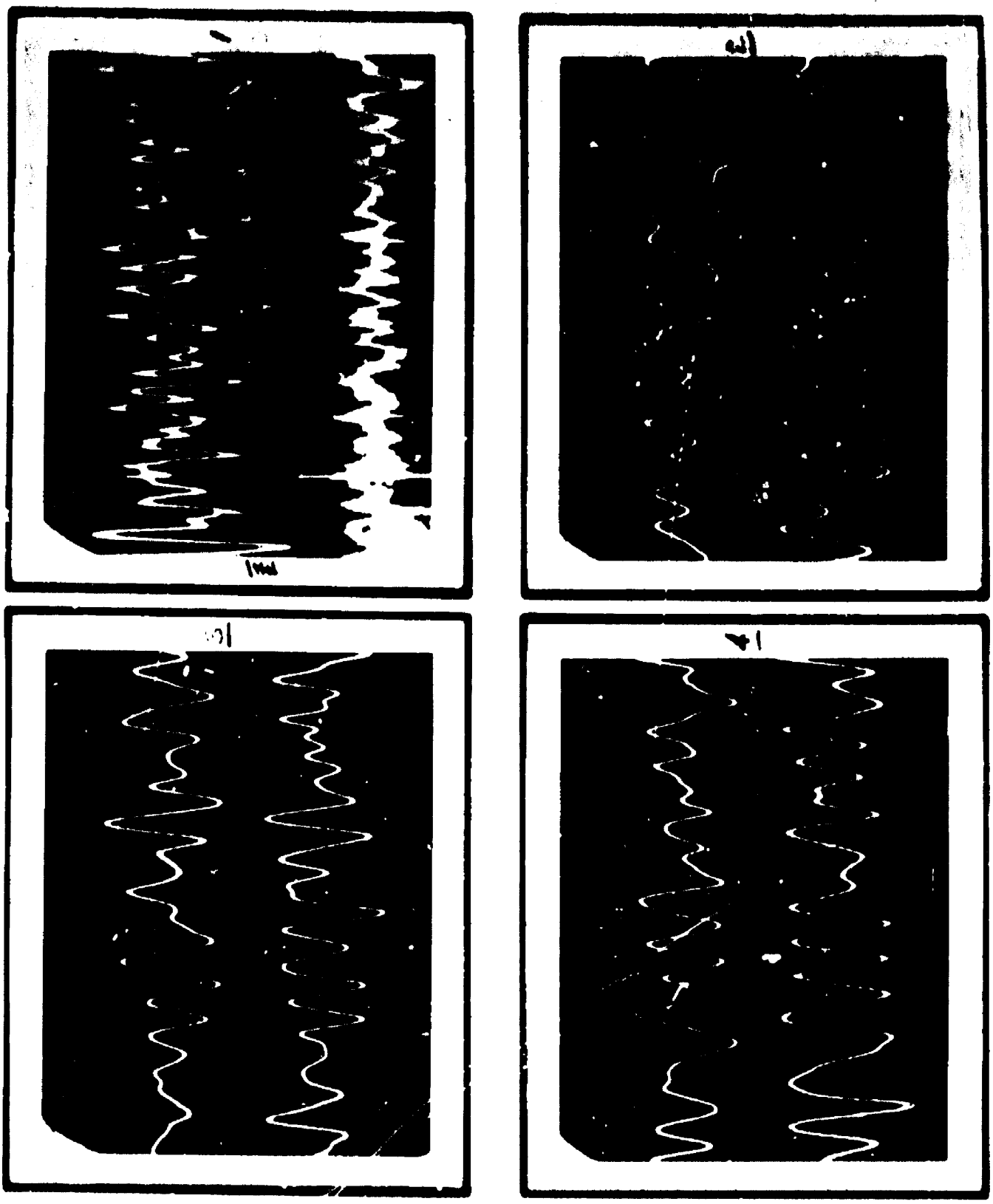
STAT



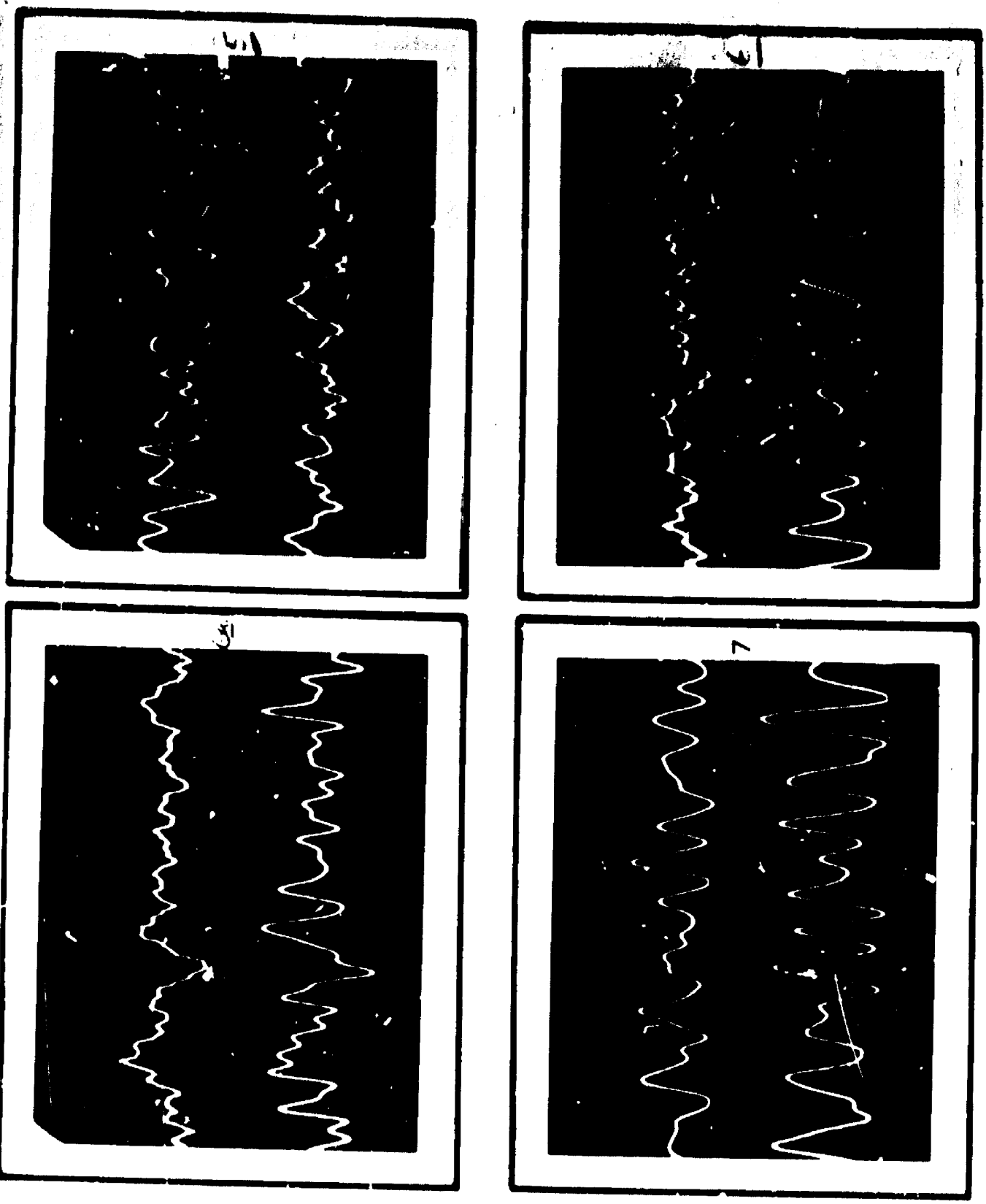
UNITED STATES GOVERNMENT
WASHINGTON, D C.

STAT

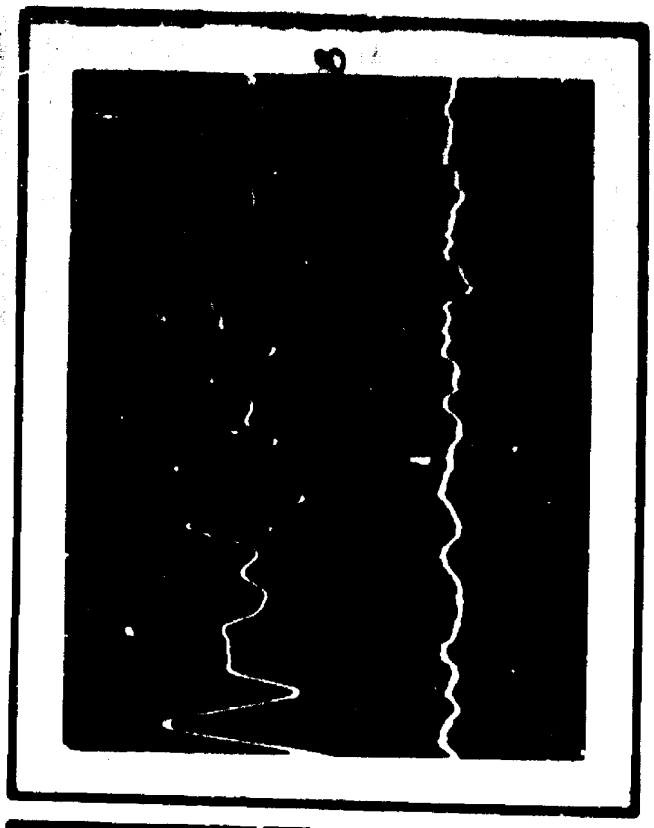
VIBRATION RECORDS

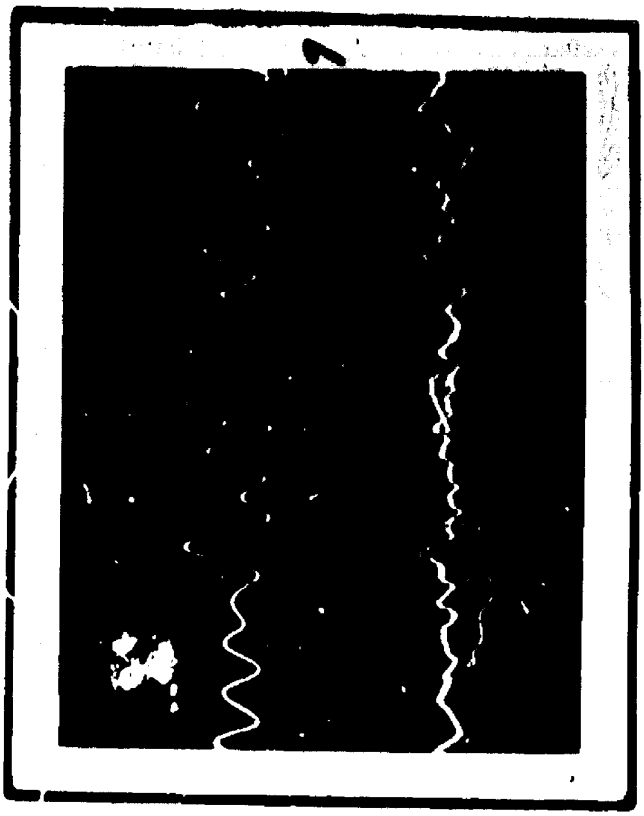


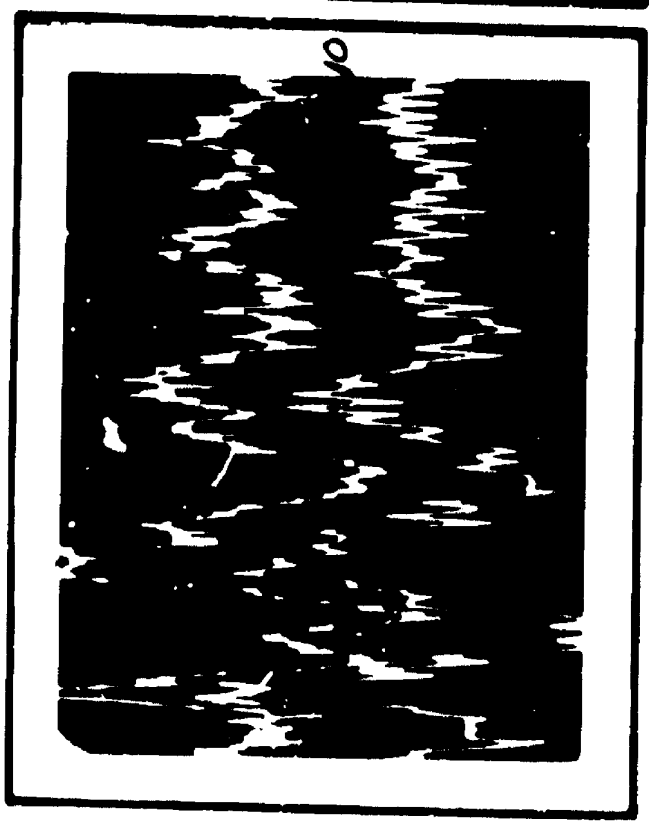
SCALES			
RECORD NO	VERTICAL (IN. /SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
1	0.0005	0.0002	100
2	0.001	0.001	100
3	0.001	0.001	100
4	0.001	0.001	100

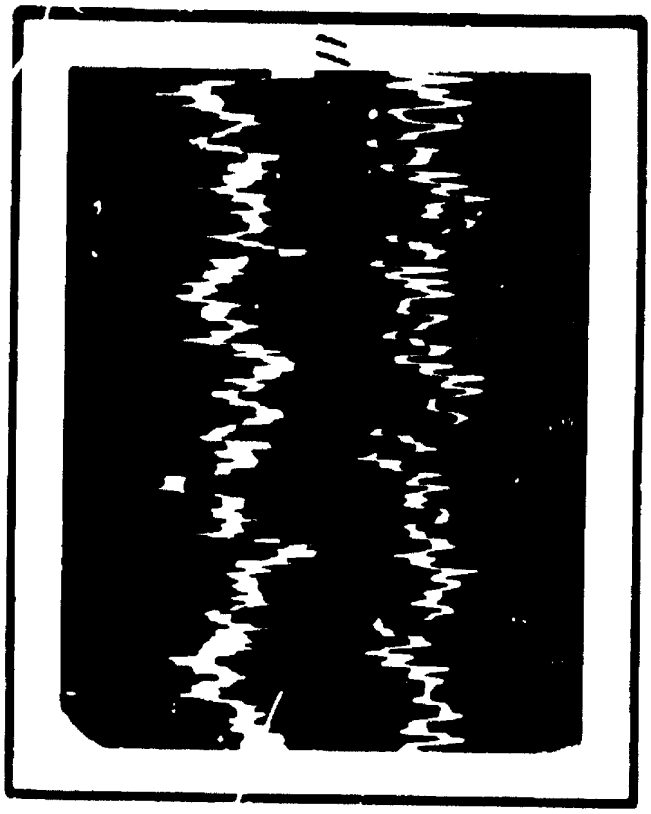


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
5	0.001	0.001	50
6	0.001	0.001	50
6A	0.001	0.001	50
7	0.001	0.001	50

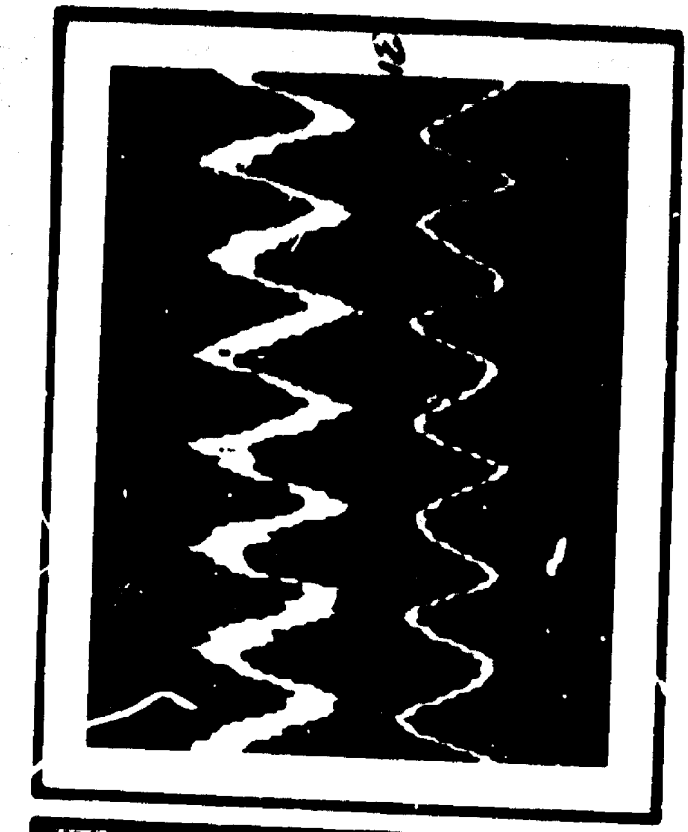


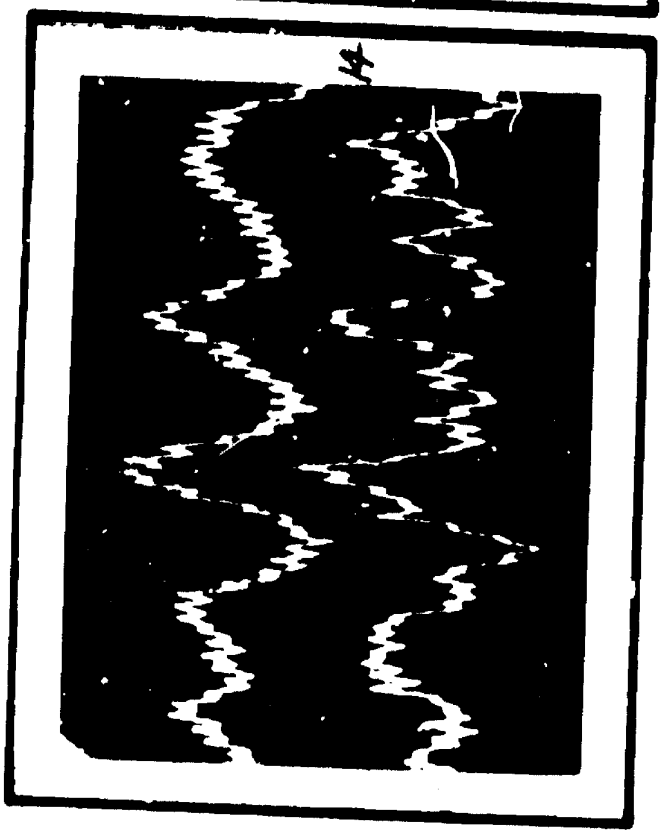


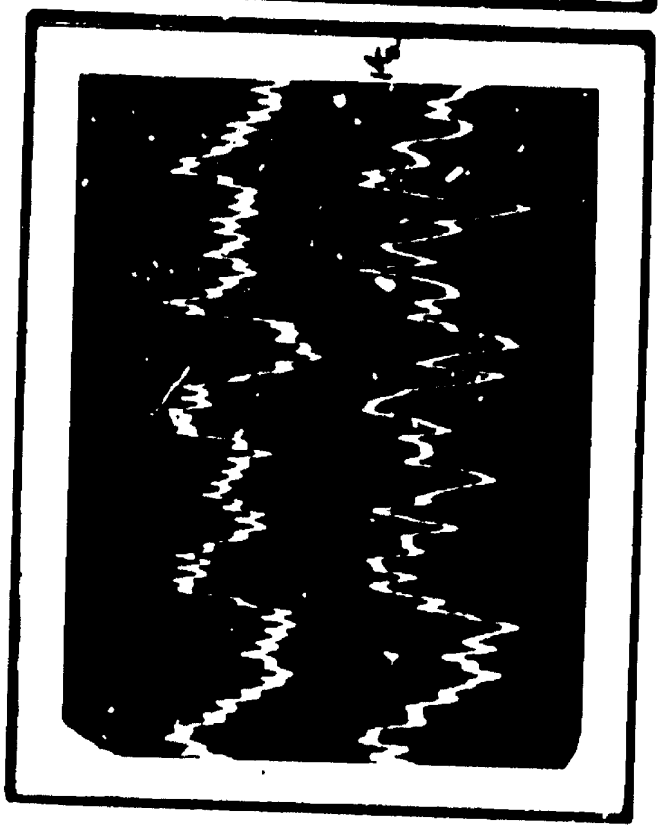




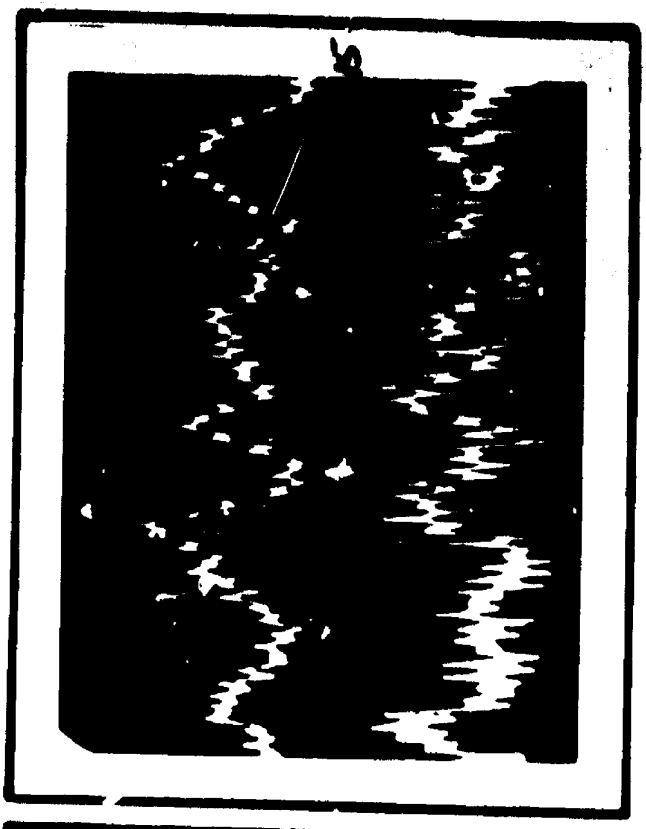
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
9	0.001	0.001	10
	0.001	0.001	10
10	0.010	0.050	10
11	0.010	0.050	10

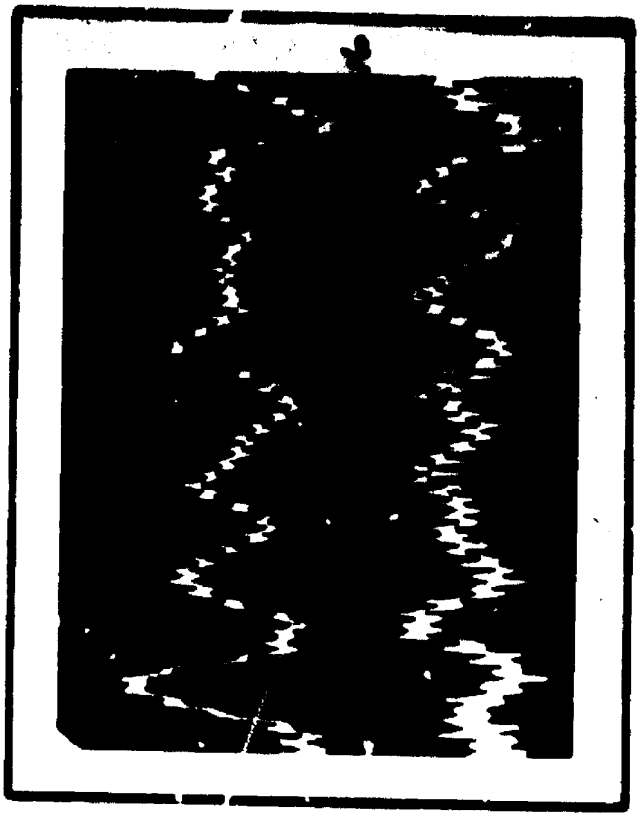


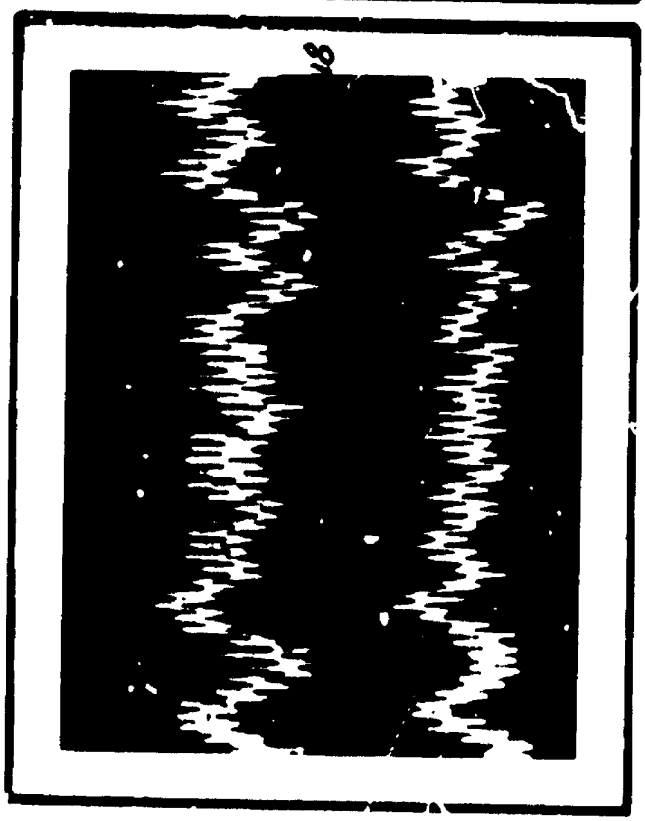




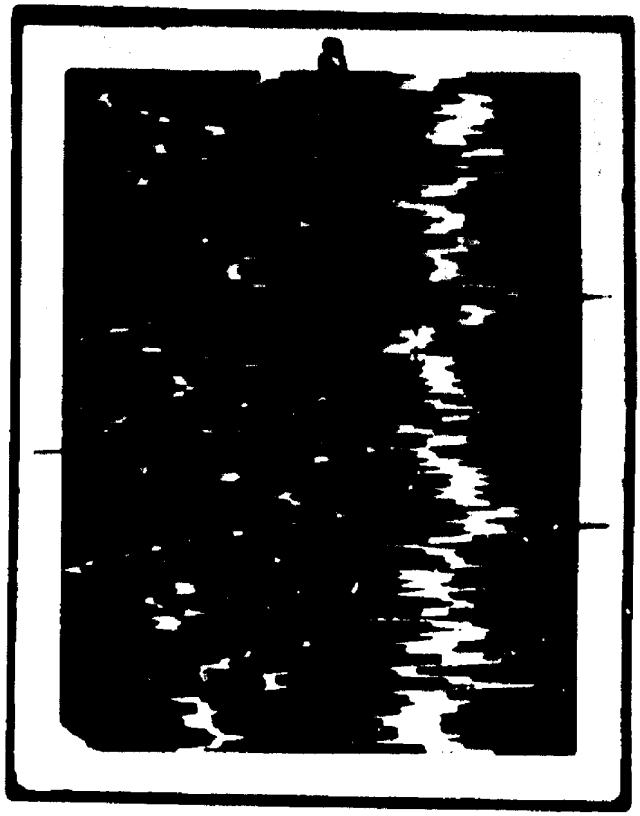
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
1			
2			
3			
4			

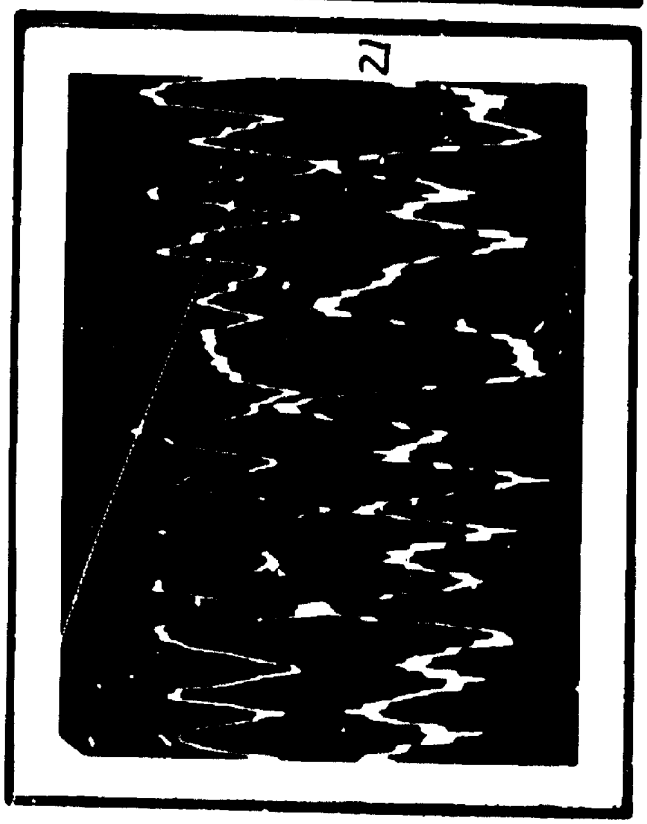




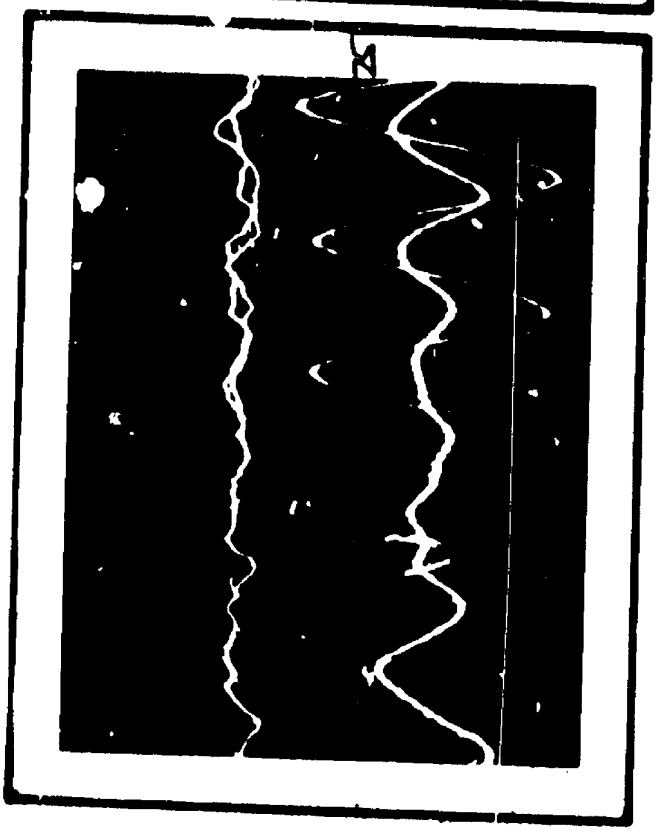


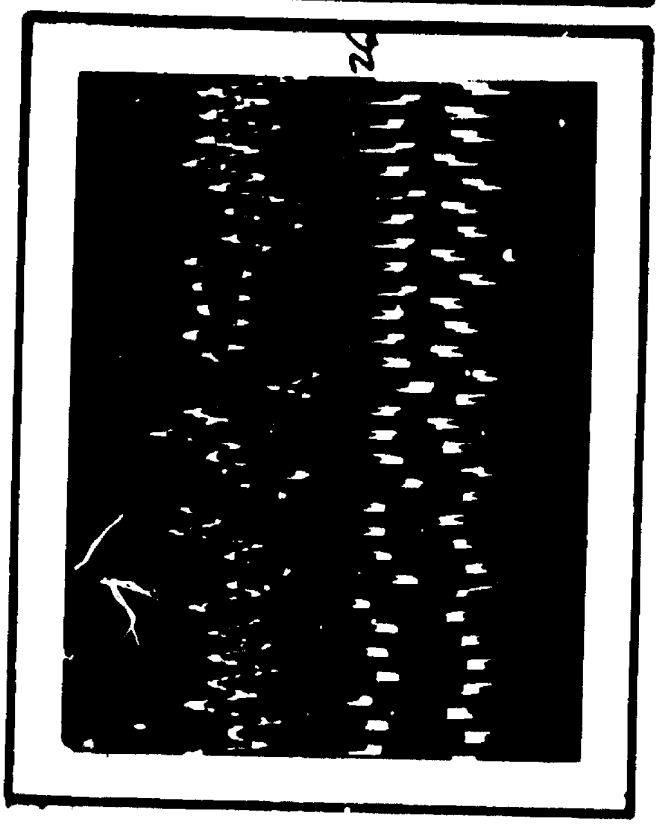
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
5	0.0005	0.0005	10
6	0.0005	0.0005	10
7	0.0005	0.0005	10
8	0.0005	0.0005	10



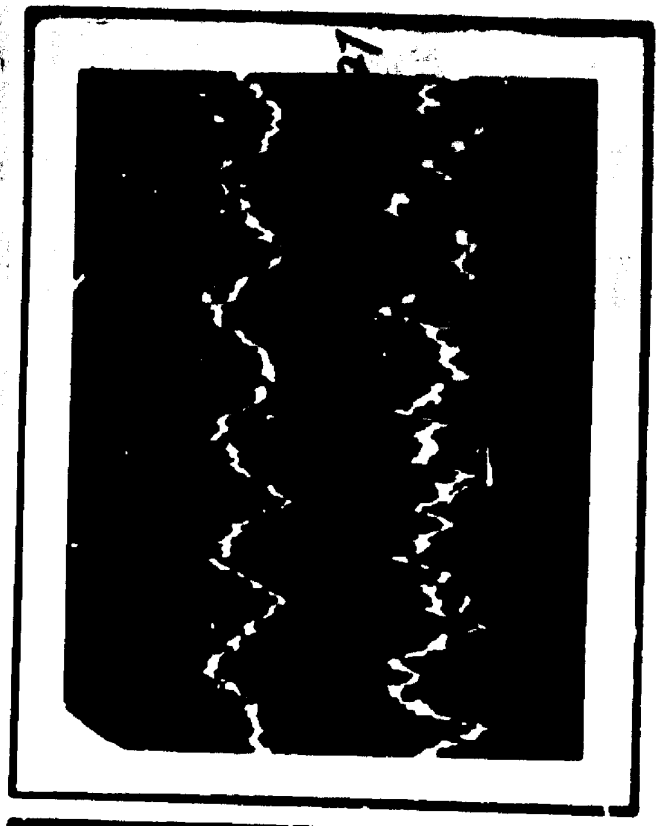


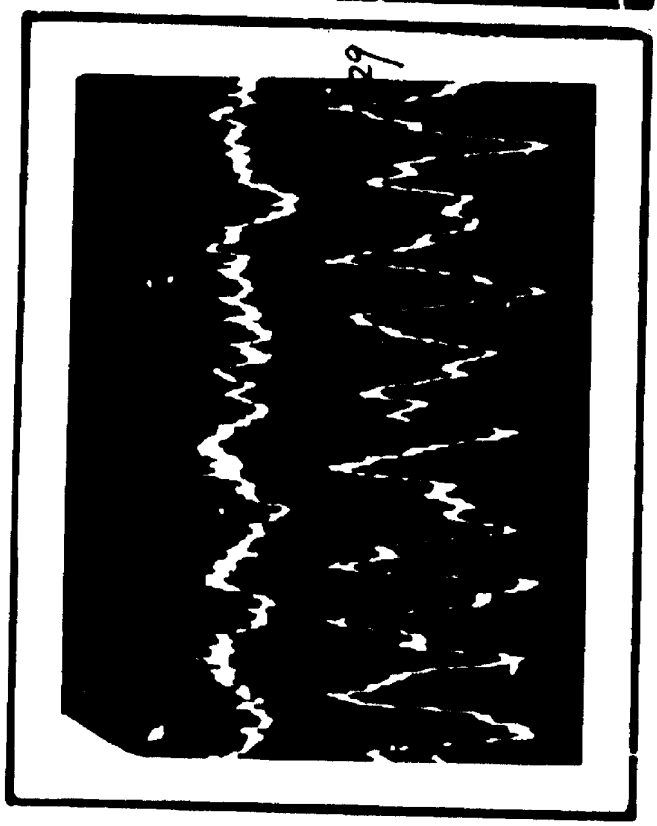
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	

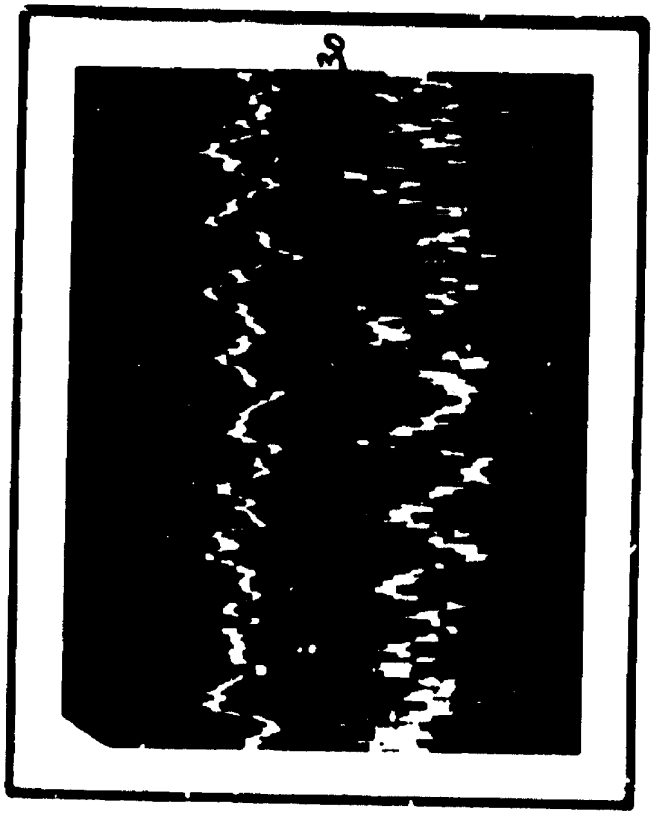




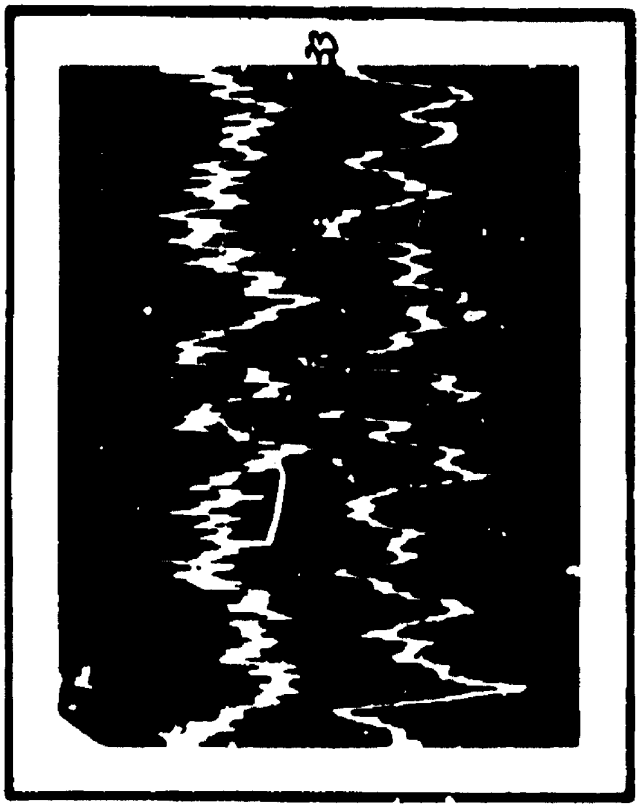
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
23	0.002	0.002	50
24	0.005	0.005	50
22	0.005	0.005	50
21	0.001	0.001	50
			50



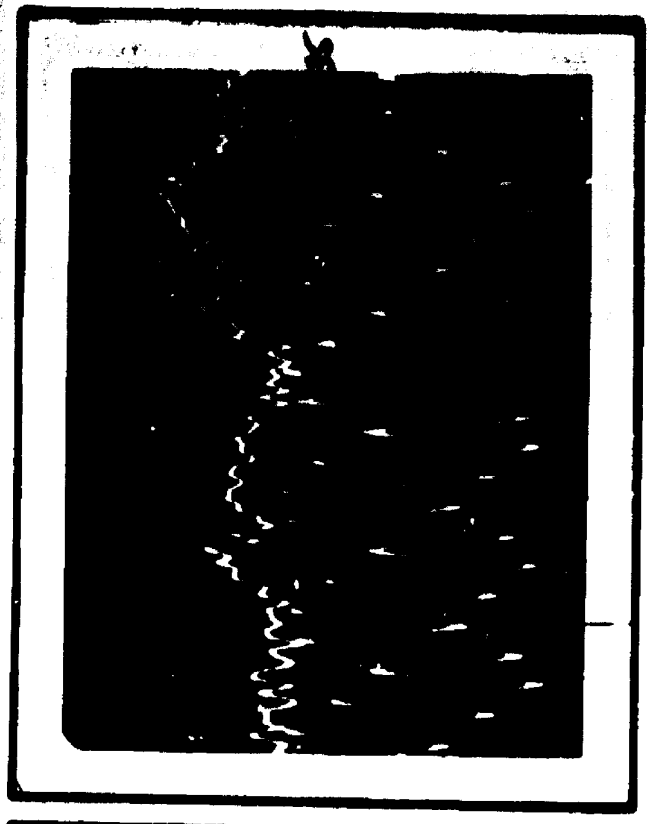


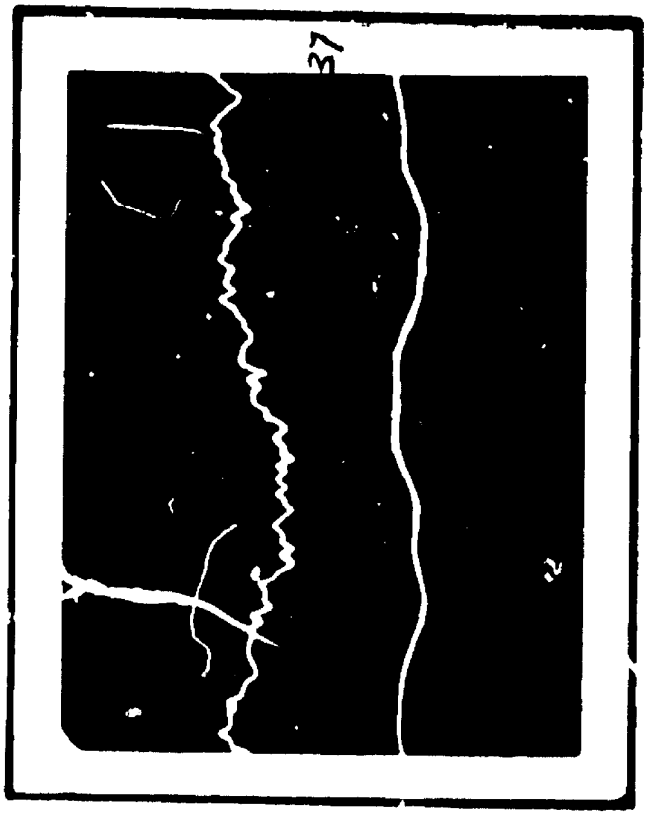


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
27	0.010	0.001	10
28	0.010	0.001	10
29	0.010	0.001	10
30	0.010	0.001	10

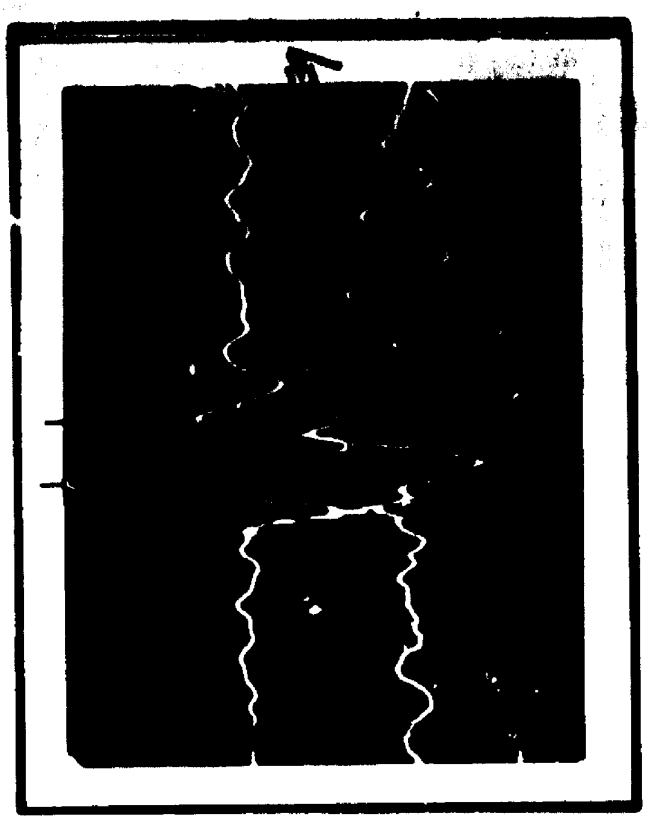


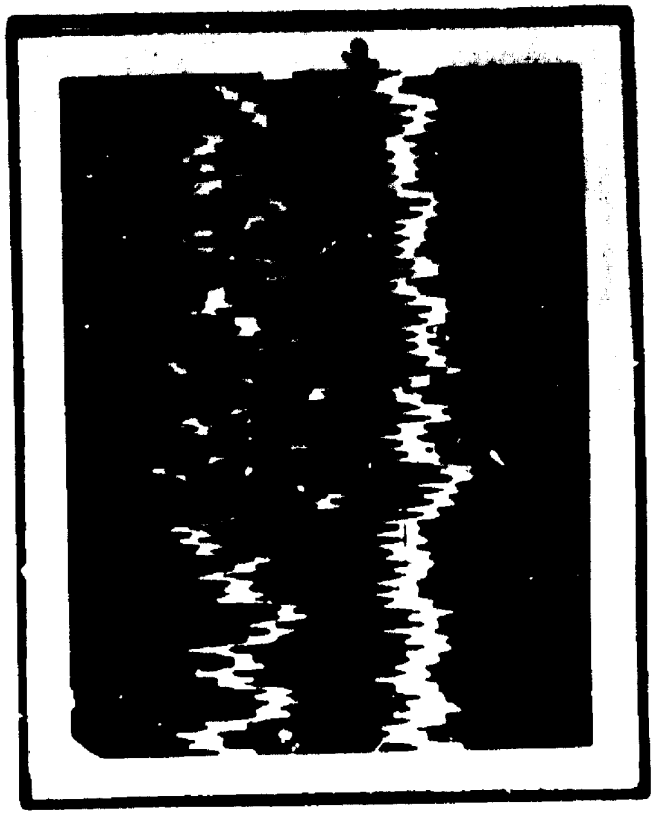
SCALES			
RECORD NO.	VERTICAL (IN. /SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
12	0.50	0.50	10
13	0.50	0.50	10
14	0.05	0.05	10

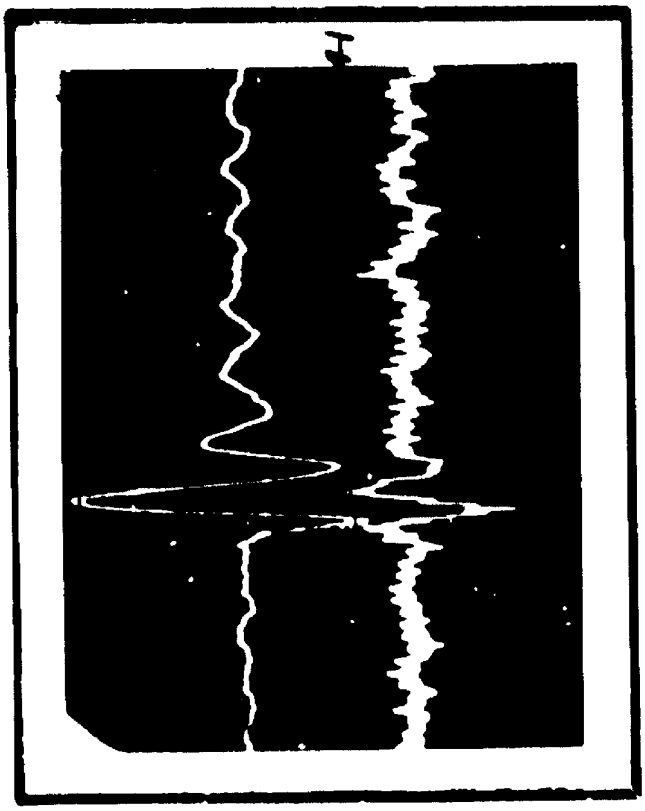


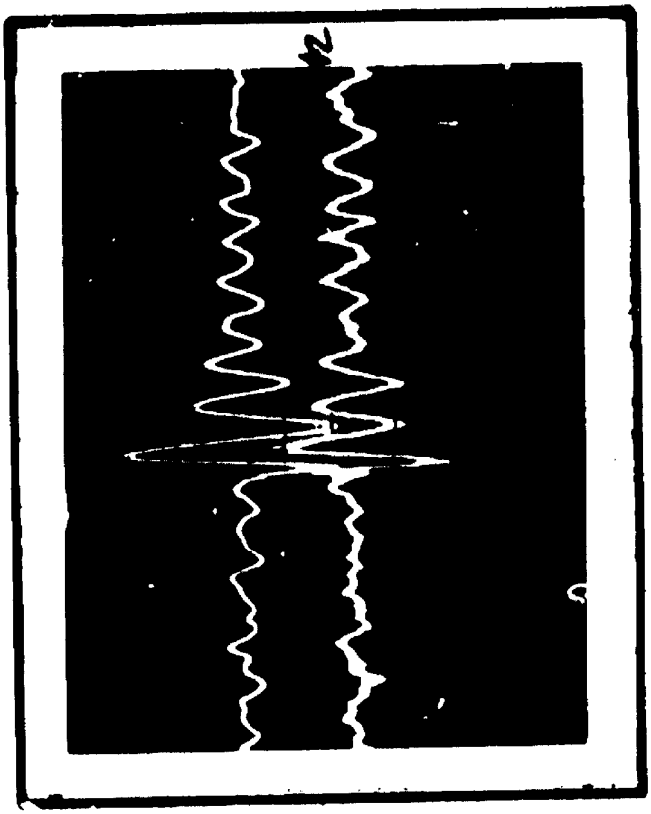


SCALES			
RECORD NO	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
36	0.001	0.005	10
36	0.001	0.005	10
37	0.001	0.005	10
38	0.010	0.005	10

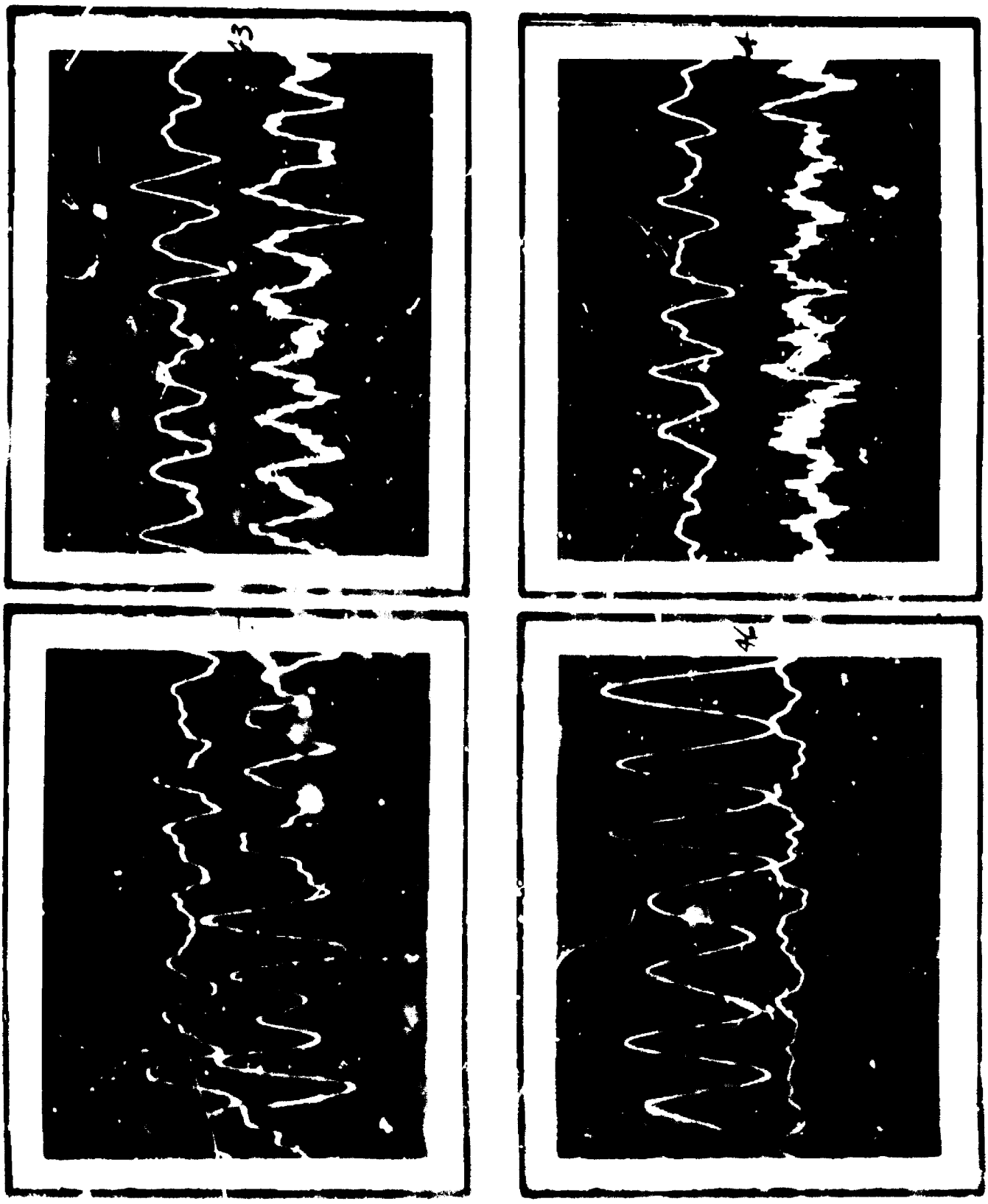




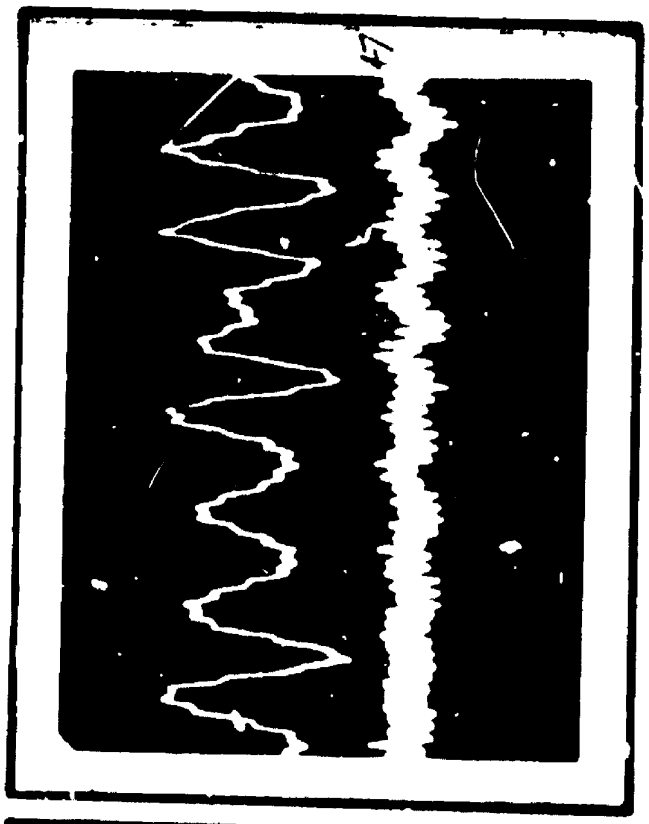


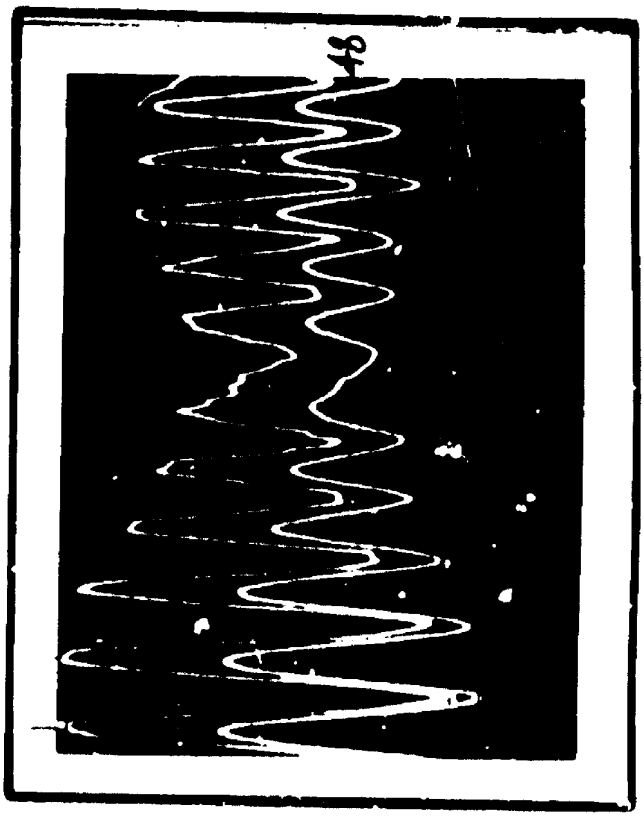


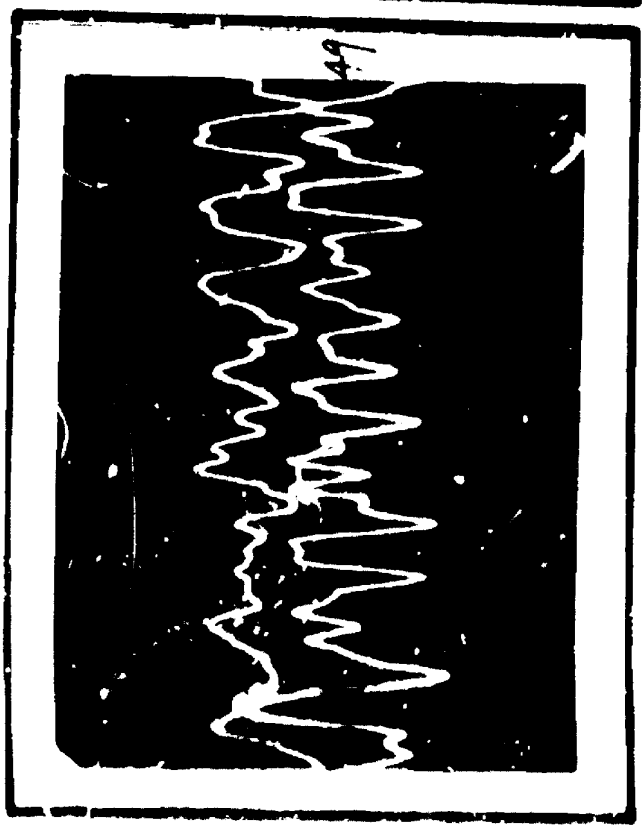
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
35	0.010	0.005	50
36	0.005	0.005	50
41	0.010	0.001	100
42	0.010	0.005	100

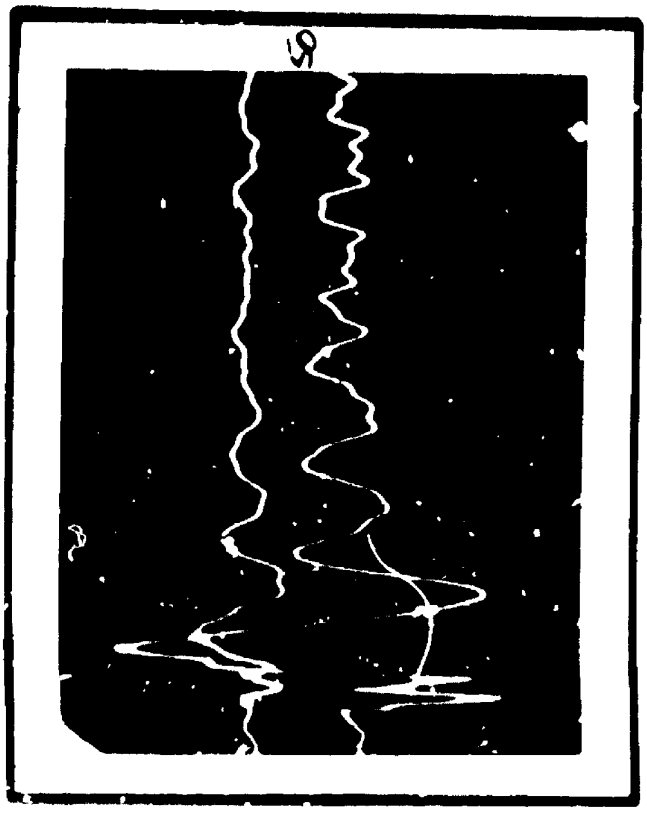


SCALES			
RECORD NO.	VERTICAL (IN /SEC.)/CM.		HORIZONTAL MILLISEC / CM.
	TOP	BOTTOM	
	0.20	0.05	50
	0.20	0.05	50
	0.05	0.05	50
	0.05	0.05	50

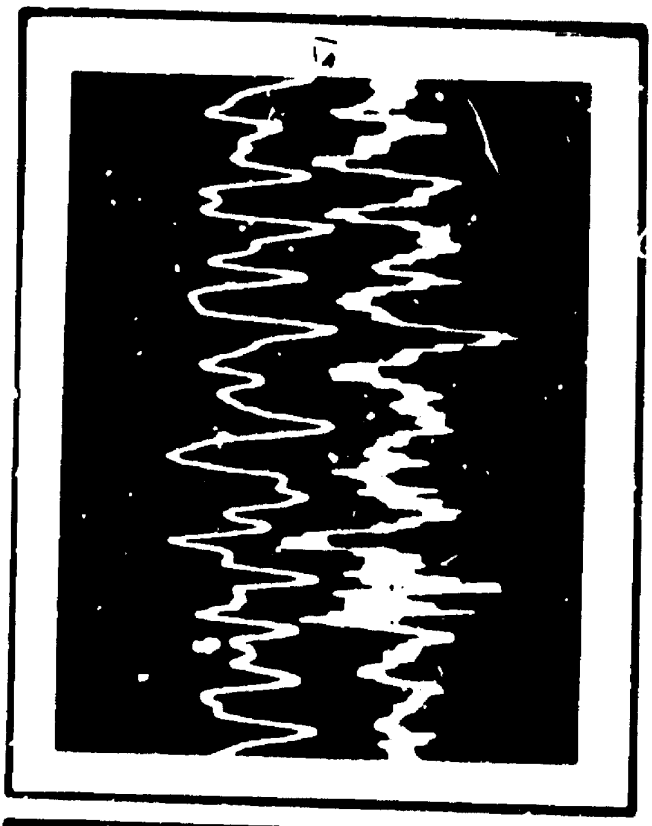


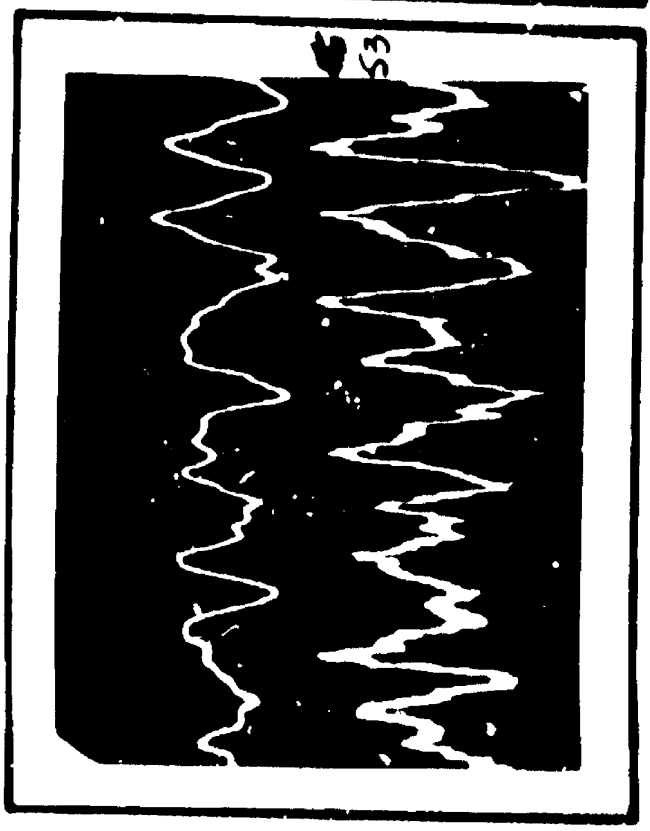


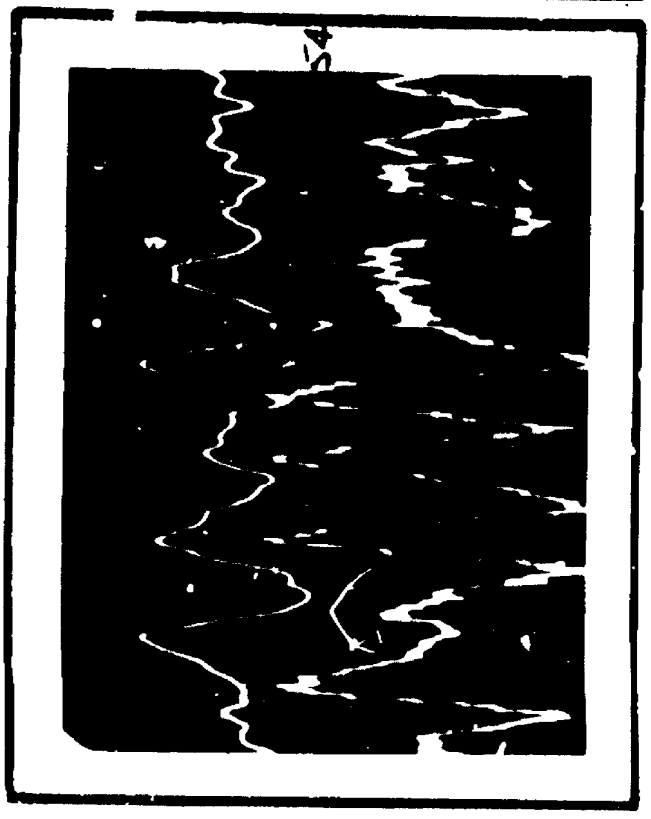




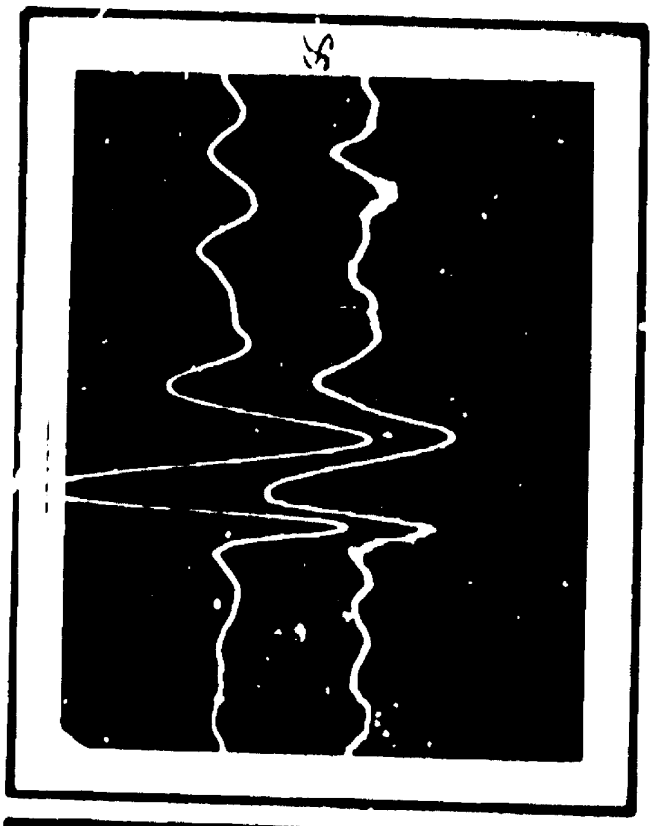
SCALES			
RECORD NO	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
47	0.[illegible]	0.[illegible]	[illegible]
48	0.[illegible]	0.[illegible]	[illegible]
47	0.[illegible]	0.[illegible]	[illegible]
49	0.[illegible]	0.[illegible]	[illegible]

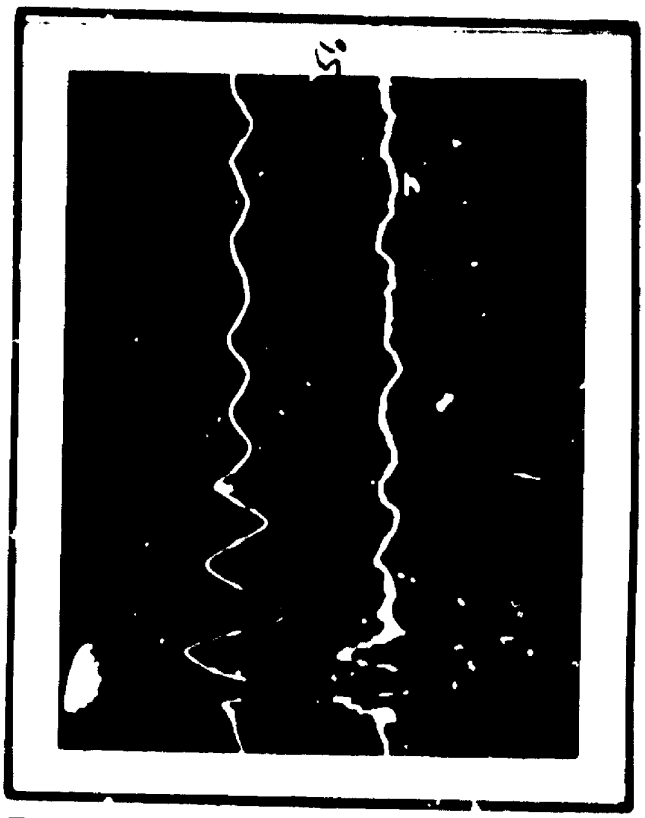


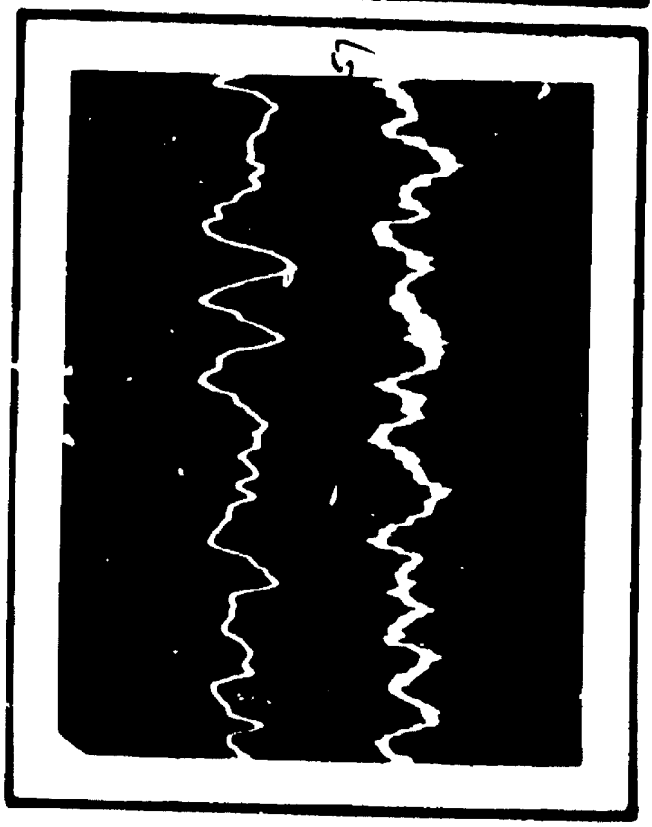


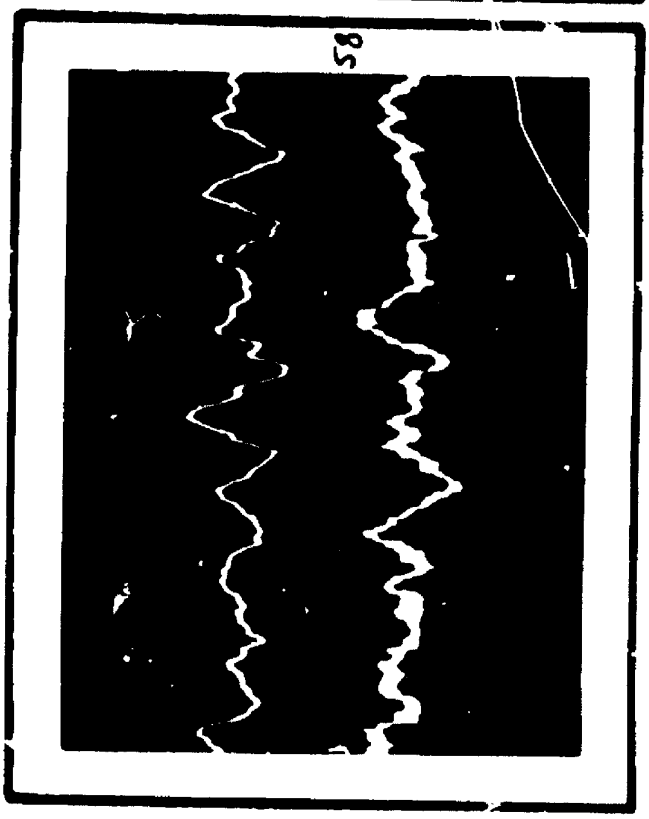


SCALES			
RECORD NO.	VERTICAL (IN. /SEC.)/CM.		HORIZONTAL MILL.SEC. / CM.
	TOP	BOTTOM	
S1	0.005	0.0005	50
S2	0.005	0.0005	50
S3	0.005	0.0005	50
S4	0.005	0.0005	50

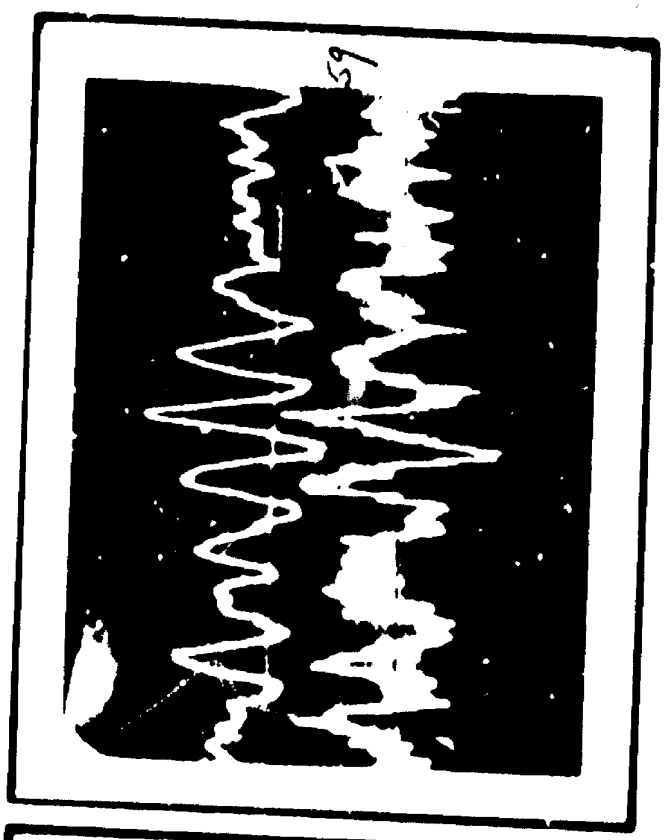


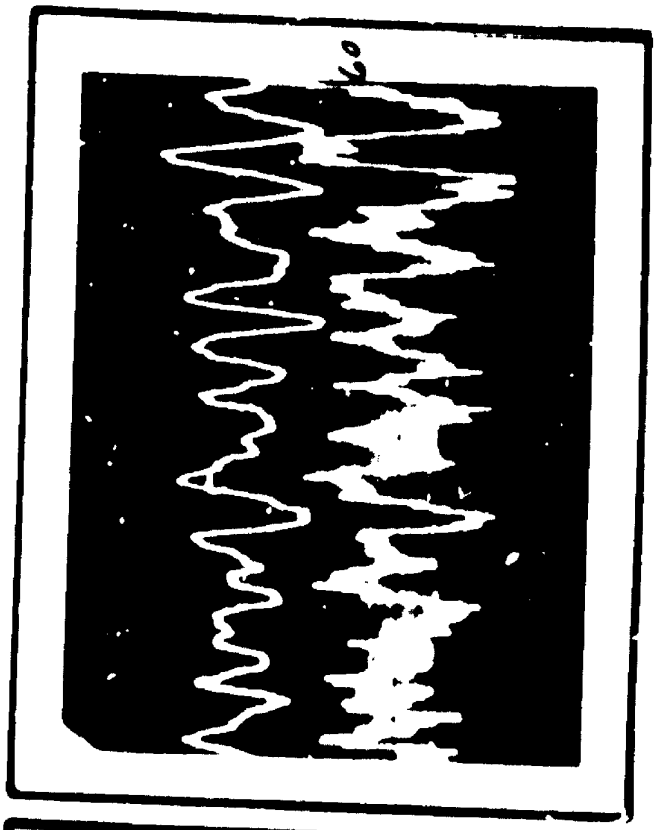


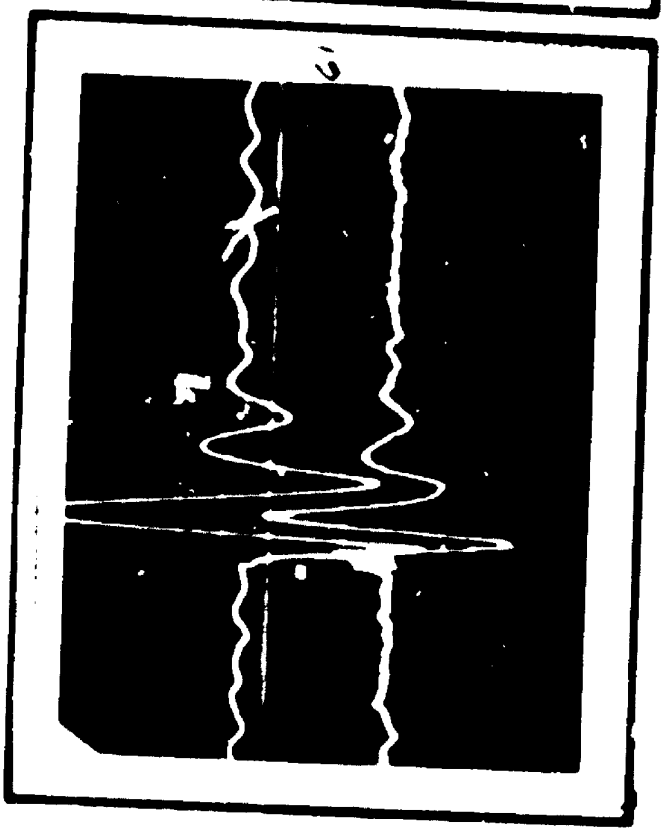


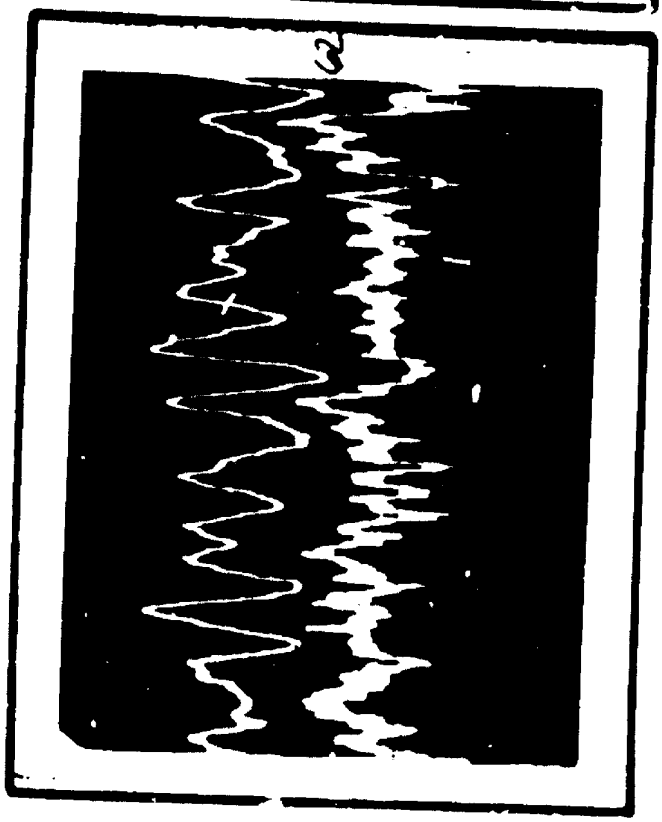


SCALES			
RECORD NO	VERTICAL (IN. /SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
55	0.020	0.002	50
56	0.020	0.002	50

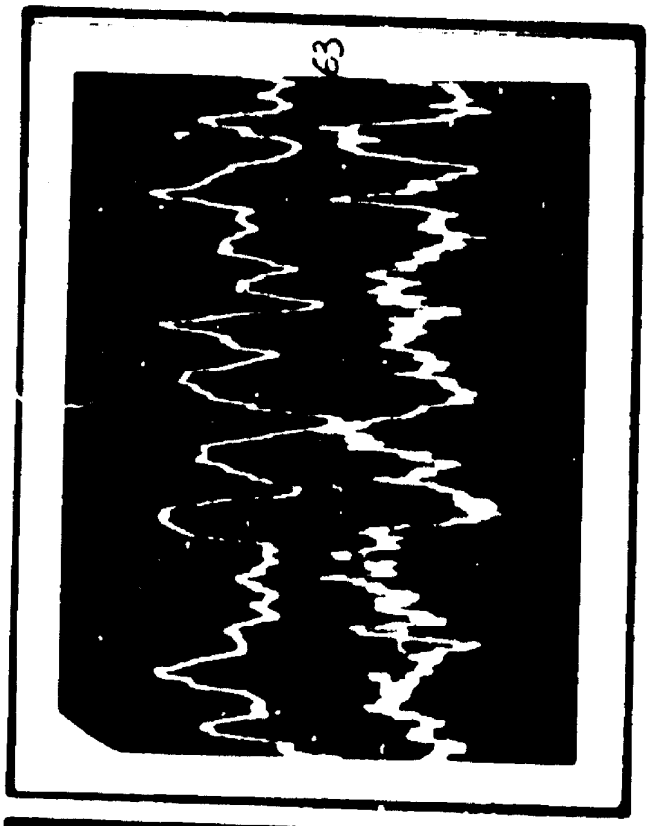


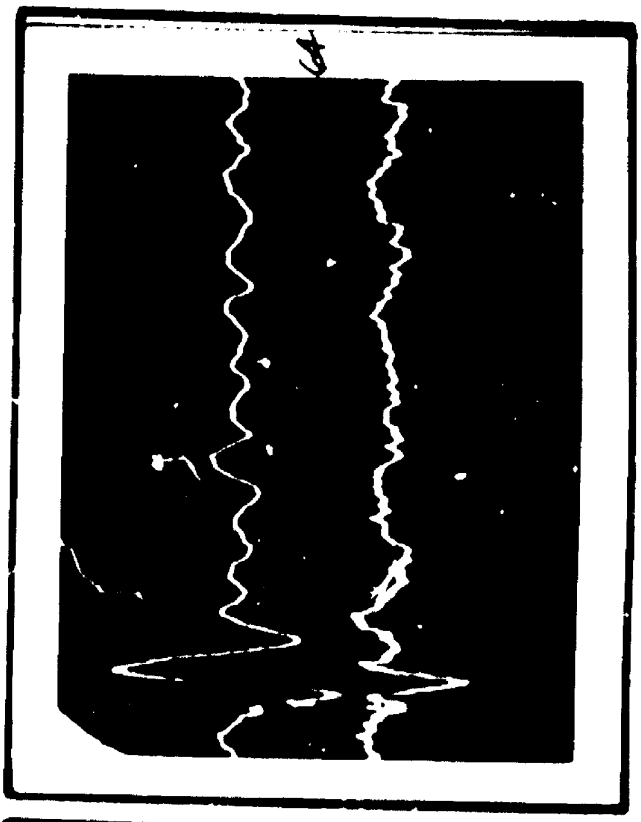


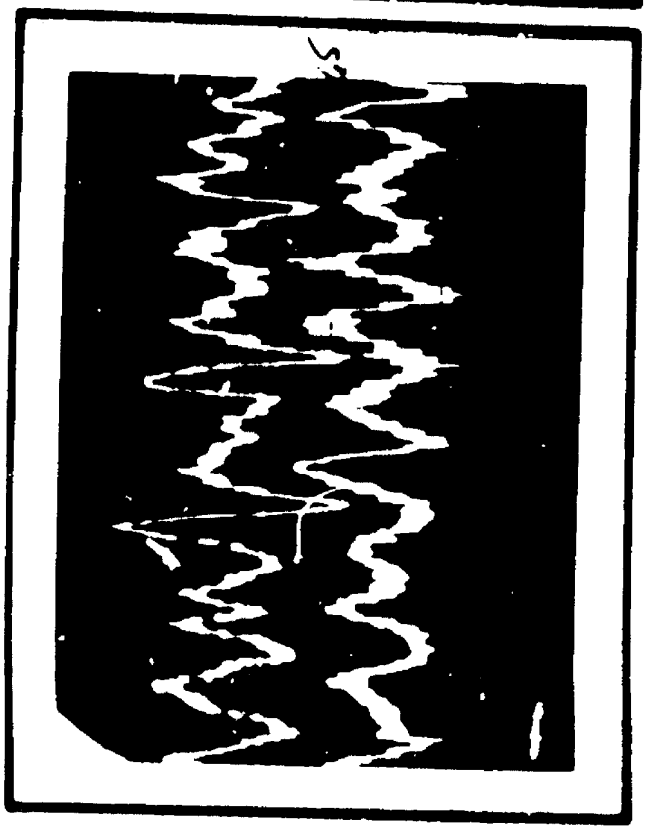


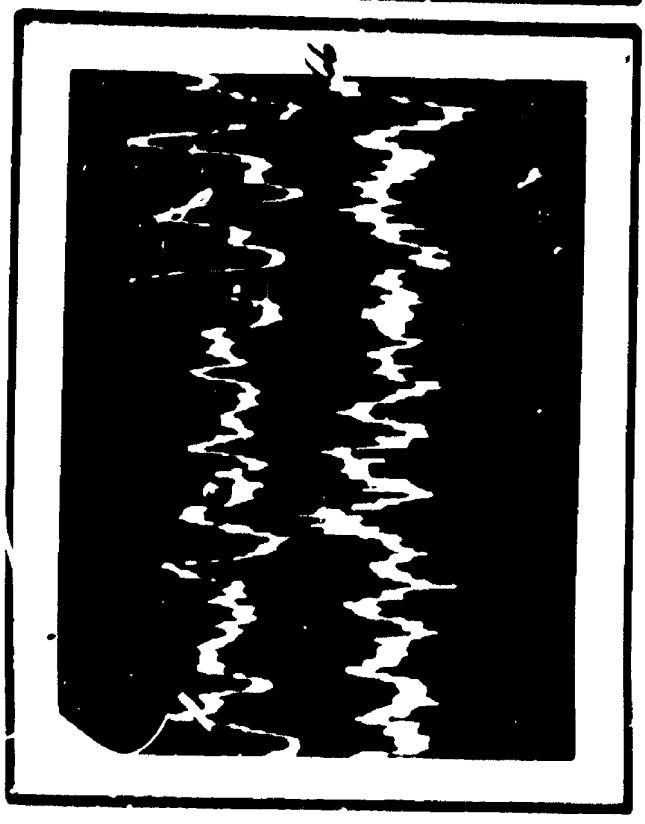


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
59	0.002	0.0002	50
60	0.002	0.0002	50
61	0.020	0.002	50
62	0.001	0.0002	50

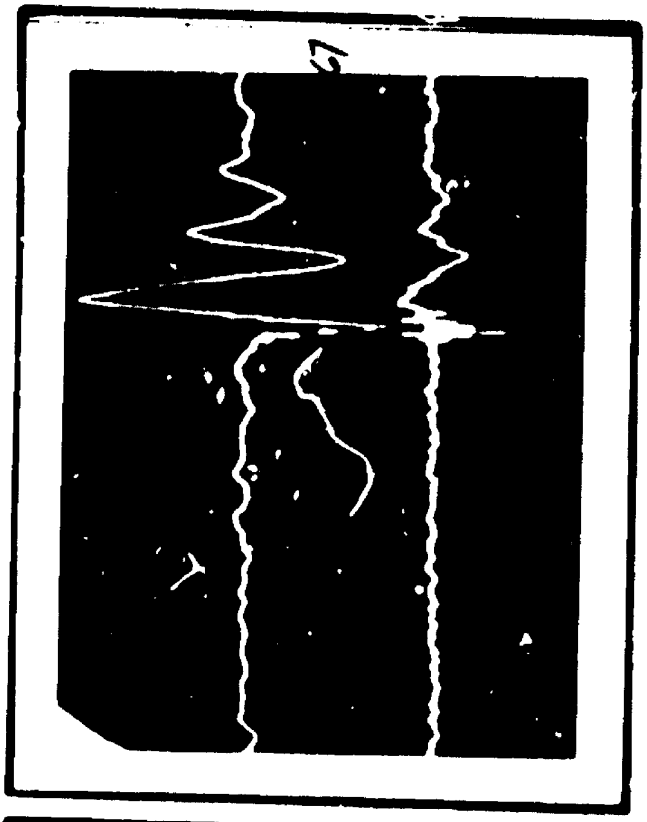


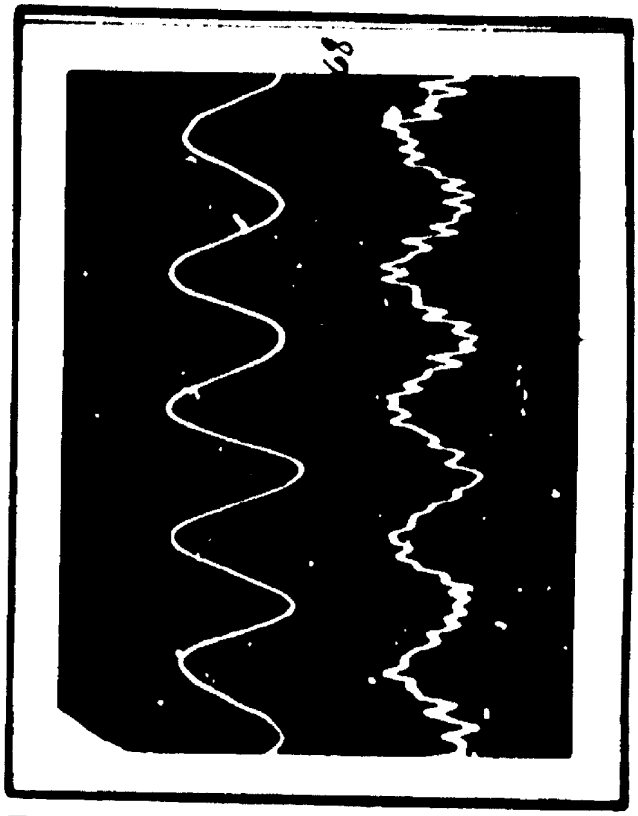




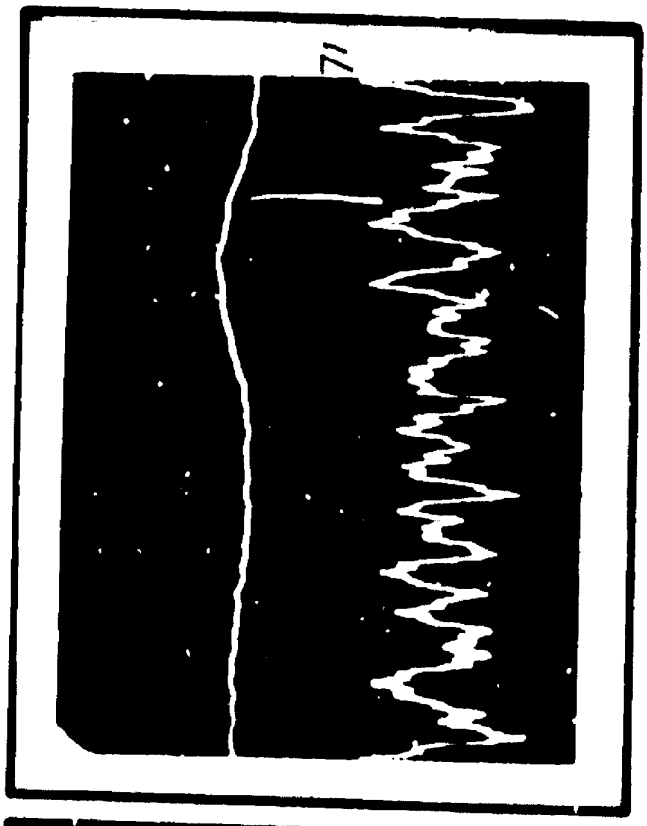


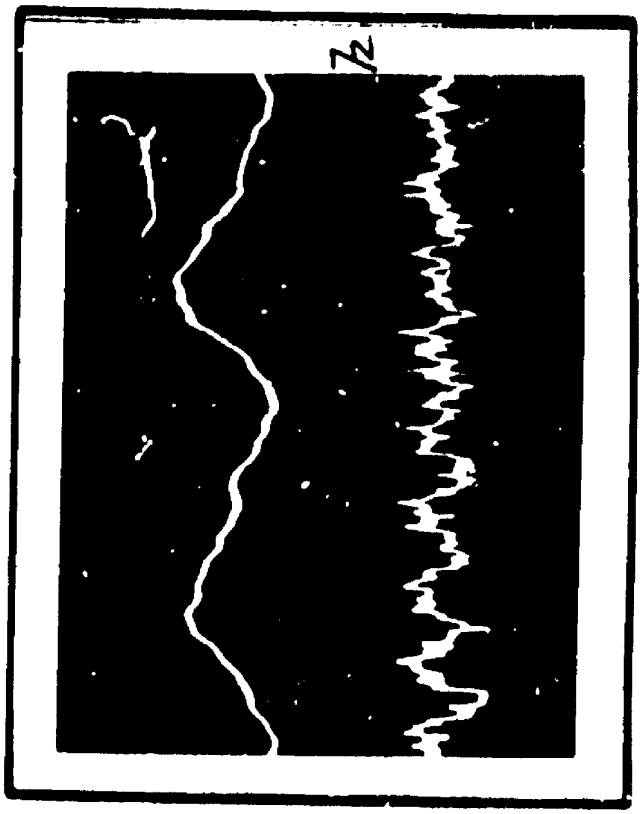
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
S3	0.001	0.0002	50
S4	0.005	0.001	50
S5	0.002	0.0005	50
S6	0.001	0.0001	50

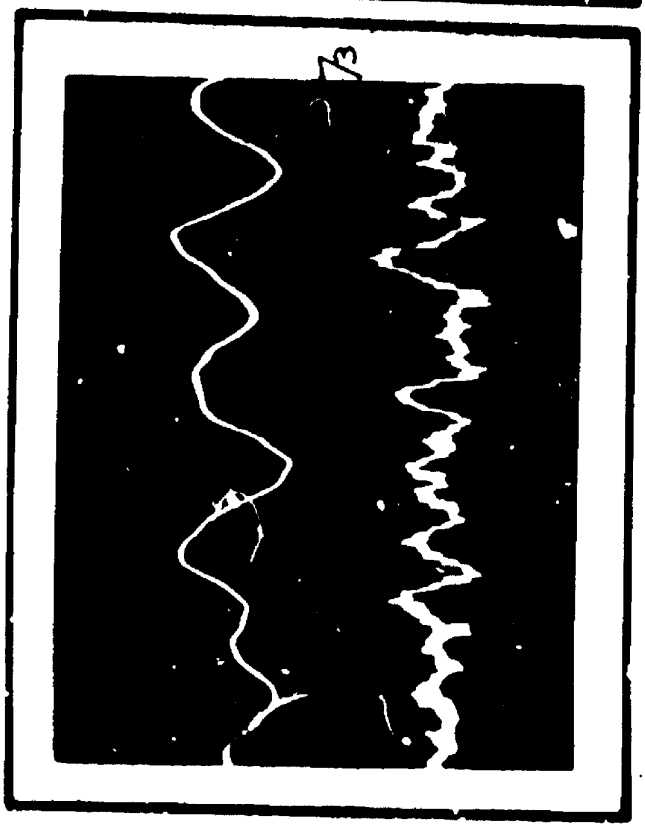




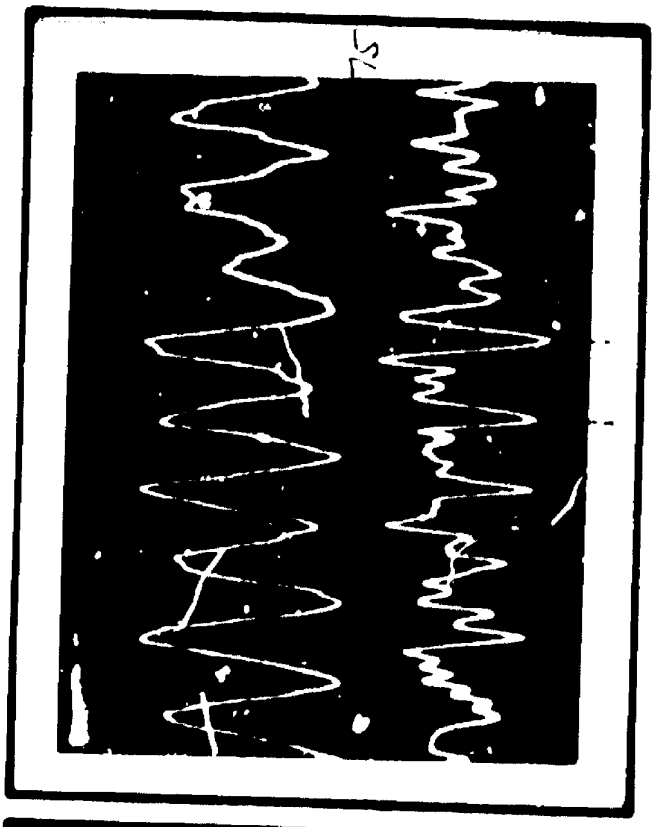
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
7	0.030	0.005	50
8	0.005	0.005	50
9	0.005	0.005	50
10	0.005	0.005	50

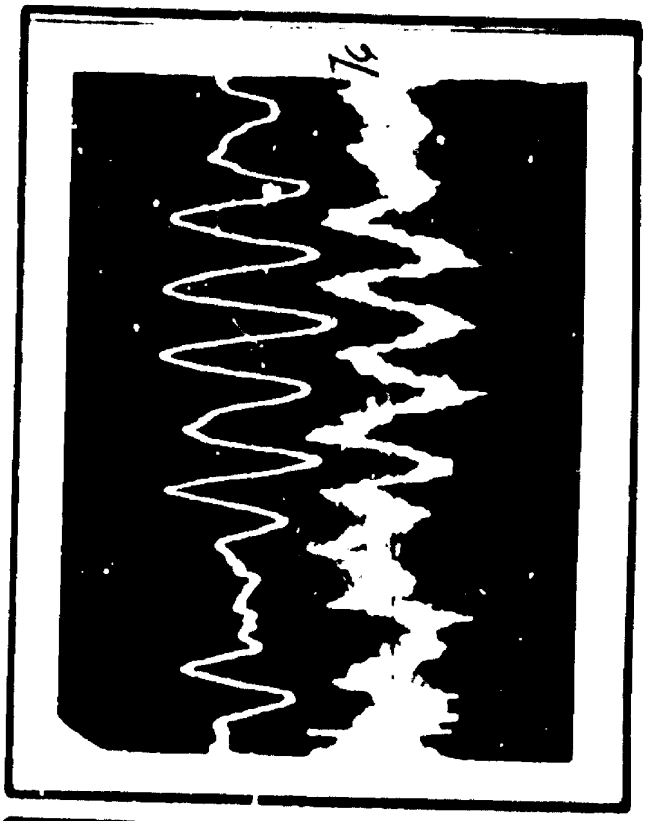


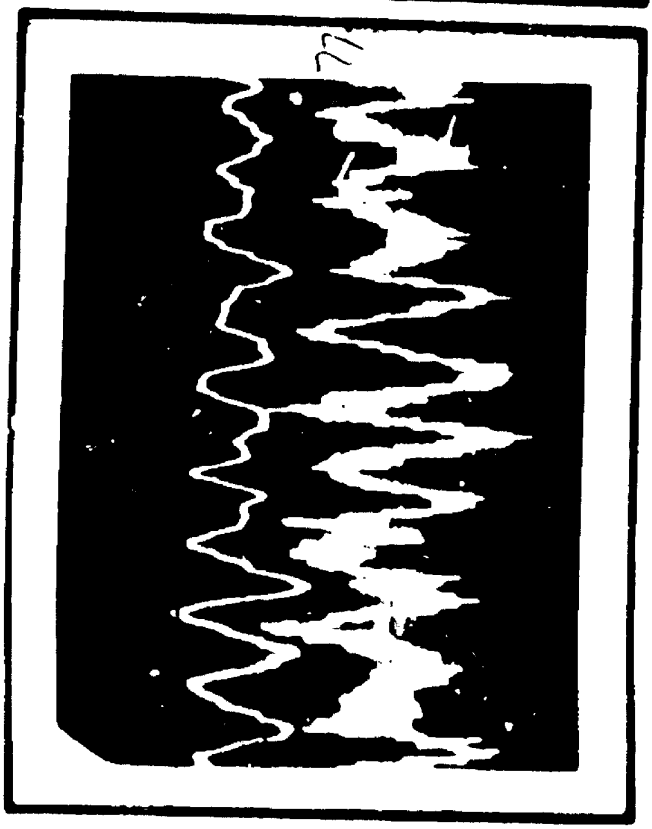




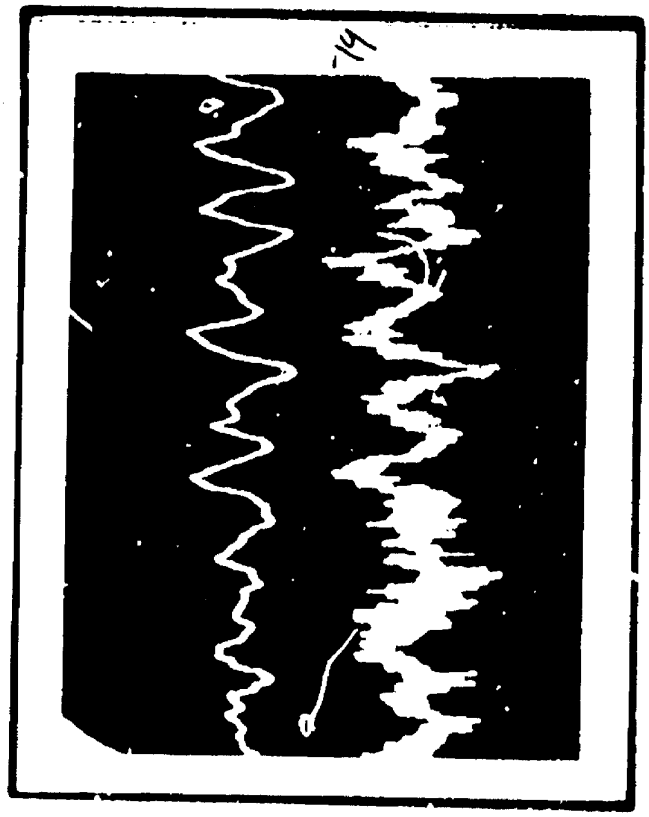
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
7'1	0.002	0.002	50
7'2	0.001	0.001	50
7'3	0.001	0.001	50

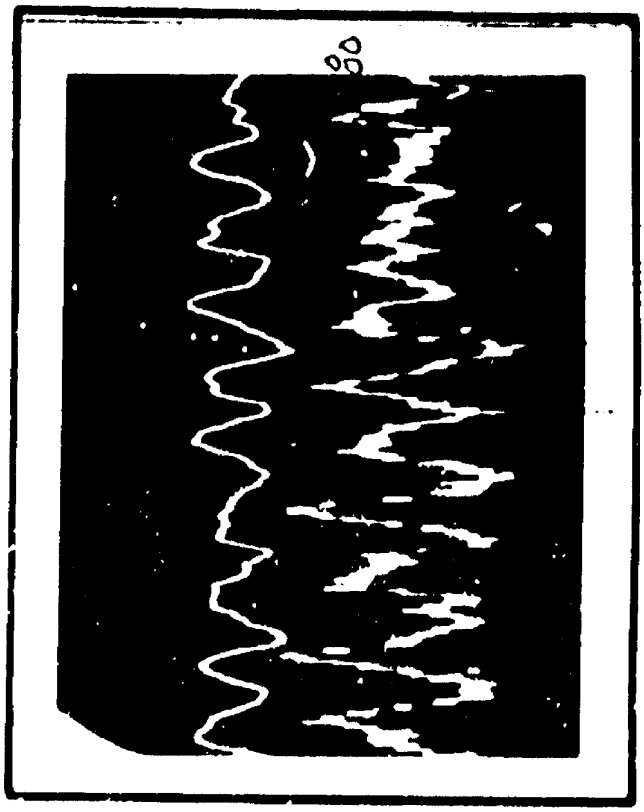


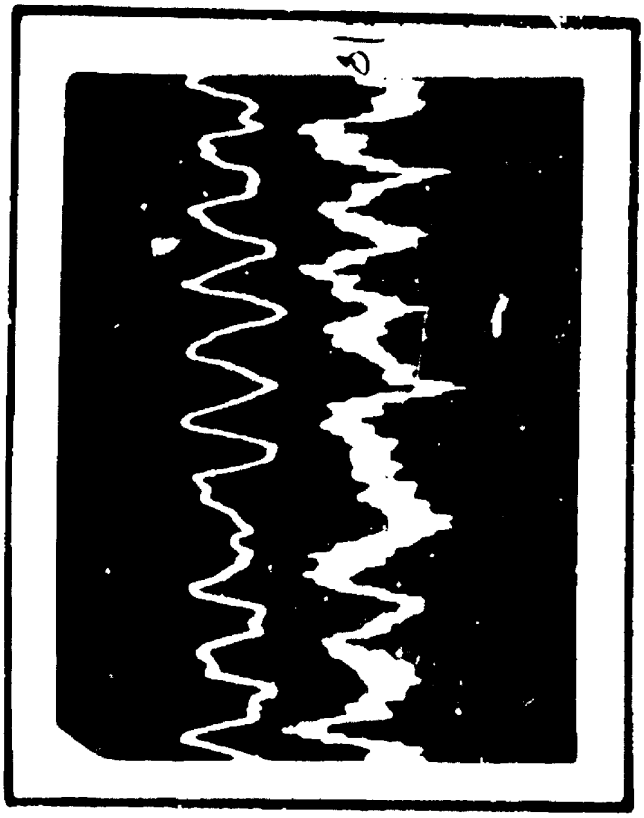


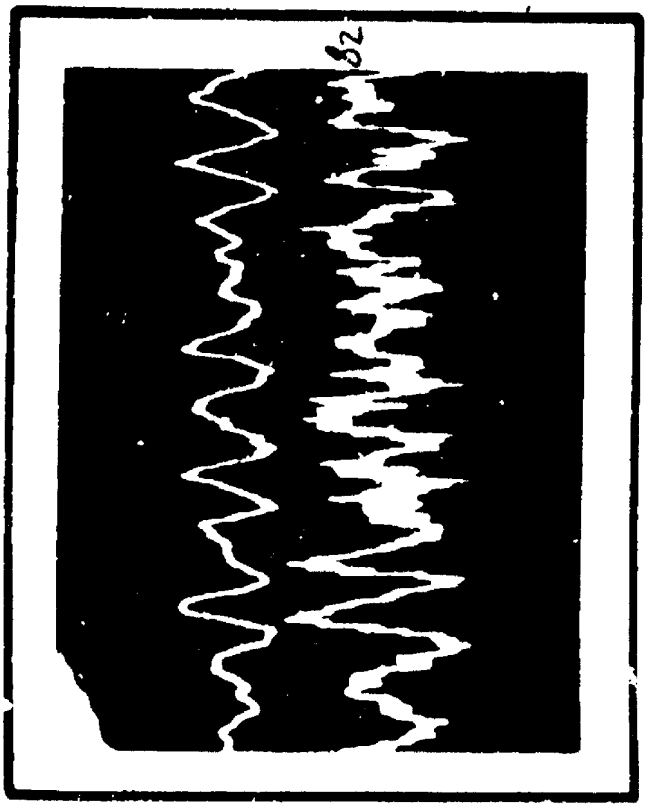


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
75	0.005	0.005	50
76	0.005	0.005	50
77	0.005	0.005	50
78	0.010	0.005	50

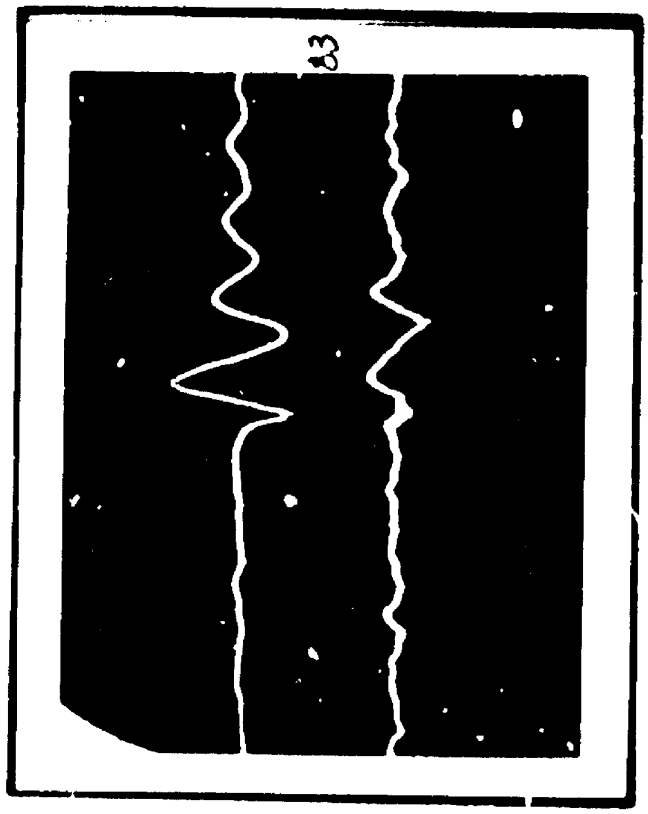


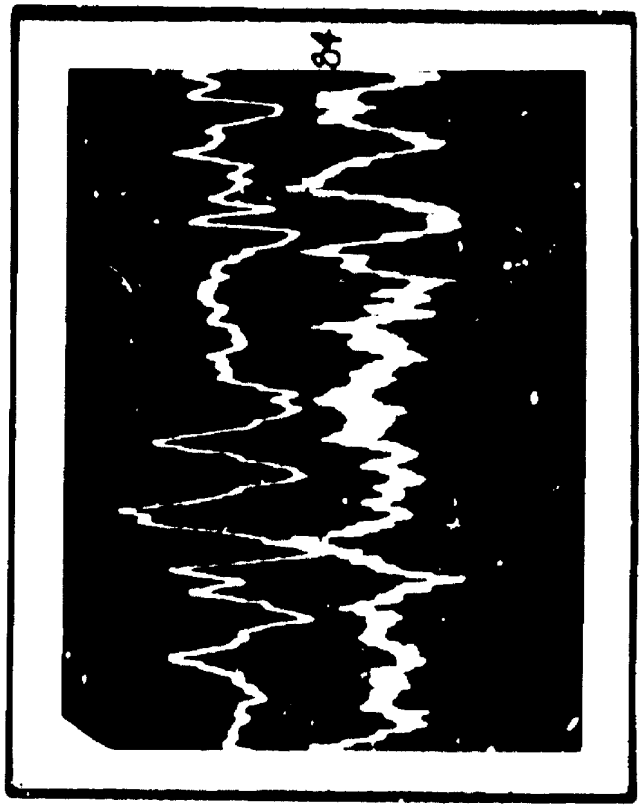


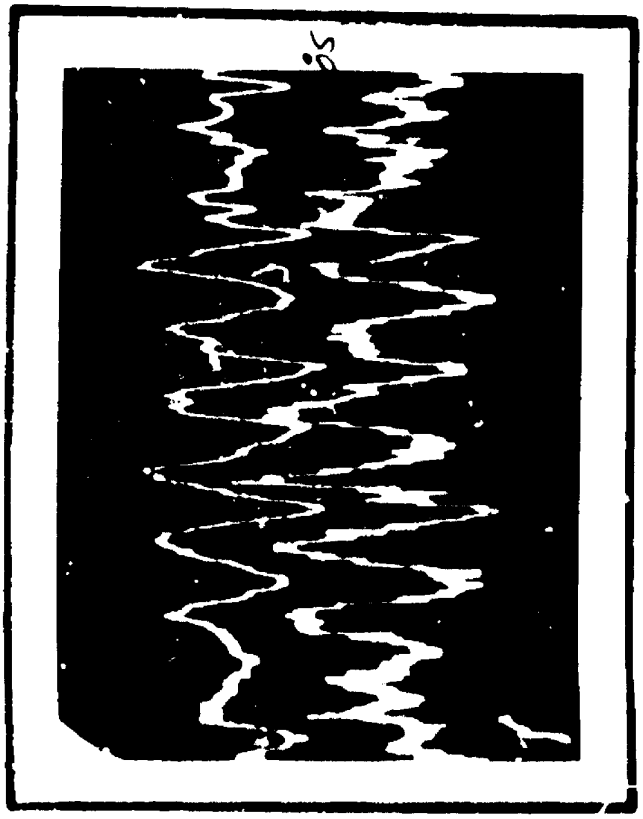


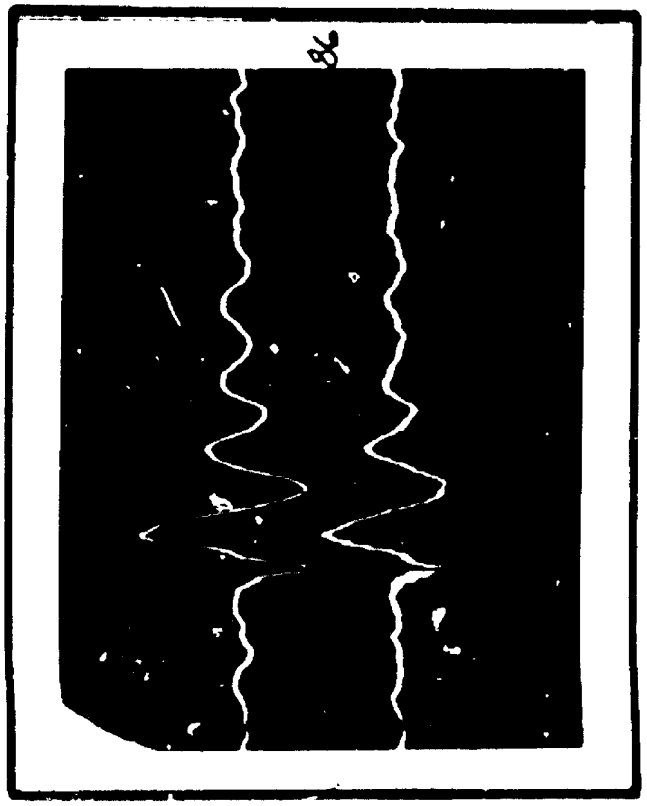


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
79	0.005	0.005	10
80	0.005	0.005	10
81	0.005	0.005	10
82	0.005	0.005	10

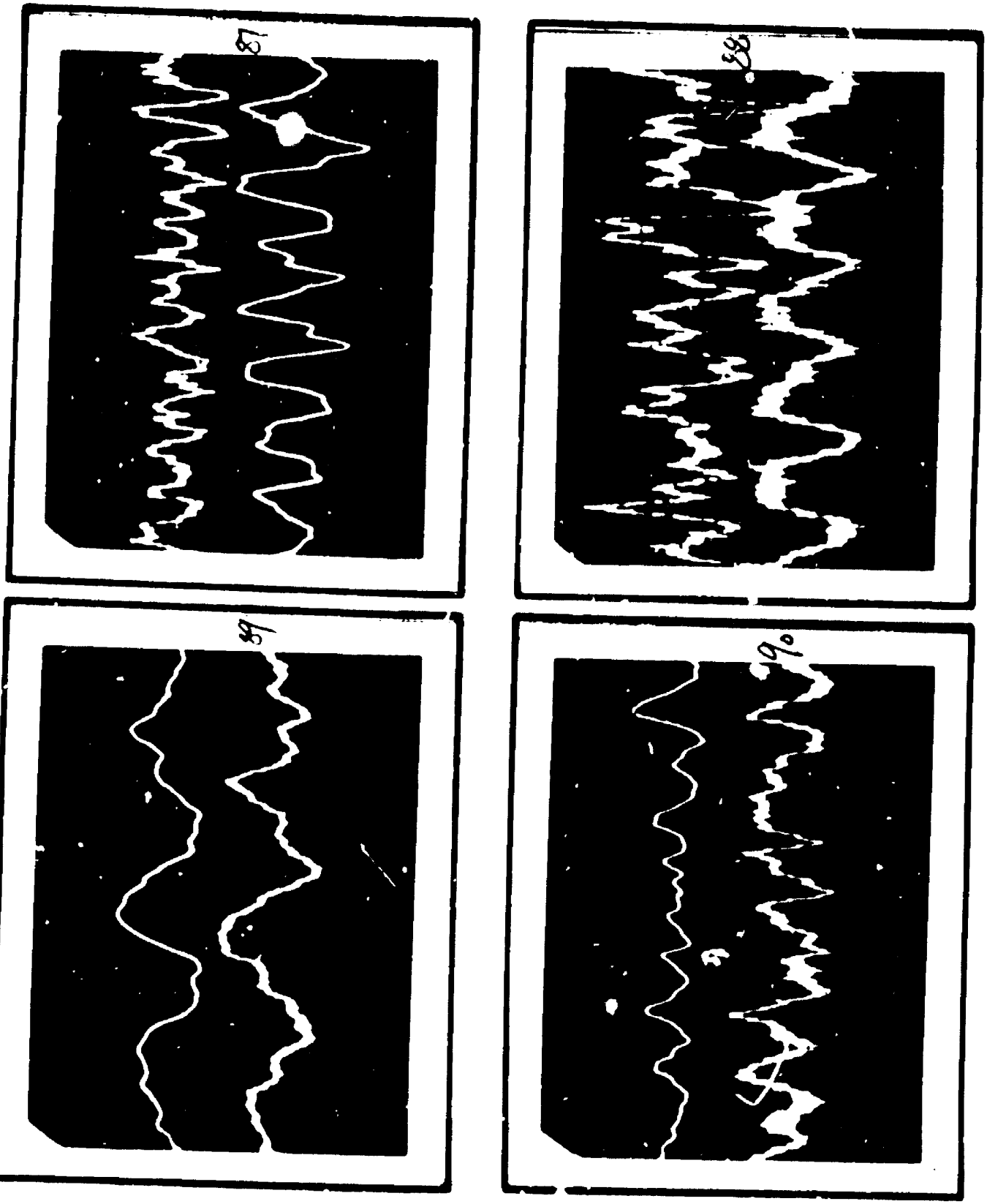




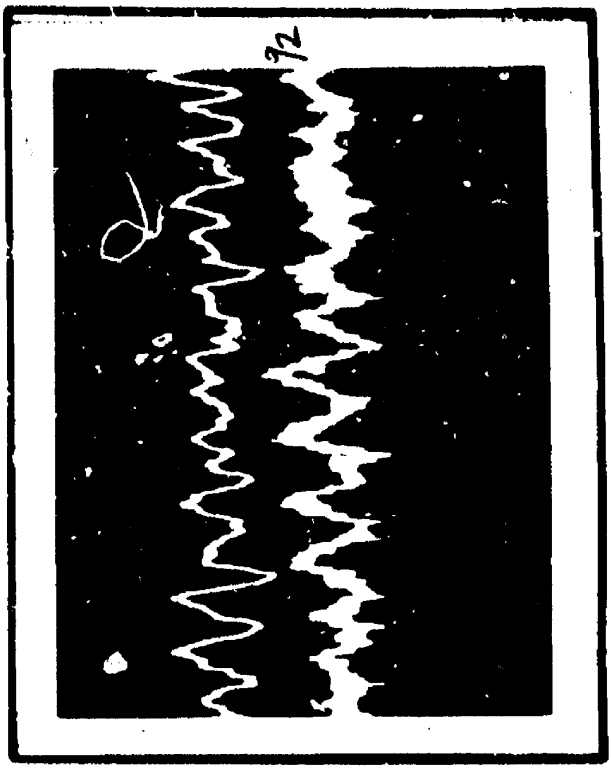


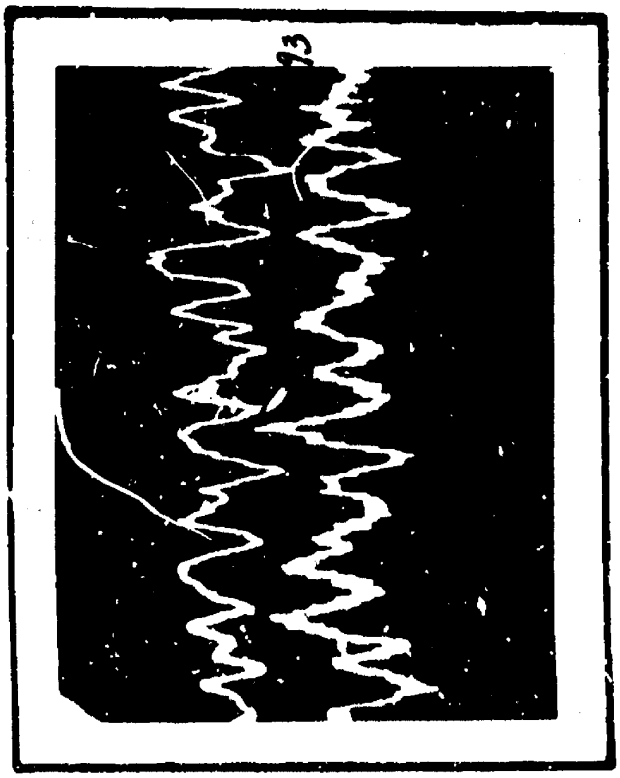


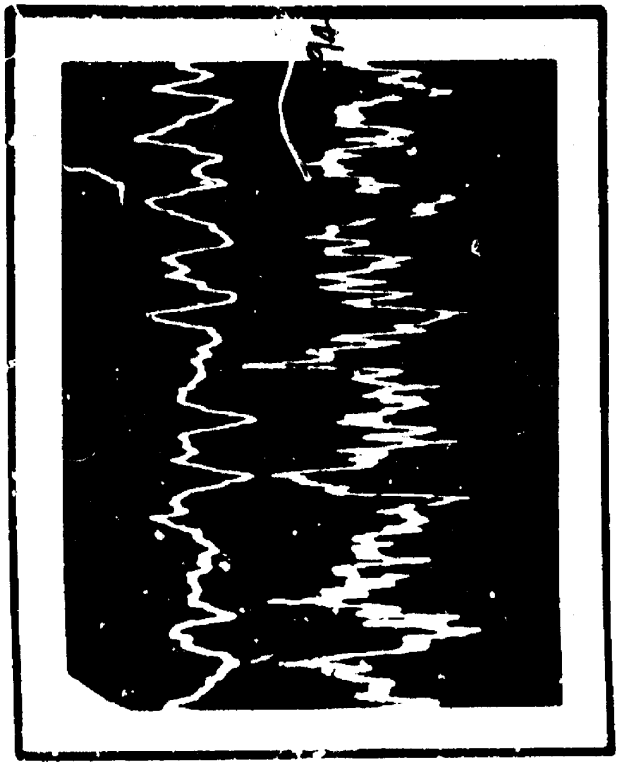
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
83	0.010	0.005	50
84	0.002	0.0005	50
85	0.002	0.0005	50
86	0.010	0.005	50



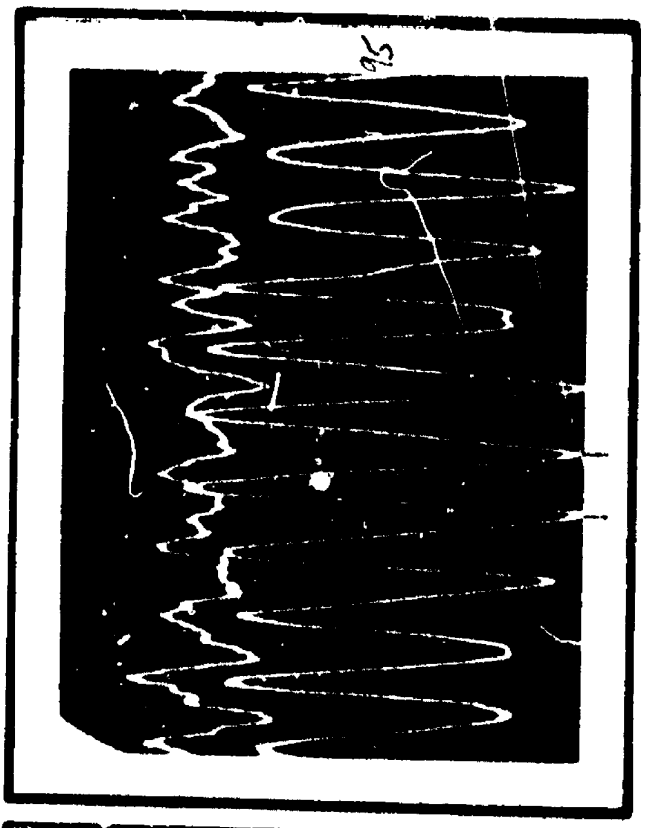
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
87	0.005	0.0005	50
88	0.005	0.100	50
89	0.010	0.001	50
90	0.005	0.0005	50

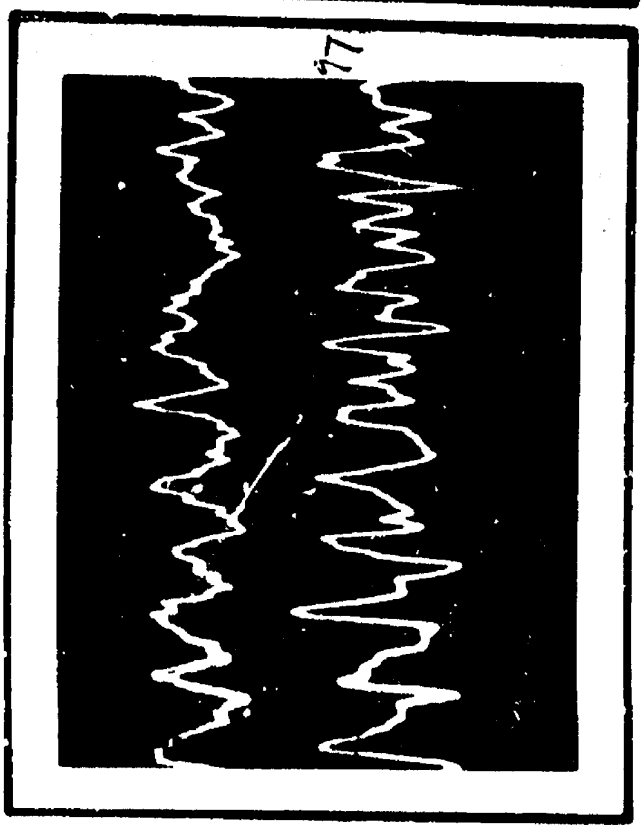


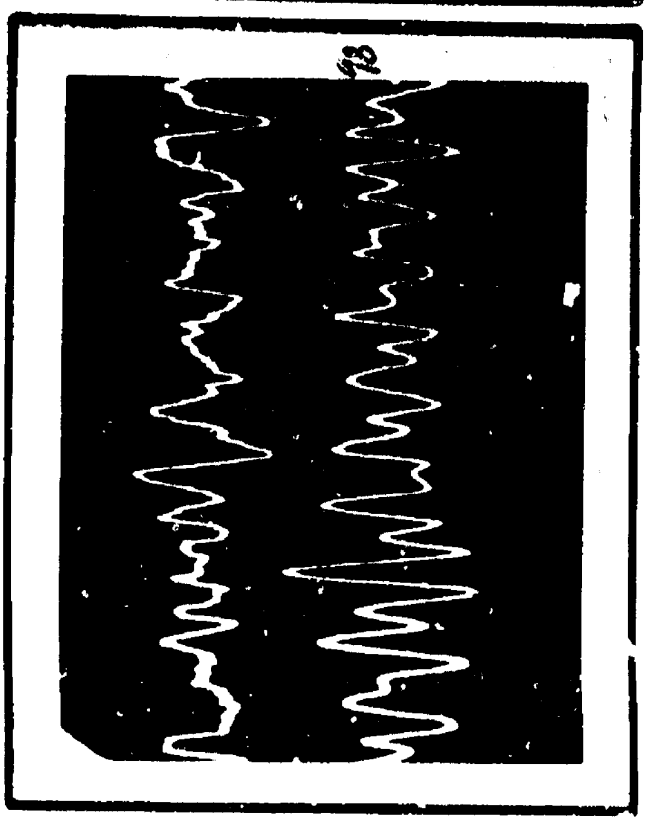




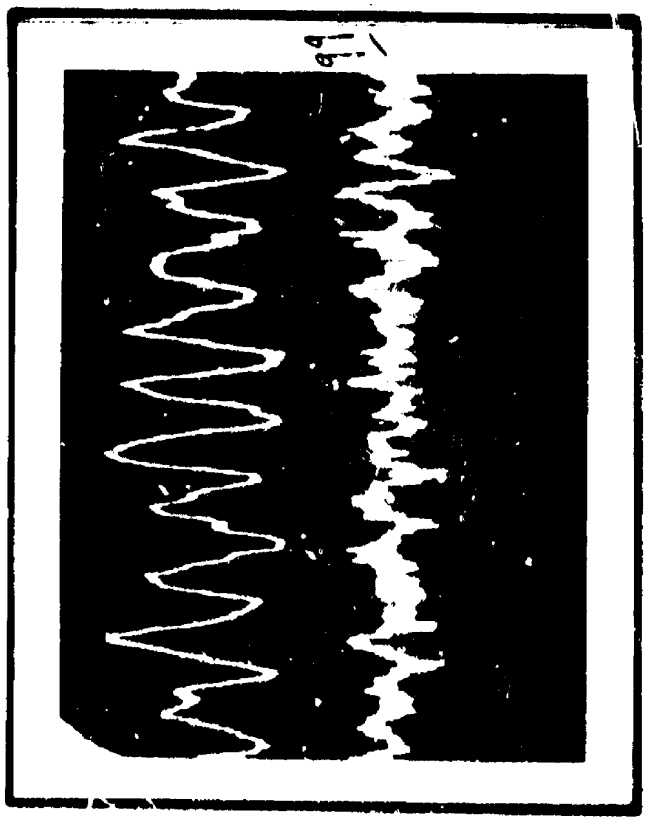
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
91	0.050	0.005	50
92	0.002	0.0005	50
93	0.002	0.0005	50
94	0.002	0.005	50

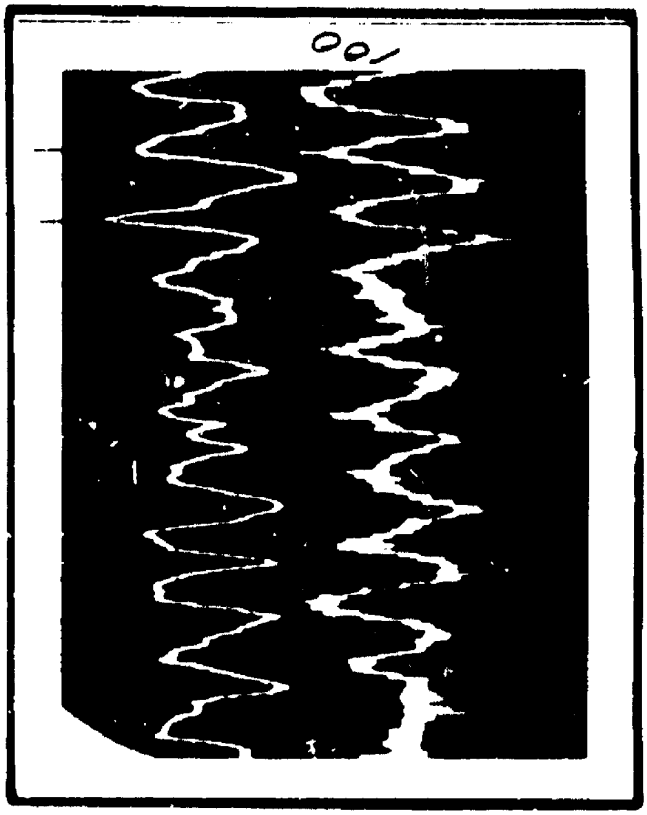


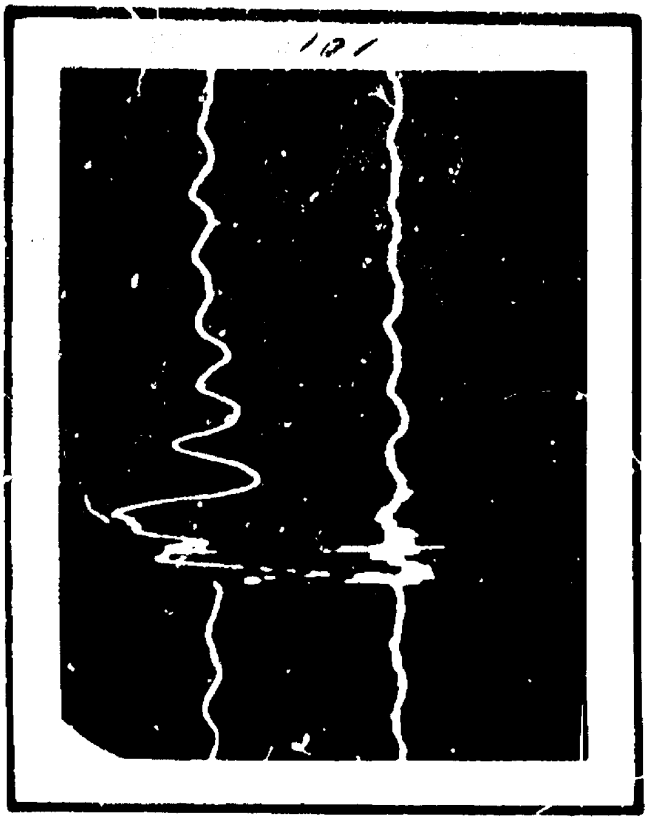


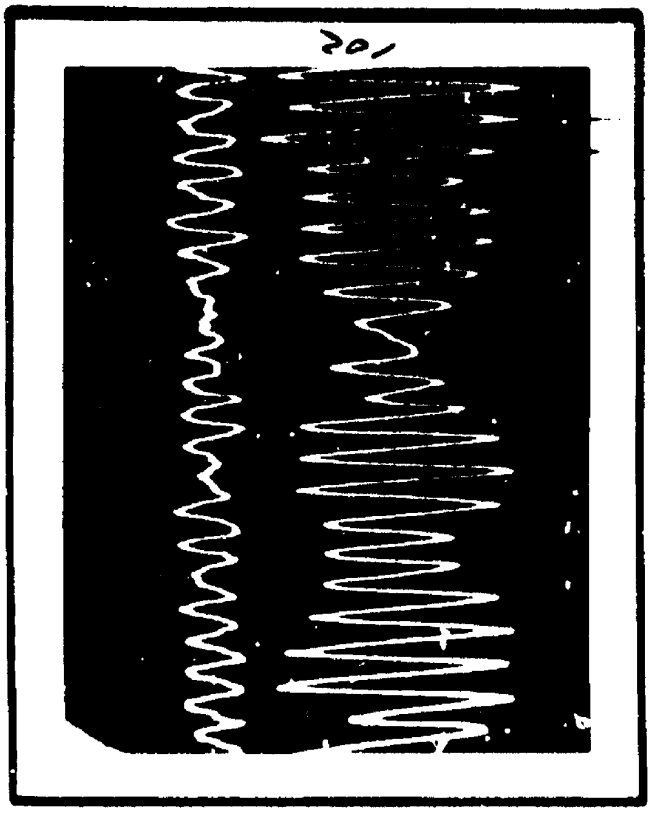


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
95	0.002	0.010	50
96	0.002	0.010	50
97	0.002	0.010	50
98	0.002	0.010	50

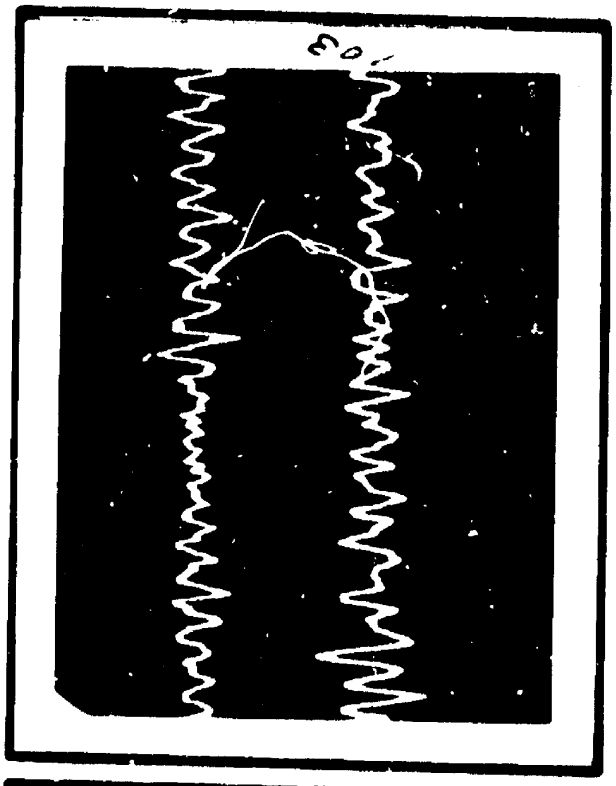


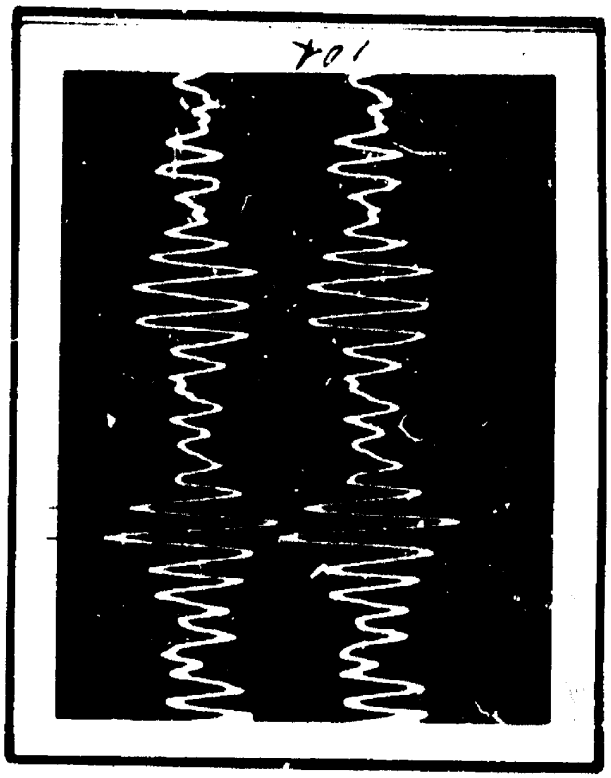


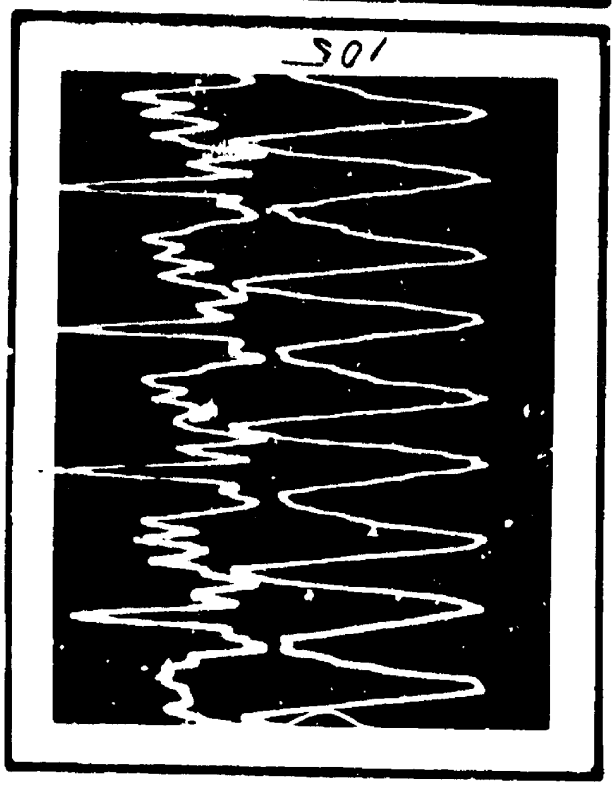


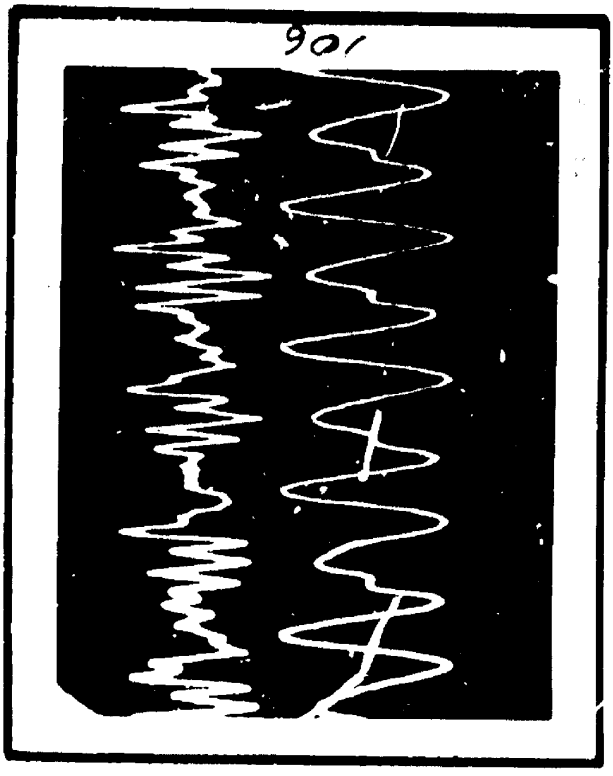


SCALES			
RECORD NO	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
99	0.002	0.0005	50
100	0.002	0.0005	50
101	0.020	0.005	50
102	0.005	0.050	100

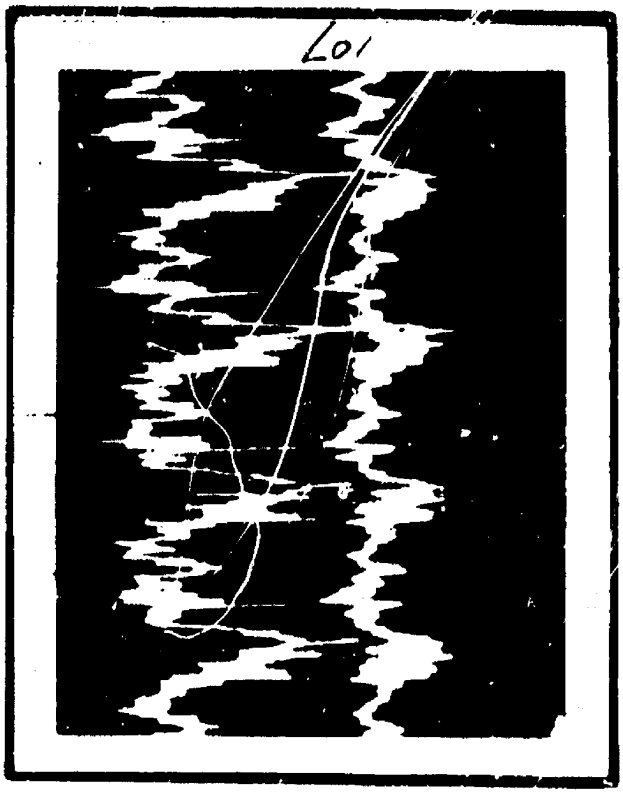


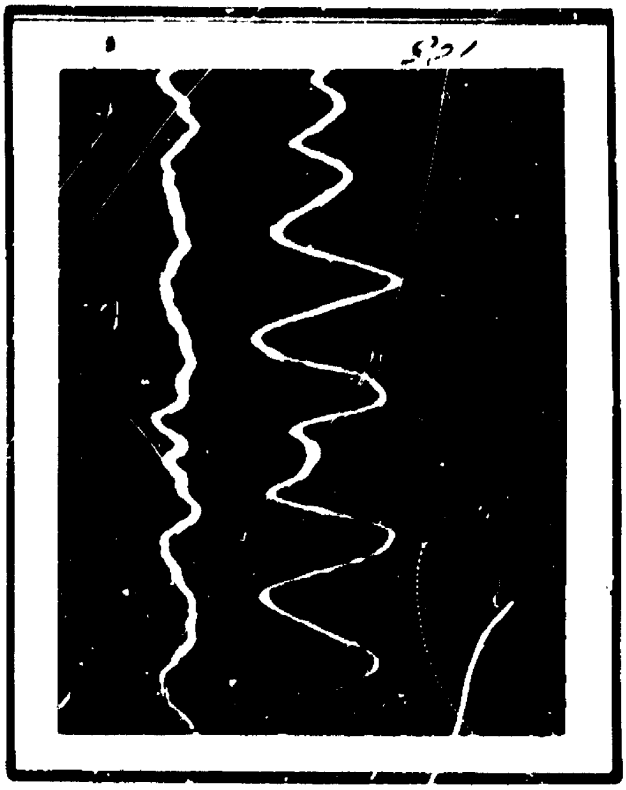


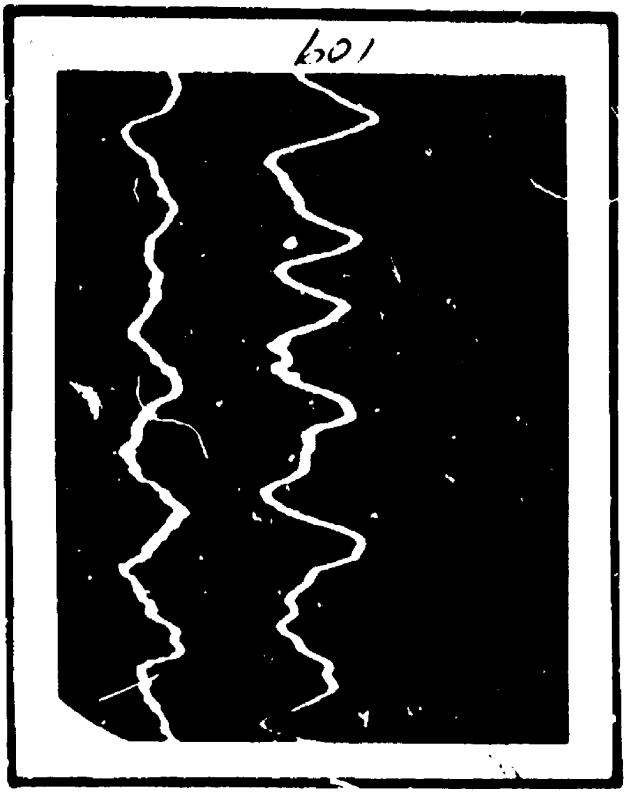


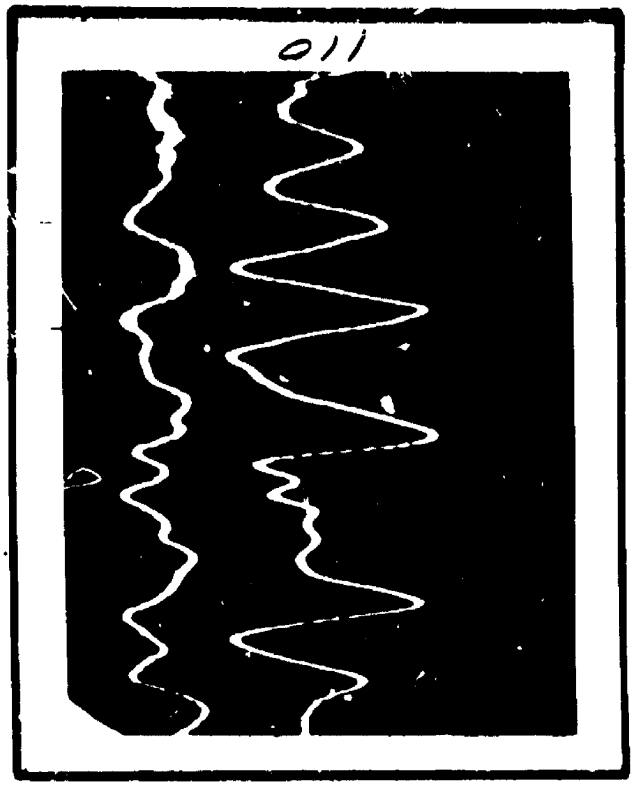


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
103	0.005	0.050	100
104	0.050	0.050	100
105	0.050	0.100	50
106	0.050	0.100	50

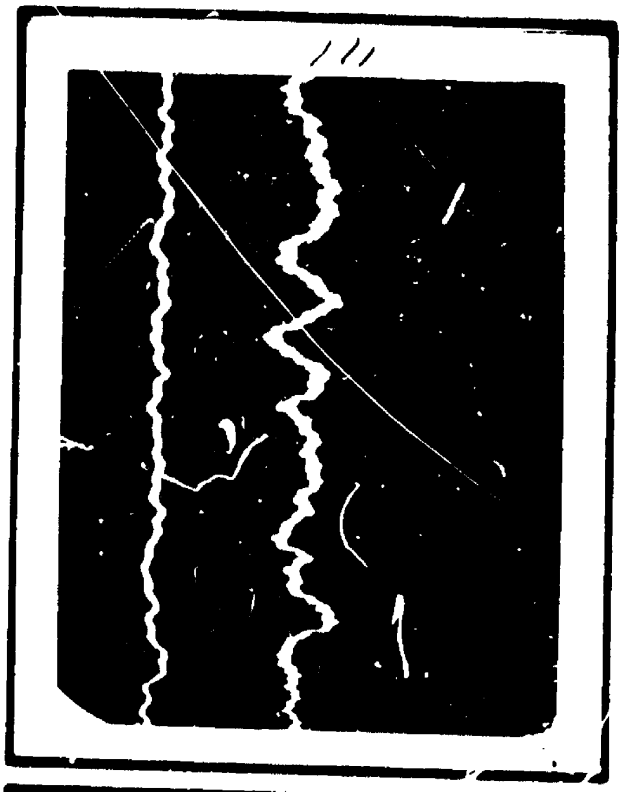


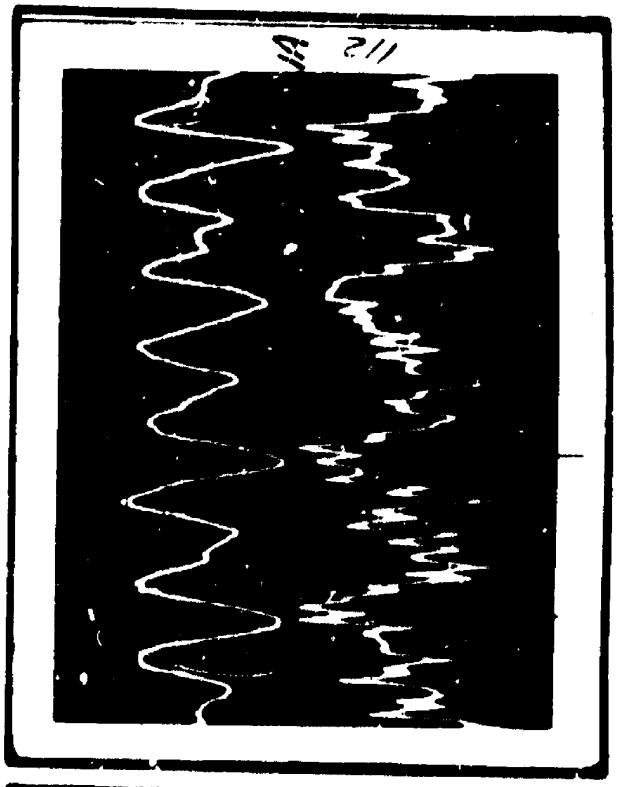


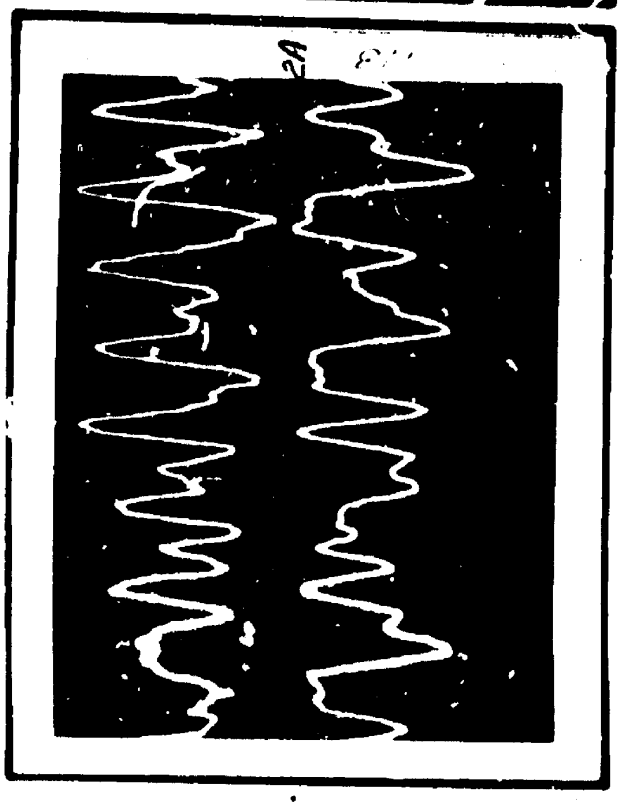


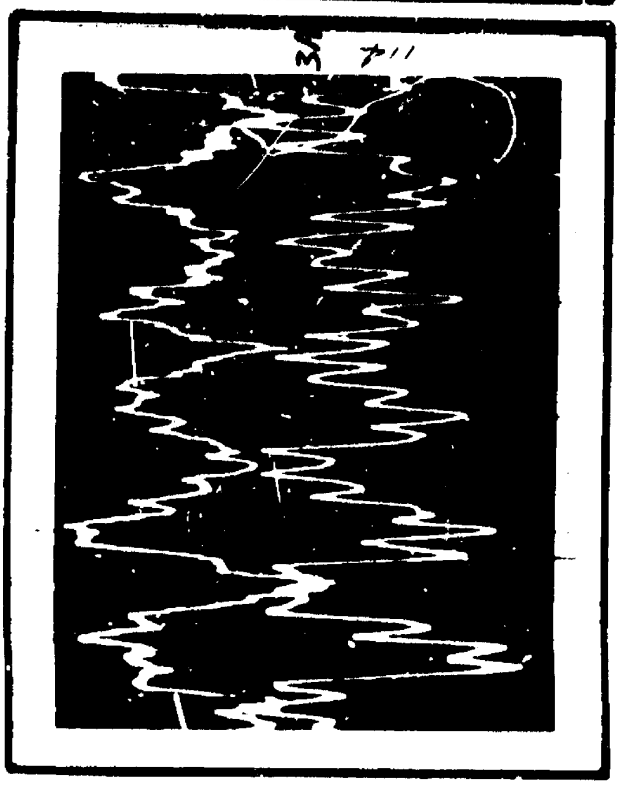


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
107	0.050	0.050	50
108	0.001	0.002	50
109	0.001	0.002	50
110	0.001	0.002	50

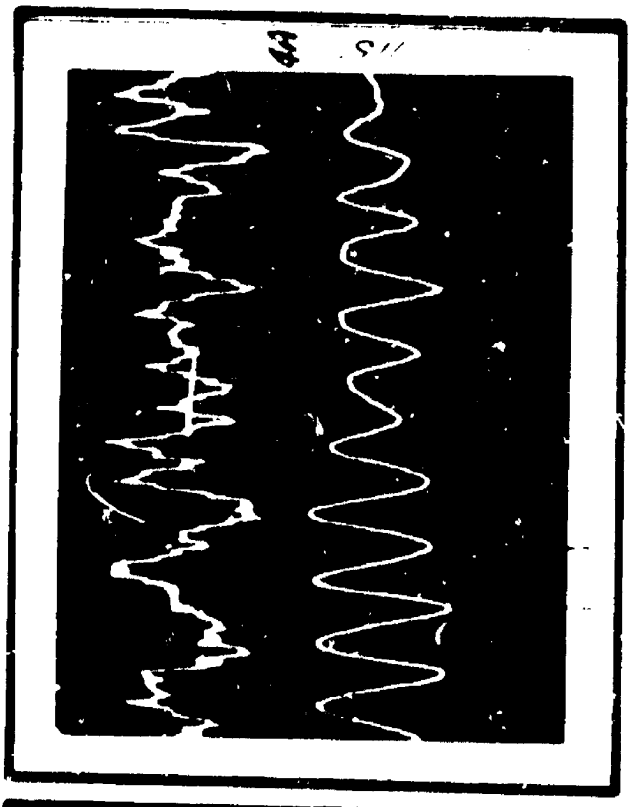


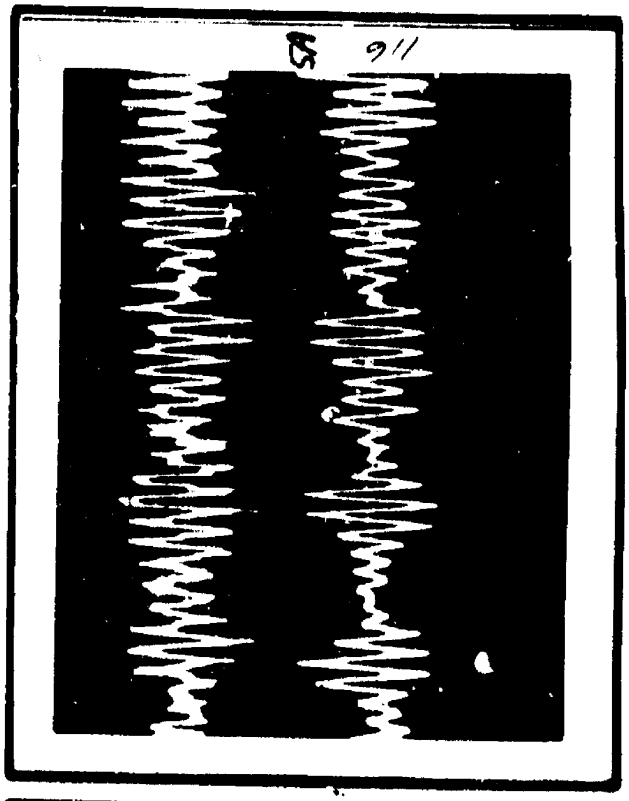




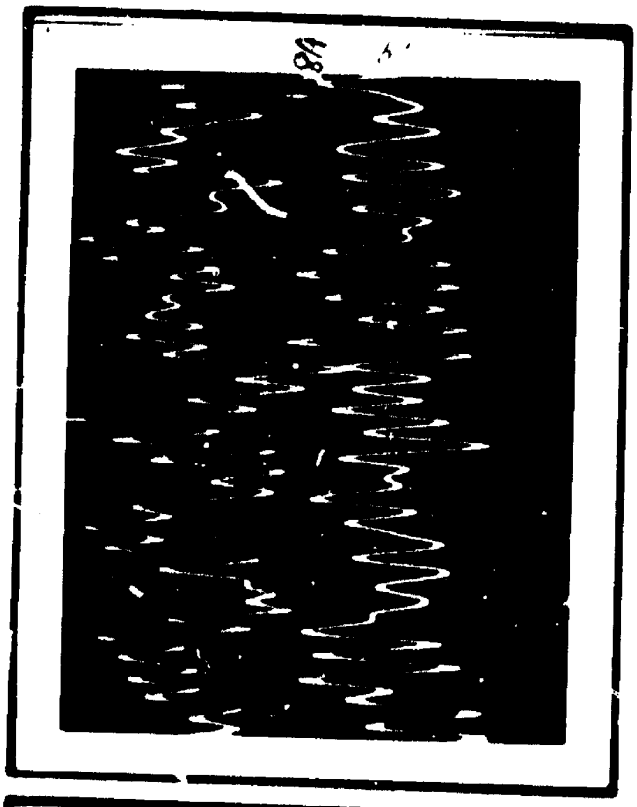


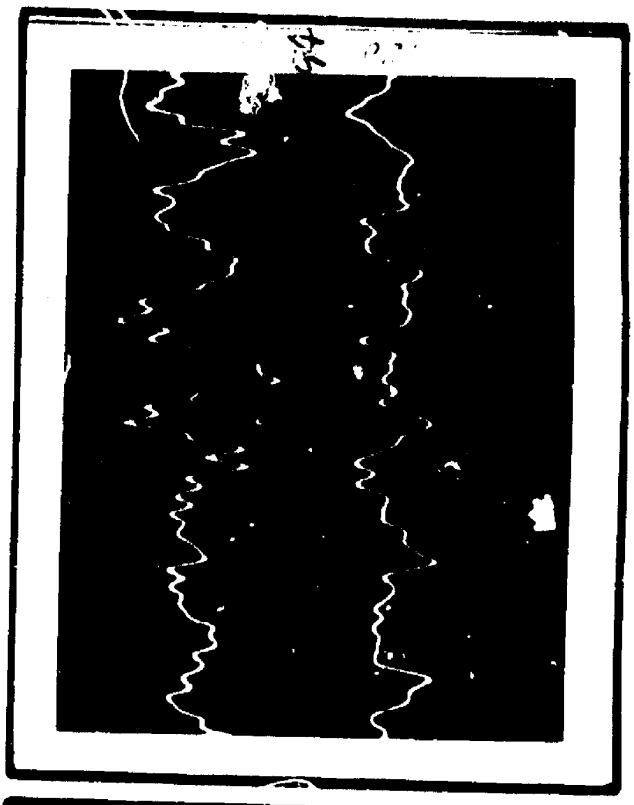
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
111	0.001	0.002	50
112	0.200	0.100	50
113	0.050	0.100	50
114	0.100	0.200	50

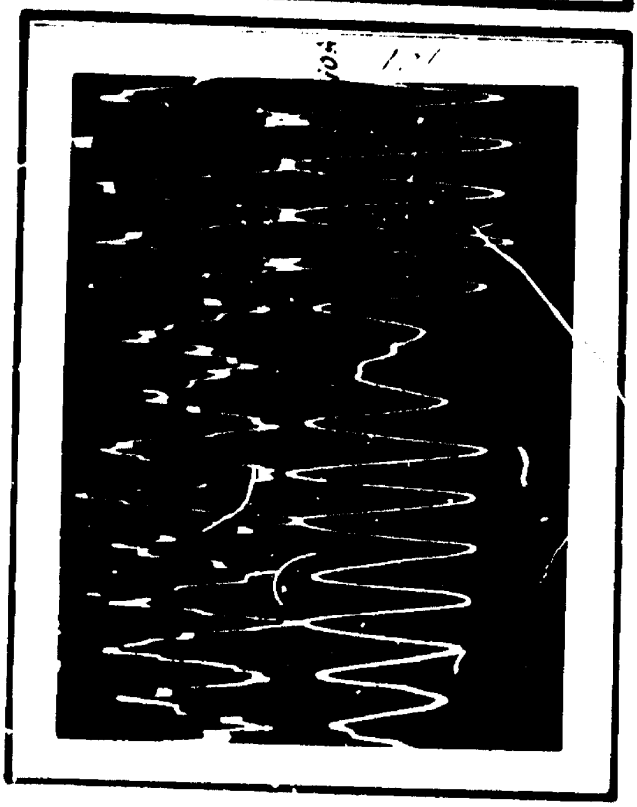




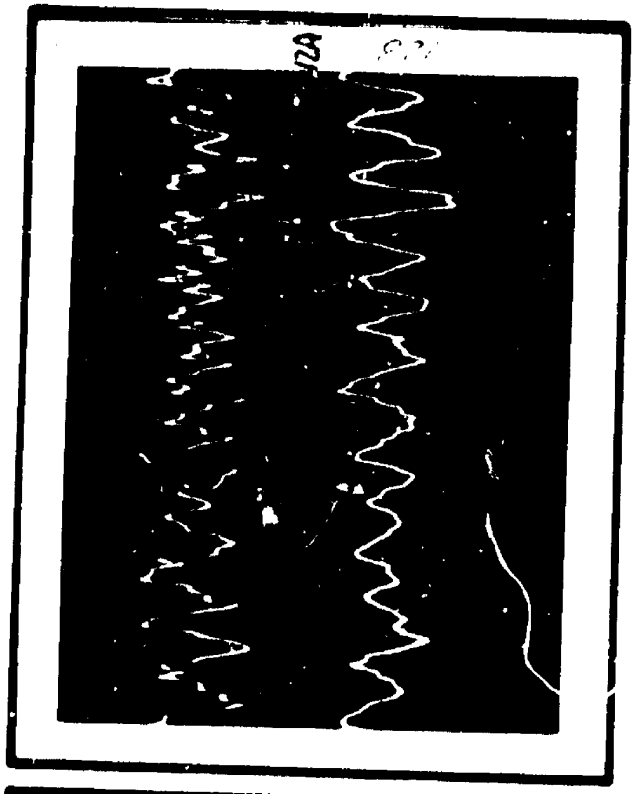
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
115	0.020	0.100	50
116	0.020	0.100	100
117	0.020	0.100	100
118	0.010	0.050	50



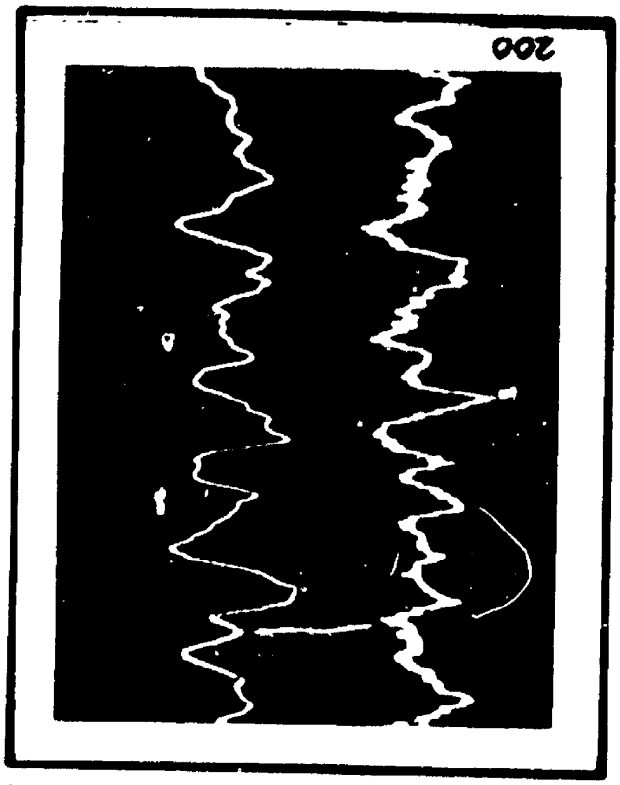


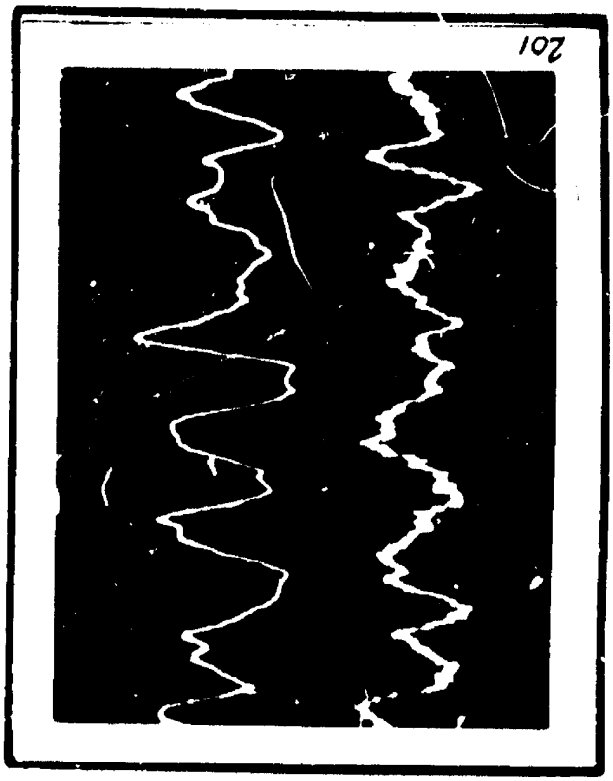


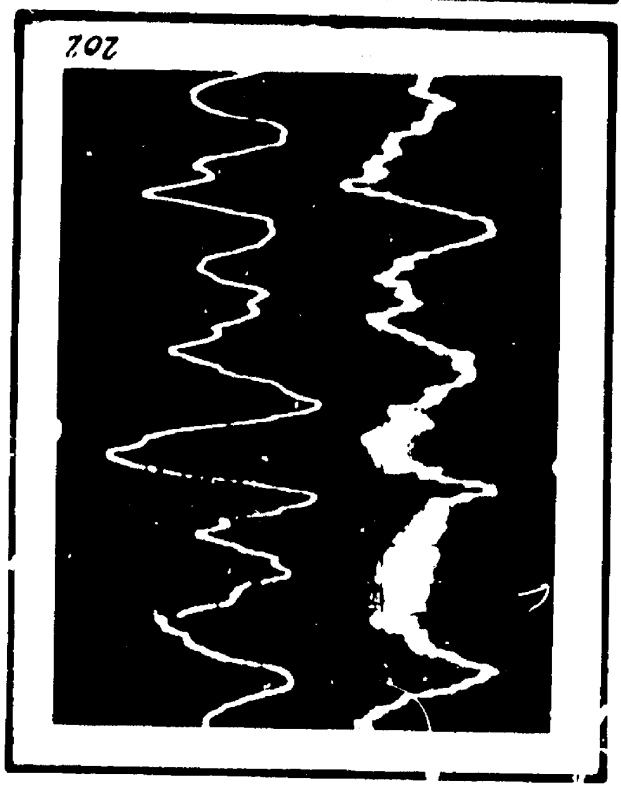
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
119	0.010	0.020	20
120	0.010	0.020	20
121	0.020	0.200	20
122	0.002	0.500	50 200

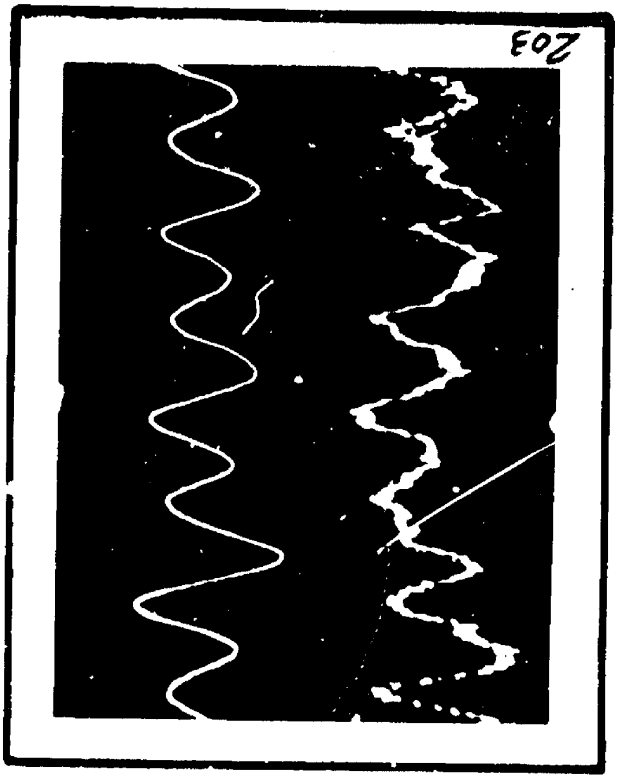


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
123	0.020	0.020	50

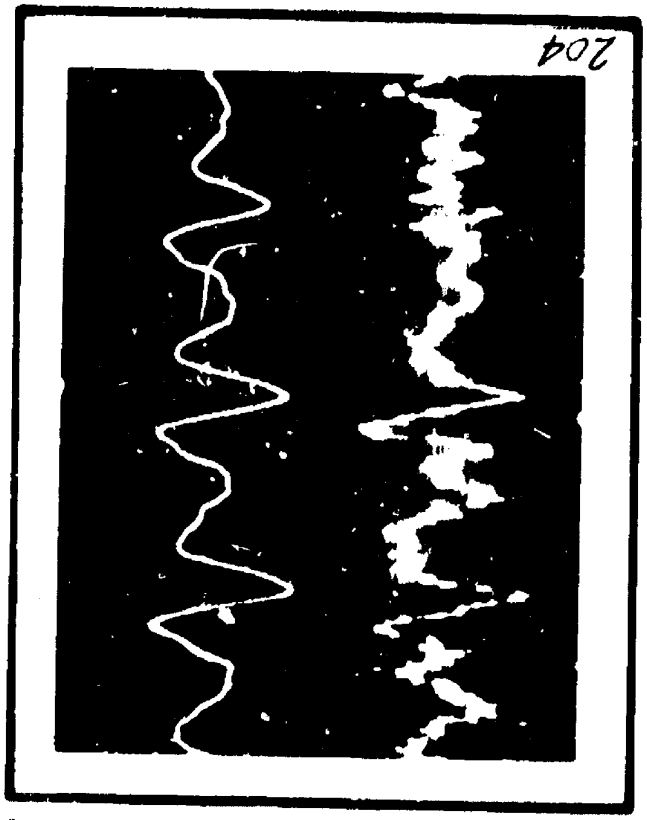


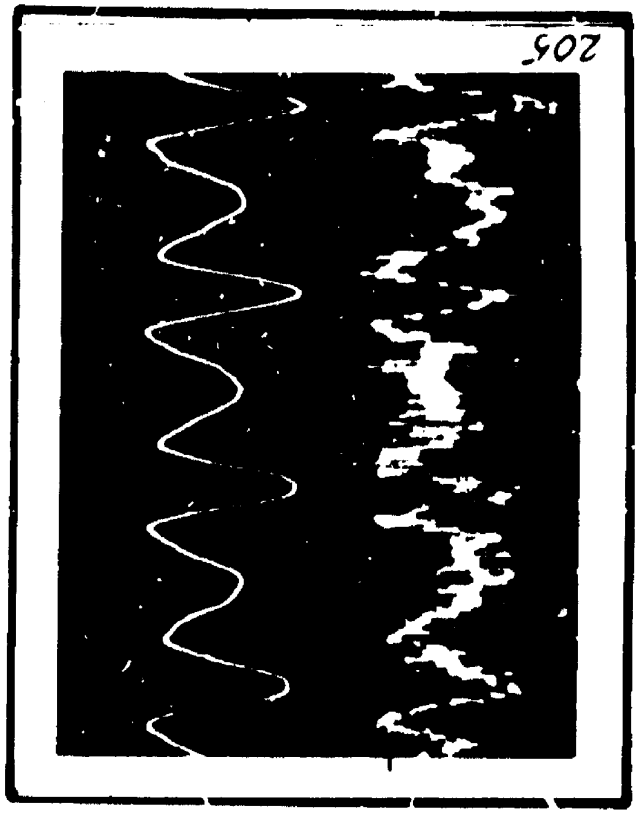


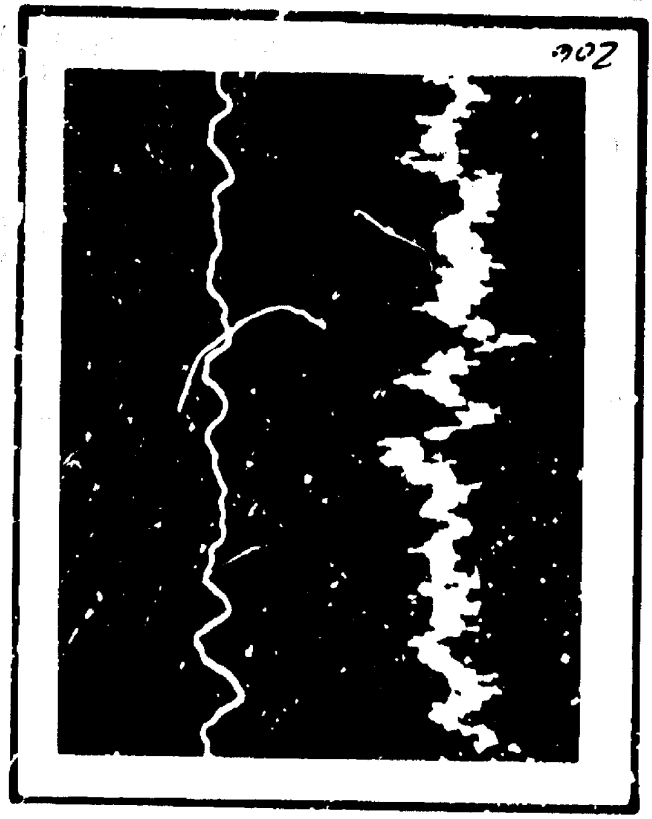


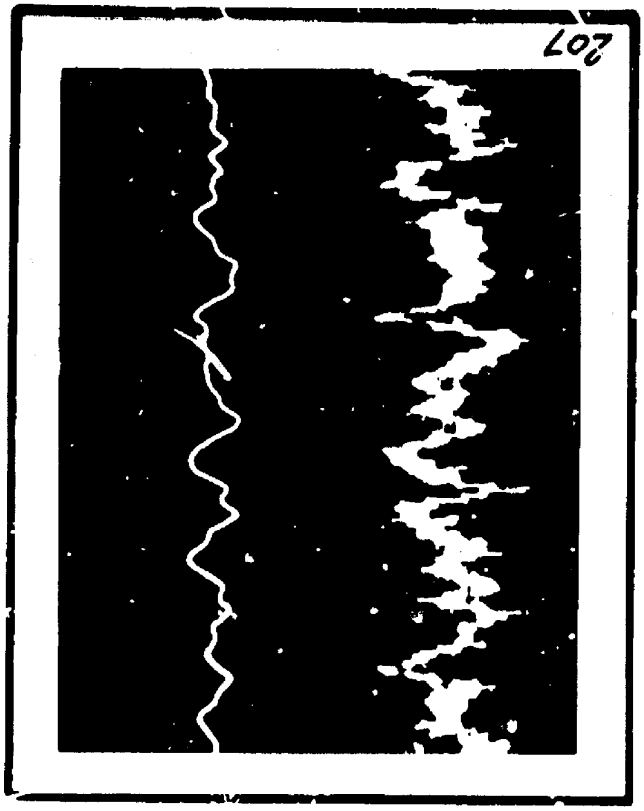


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
200	0.002	0.0005	50
201	0.002	0.0005	50
202	0.002	0.0005	50
203	0.010	0.0005	50

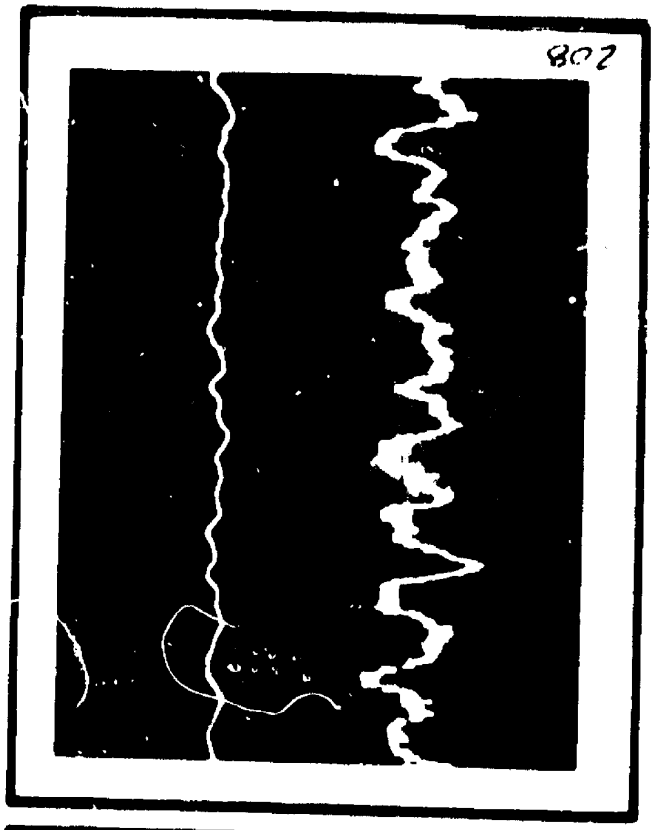


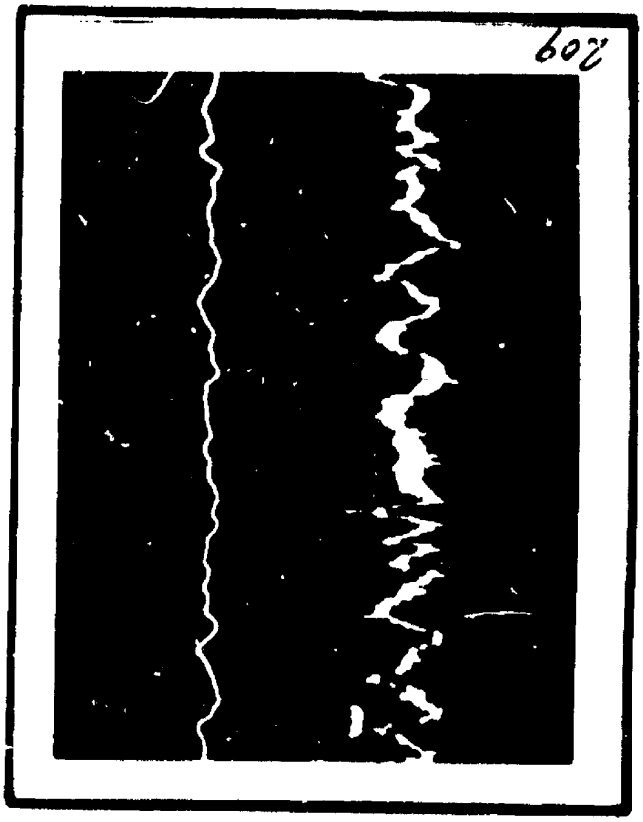


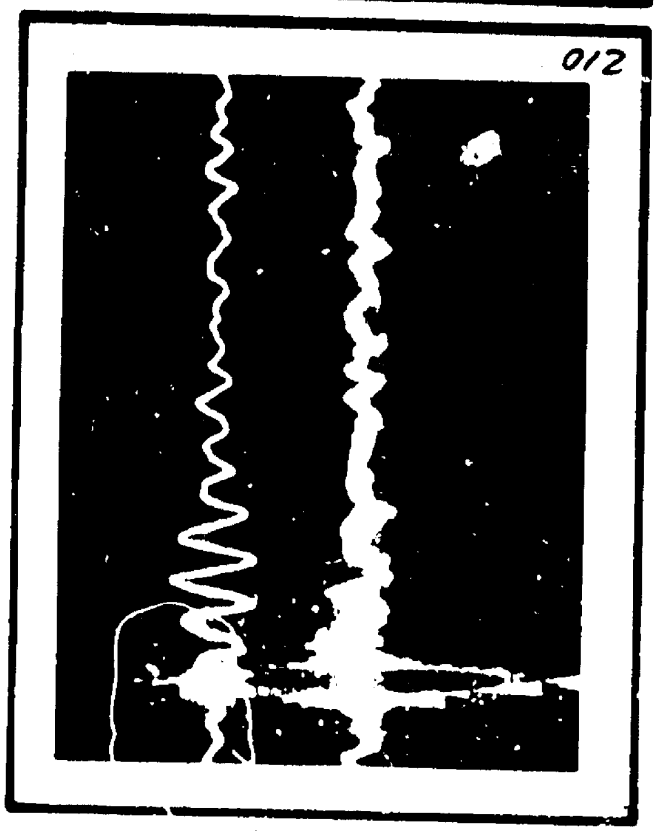


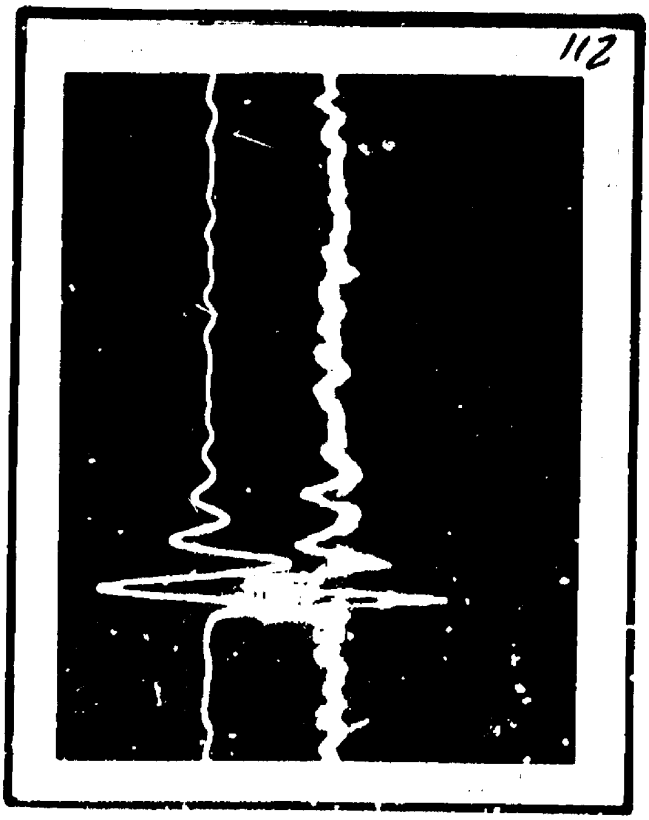


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
204	0.010	0.0005	50
205	0.010	0.0005	50
206	0.010	0.0005	50
207	0.010	0.0005	50

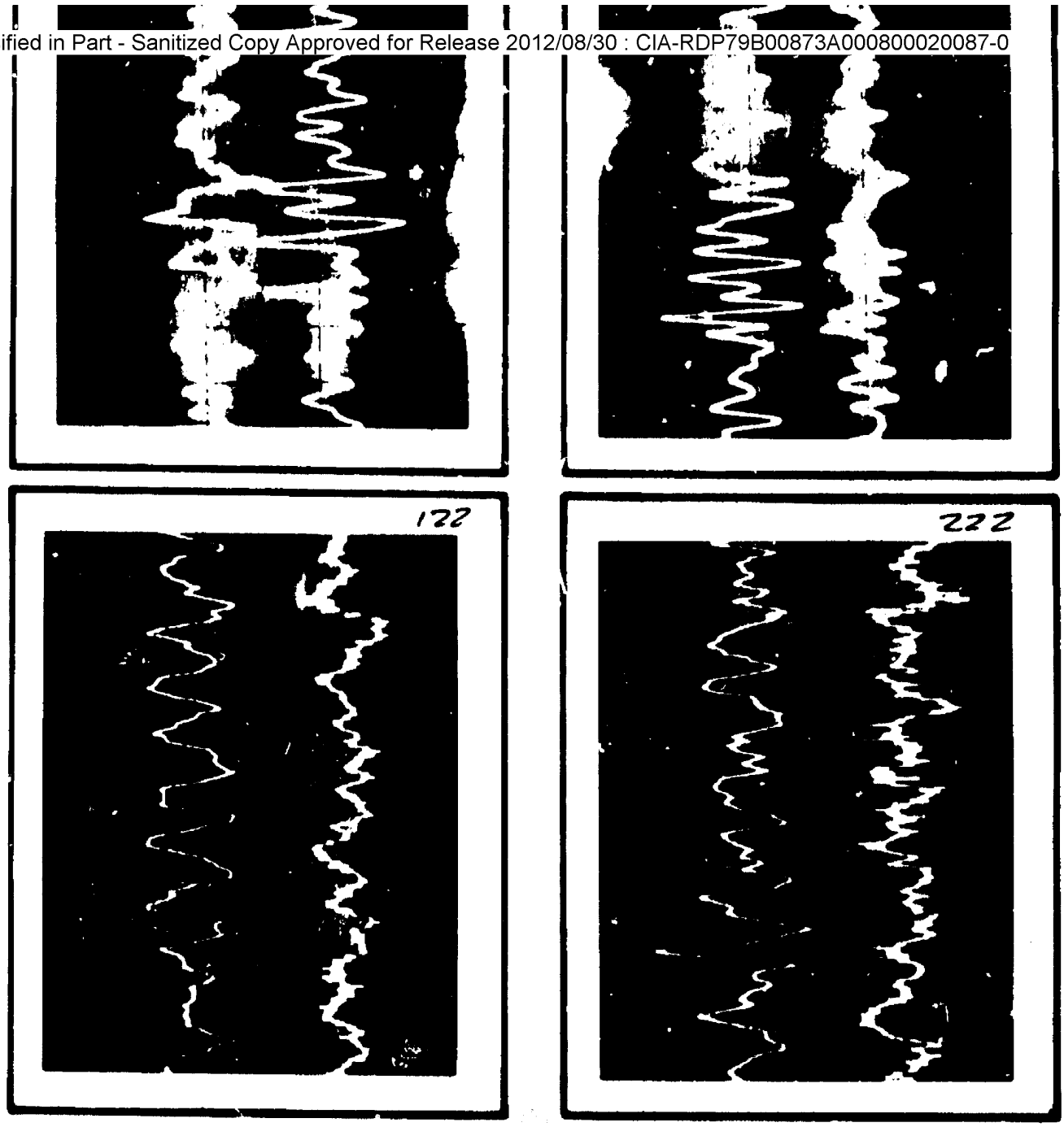




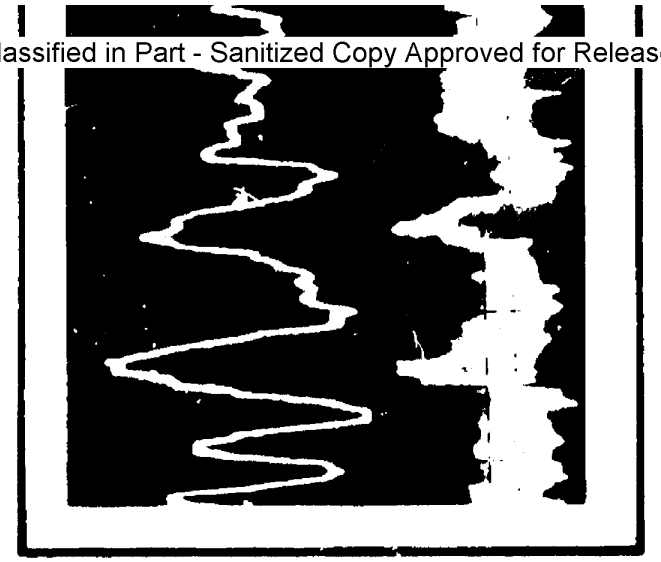


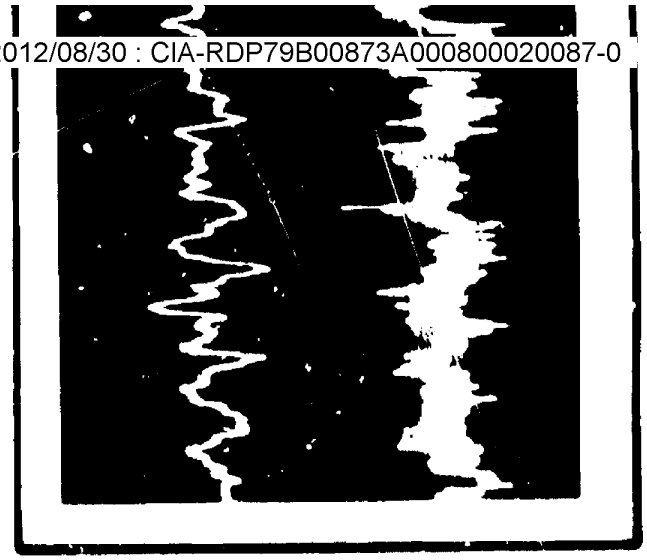


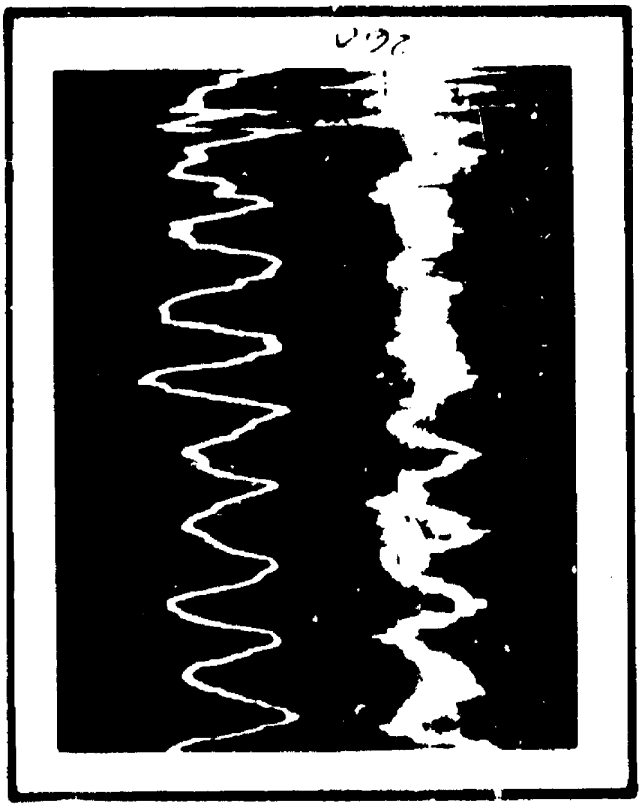
SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC / CM.
	TOP	BOTTOM	
208	0.012	0.0025	50
209	0.015	0.0005	20
210	0.010	0.001	100
211	0.005	0.002	



SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	







SCALES			
RECORD NO.	VERTICAL (IN. /SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
258	0.001	0.0002	50
259	0.001	0.0002	50
261	0.001	0.0002	50

STAT

COMPUTER INPUT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE I.

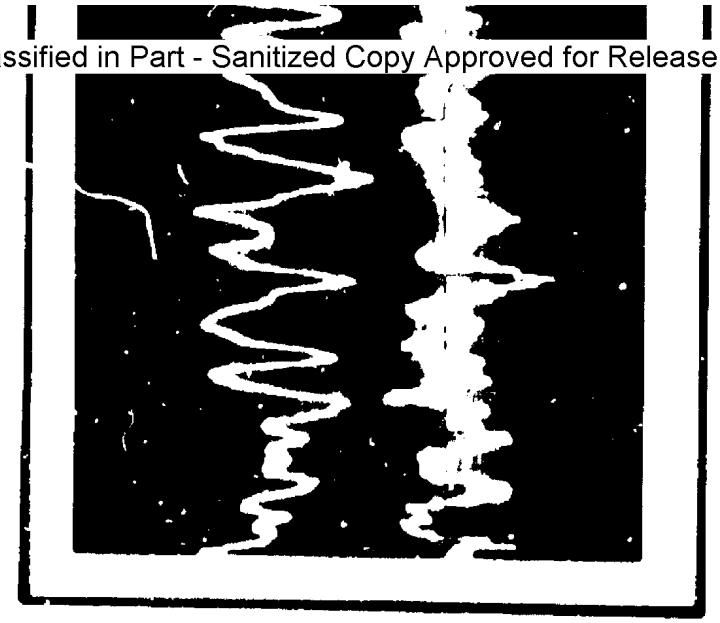
RECORD NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM	RECORD NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM
1	.5	.2	100	27	1	1	50
2	1	1	50	30	1	.2	50
3	1	1	50	31	1	.2	50
4	1	1	50	32	1	.2	50
5	1	1	50	33	1	1	50
6	1	1	50	34	1	5	10
7	1	1	50	35	1	5	10
8	1	1	50	36	1	5	10
9	1	1	50	37	1	5	10
10	10	50	50	38	10	5	50
11	10	50	50	39	10	5	50
12	20	200	50	40	1	.5	50
13	20	20	50	41	10	1	50
14	.5	.5	50	42	20	2	100
15	.5	.2	50	43	5	.5	50
16	.5	.2	50	44	5	.5	50
17	.2	.2	50	45	5	5	50
18	.2	.2	50	46	20	20	50
19	.5	.2	50	47	20	20	50
20	.5	.2	50	48	20	20	50
21	2	2	50	49	2	5	50
22	2	2	50	50	10	20	50
23	2	2	50	51	5	.5	50
24	5	5	50	52	5	.5	50
25	5	5	60	53	2	.2	50
26	1	5	50	54	2	.2	50
27	10	5	50	55	20	2	50
28	1	1	50	56	20	1	50

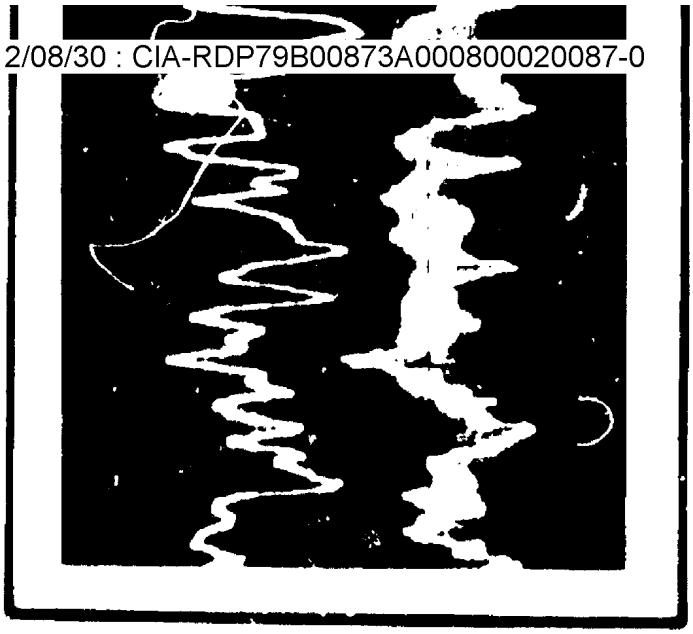
STAT

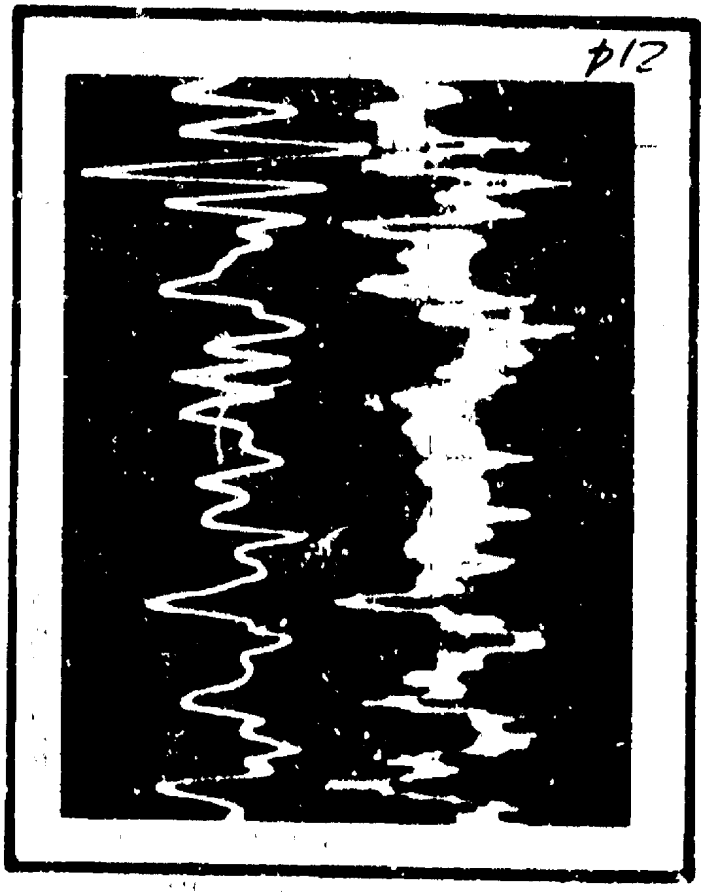
DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

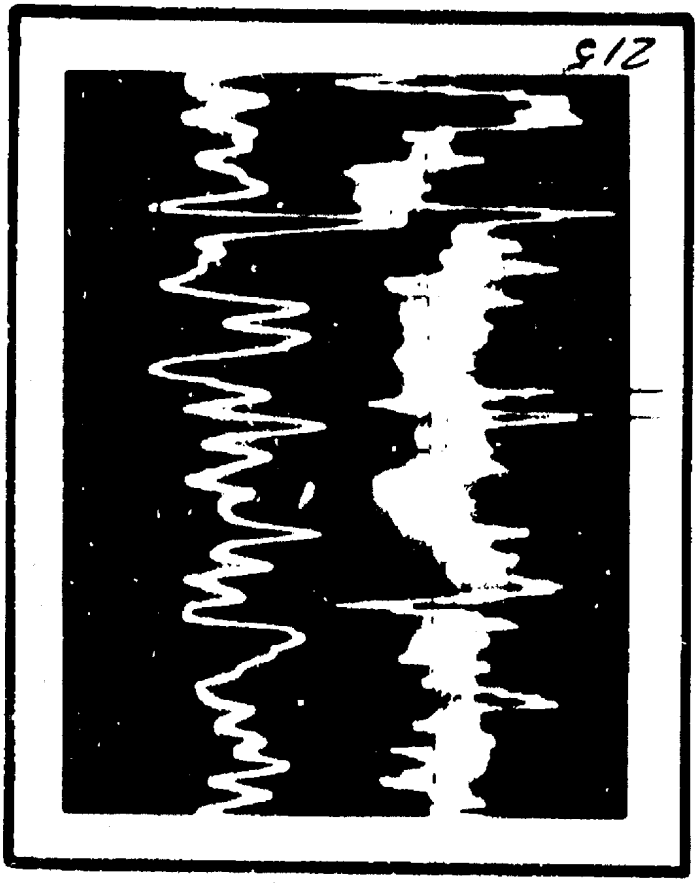
TABLE I

CURVE NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM	CURVE NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM
57	2	.5	50	85	2	.5	50
58	2	.5	50	86	20	5	50
59	2	.2	50	87	5	.5	50
60	2	.2	50	88	50	100	50
61	20	2	50	89	10	1	50
62	1	.2	50	90	5	.5	50
63	1	.2	50	91	50	5	50
64	5	1	50	92	2	.5	50
65	2	.5	50	93	2	.5	50
66	2	.5	50	94	2	5	50
67	20	5	50	95	2	10	50
68	5	5	50	96	2	10	50
69	5	5	50	97	2	10	50
70	5	5	50	98	2	20	50
71	2	2	50	99	2	.5	50
72	1	1	50	100	2	.5	50
73	1	1	50	101	20	5	50
74	2	2	50	102	5	50	100
75	2	2	50	103	5	50	100
76	5	.5	50	104	50	50	100
77	5	.5	50	105	50	100	50
78	20	2	50	106	50	100	50
79	5	.5	50	07	50	50	50
80	5	.5	50	108	1	2	50
81	5	.5	50	109	1	2	50
82	5	.5	50	110	1	2	50
83	50	5	50	111	1	2	50
84	2	.5	50				

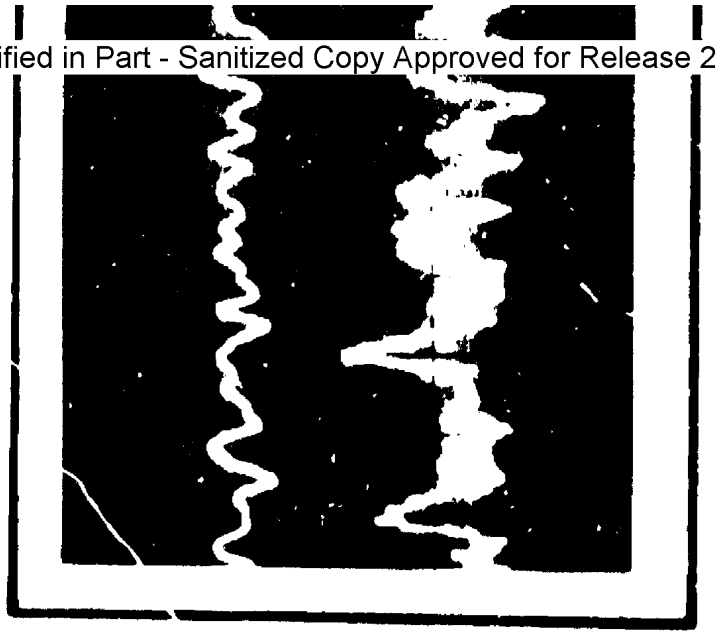


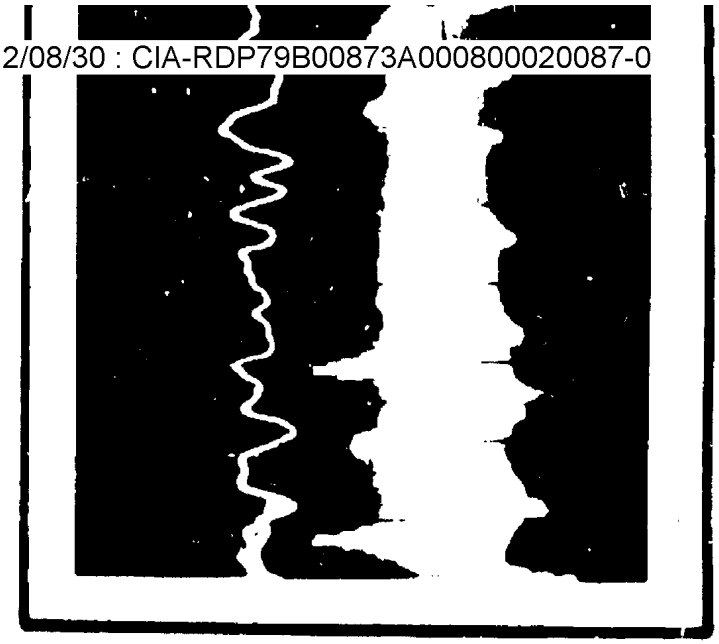


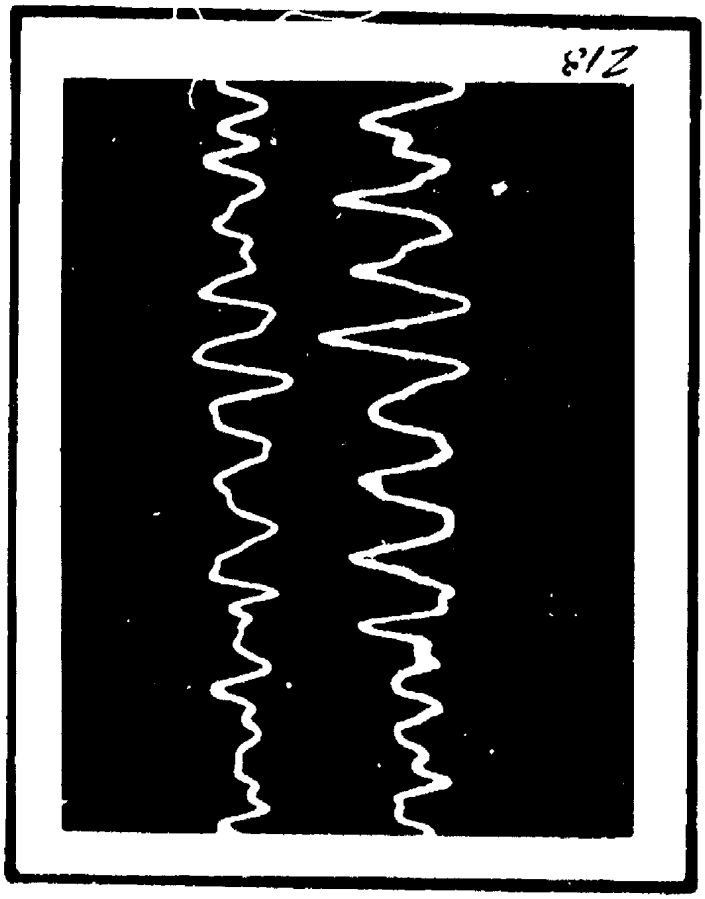


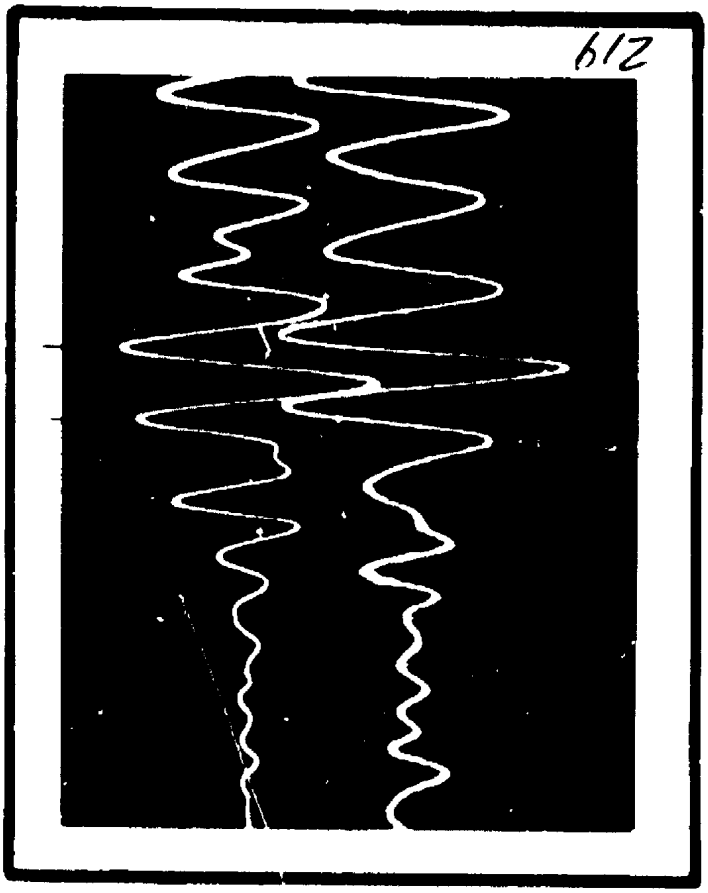


SCALES			
RECORD NO.	VERTICAL (IN. /SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
212	0.002	0.0005	10
213	0.005	0.0005	10
214	0.005	0.0005	10

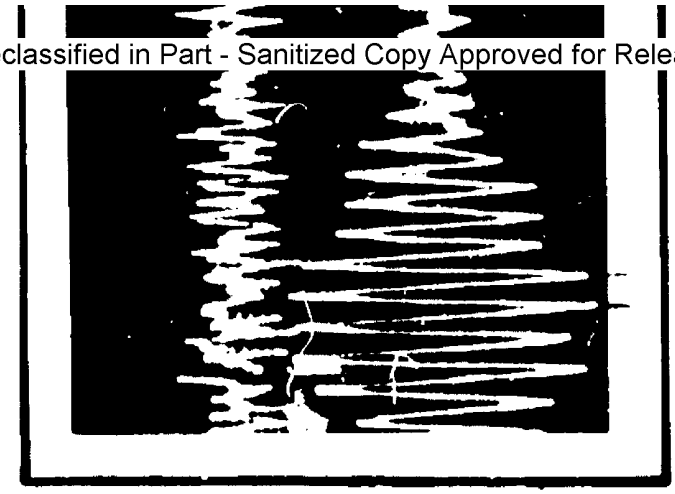


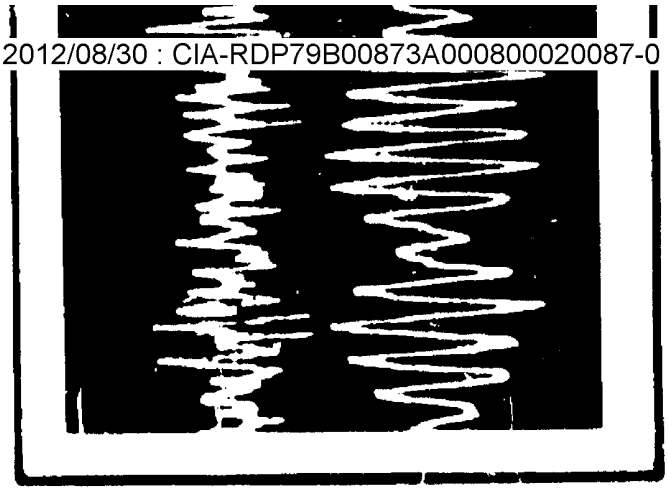


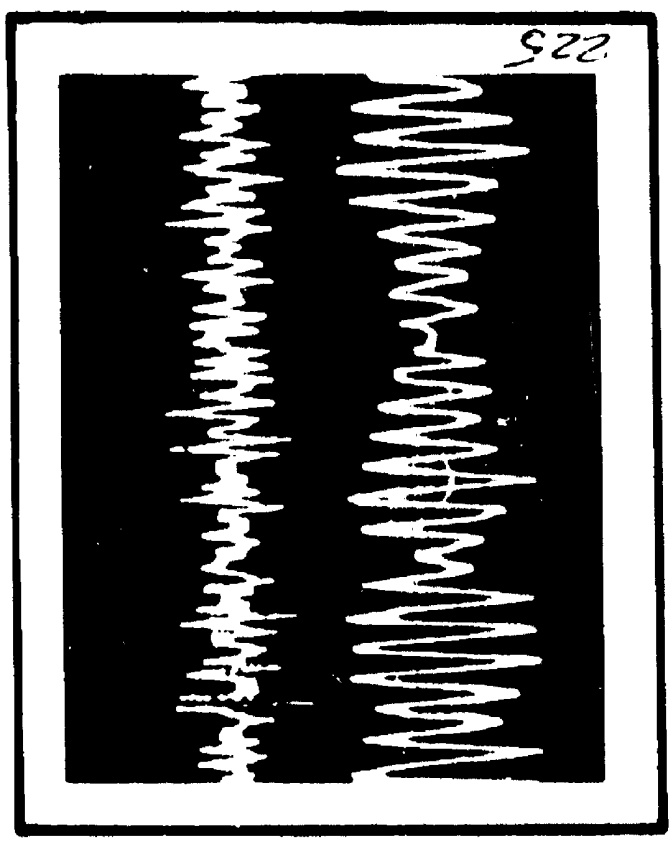


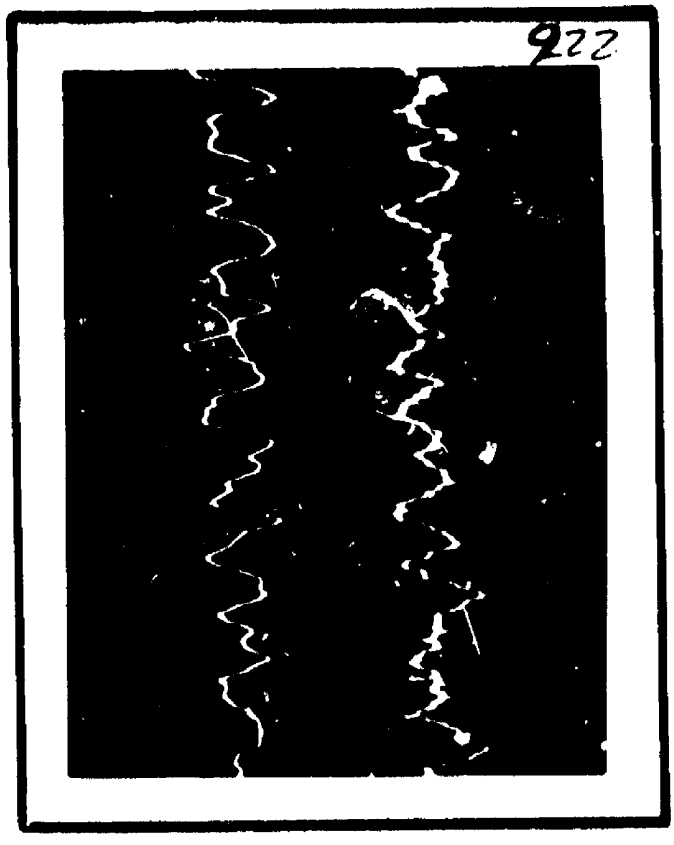


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
216	0.005	0.005	50
217	0.005	0.001	100
218	XXX	XXX	100

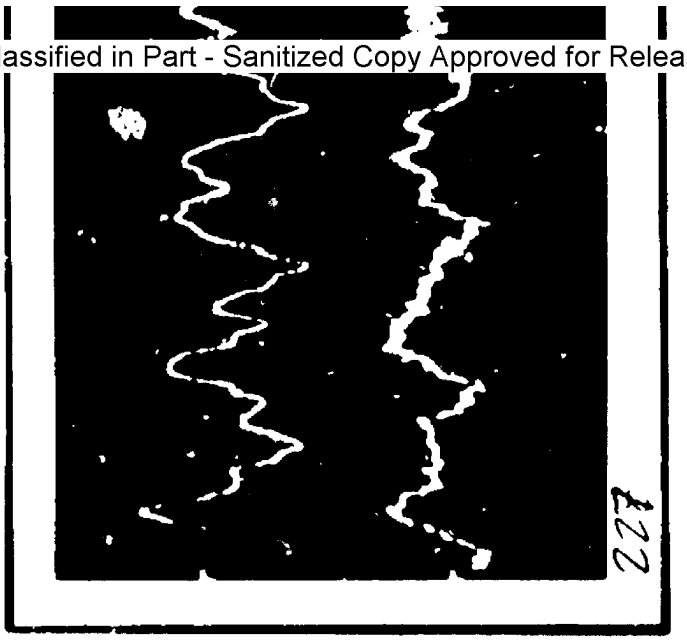


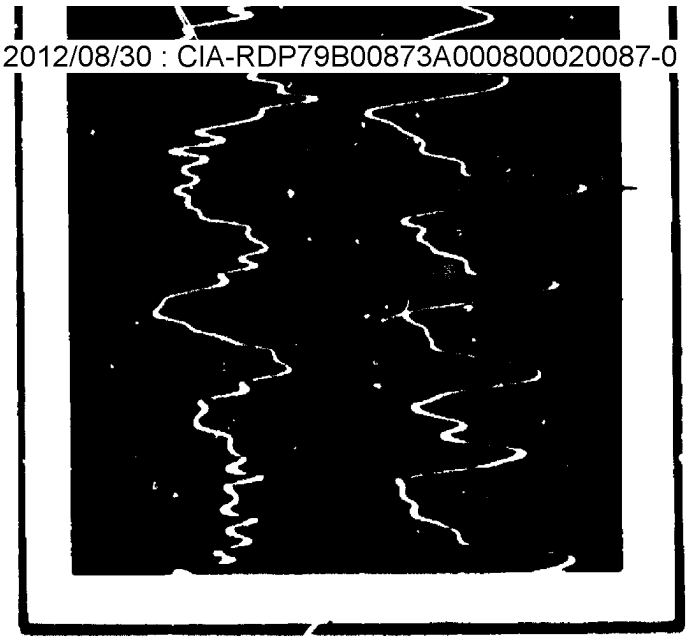


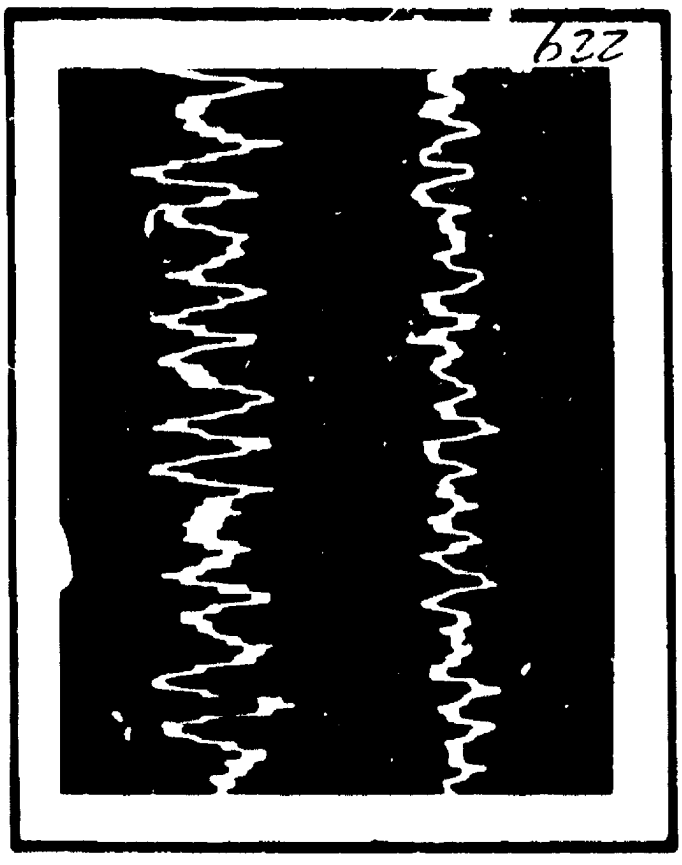


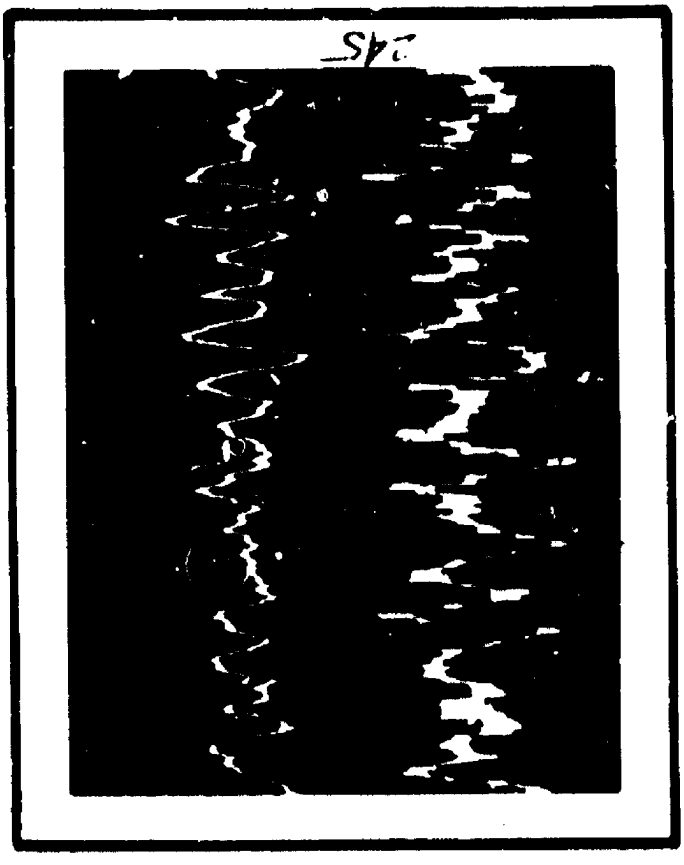


SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
225	0.002	0.020	200
222	0.002	0.020	200

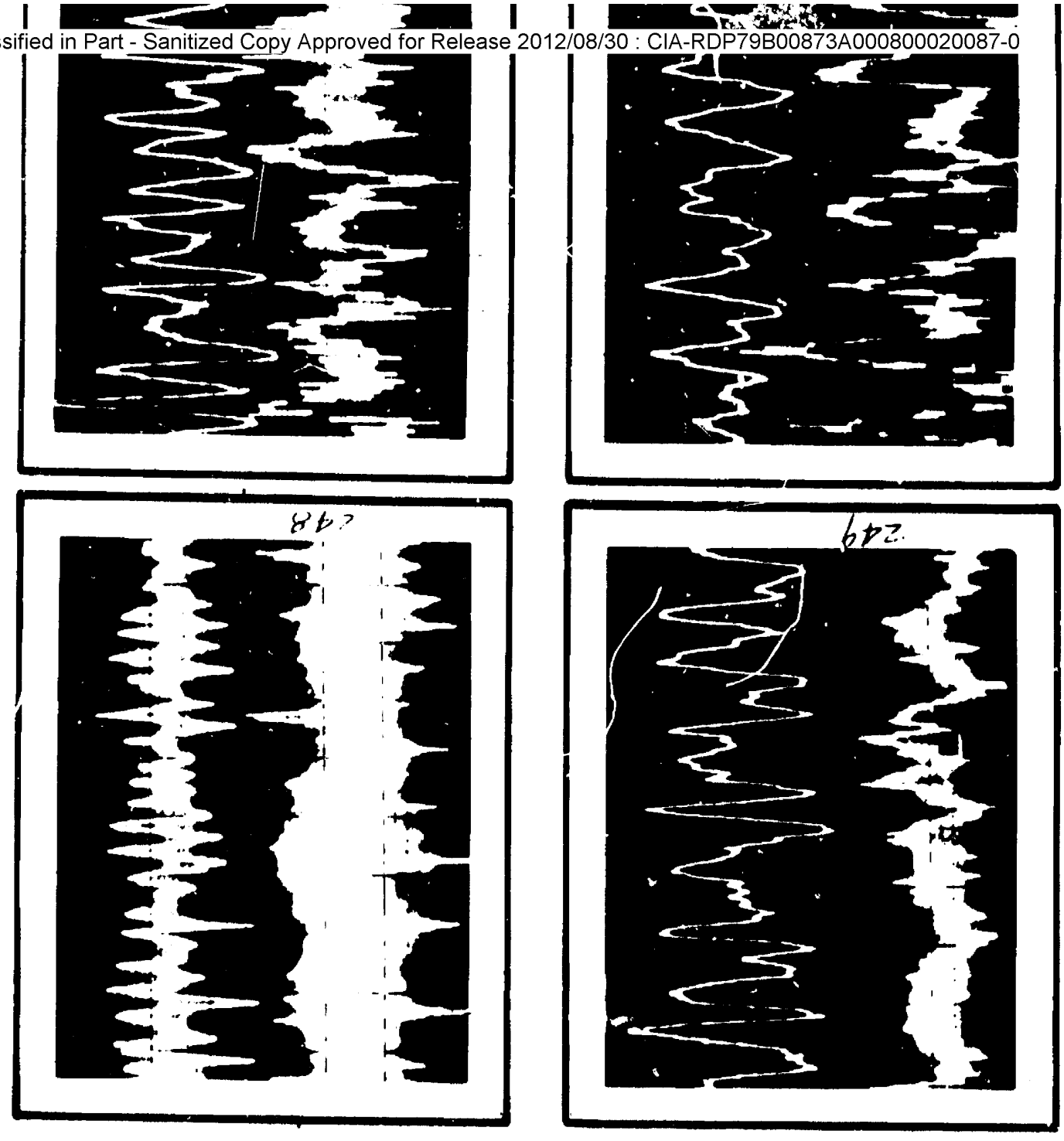




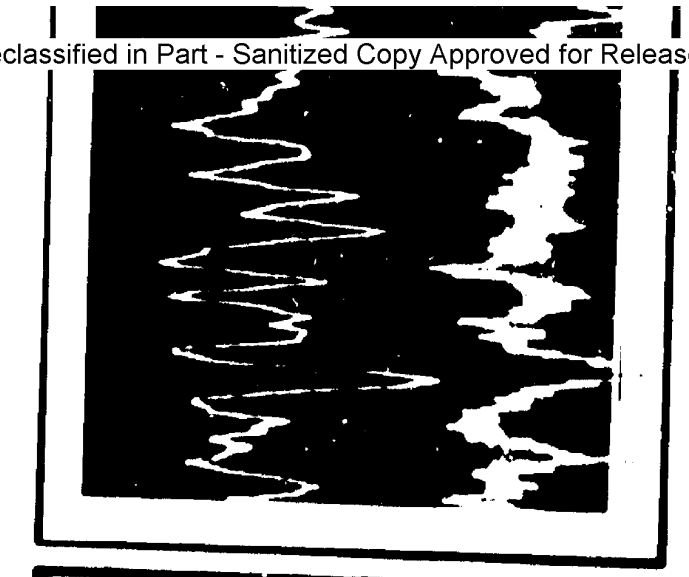


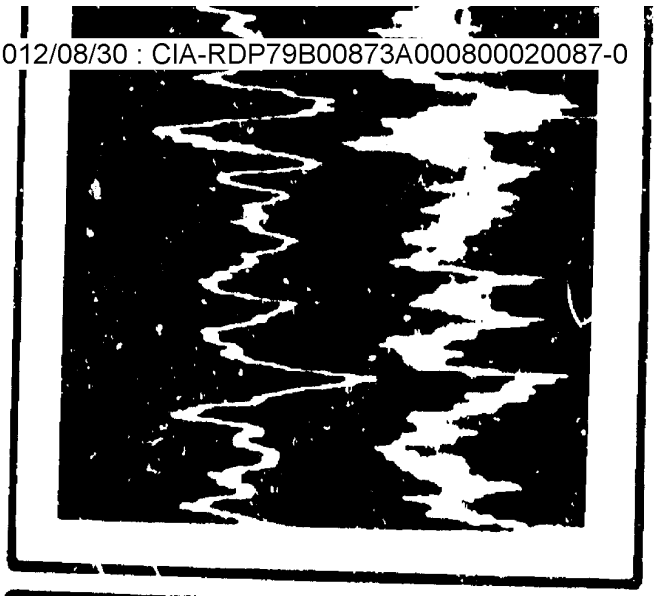


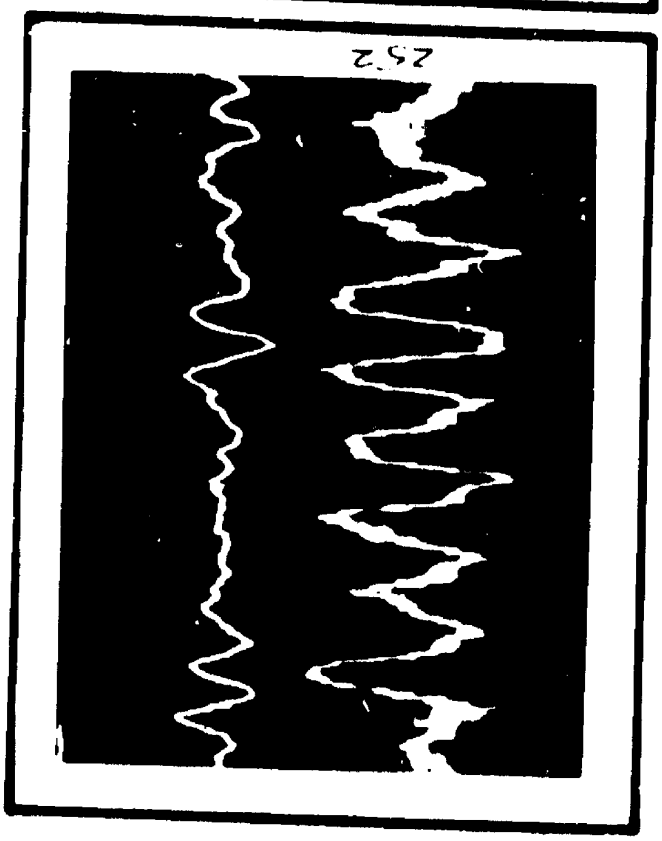
SCALES			
RECORD NO.	VERTICAL (IN. /SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
227	0.002	0.0005	10
228	0.200	0.200	10
229	0.200	0.20[illegible]	10

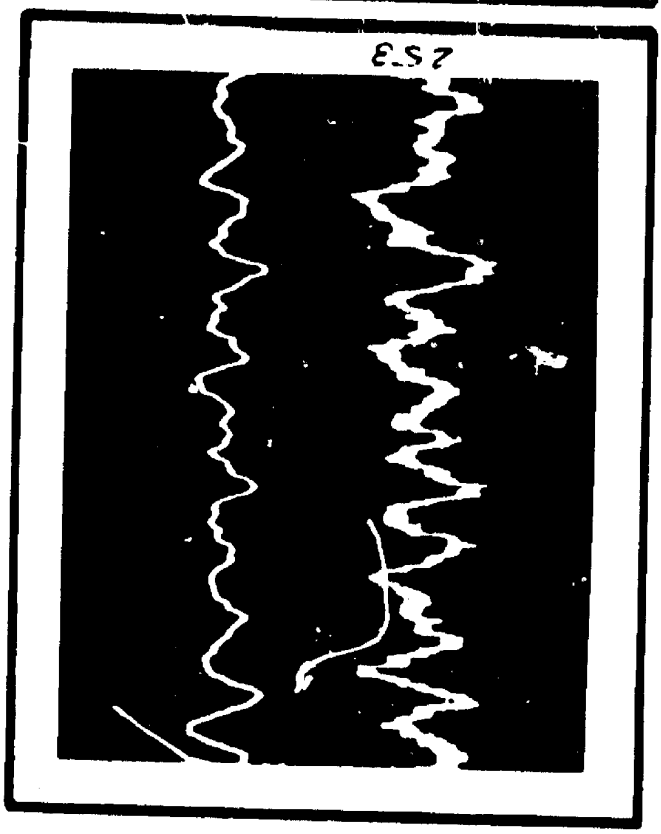


SCALES			
RECORD NO.	VERTICAL (IN. /SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
246	0.001	0.0002	50
247	0.002	0.0005	50
248	0.001	0.0005	50

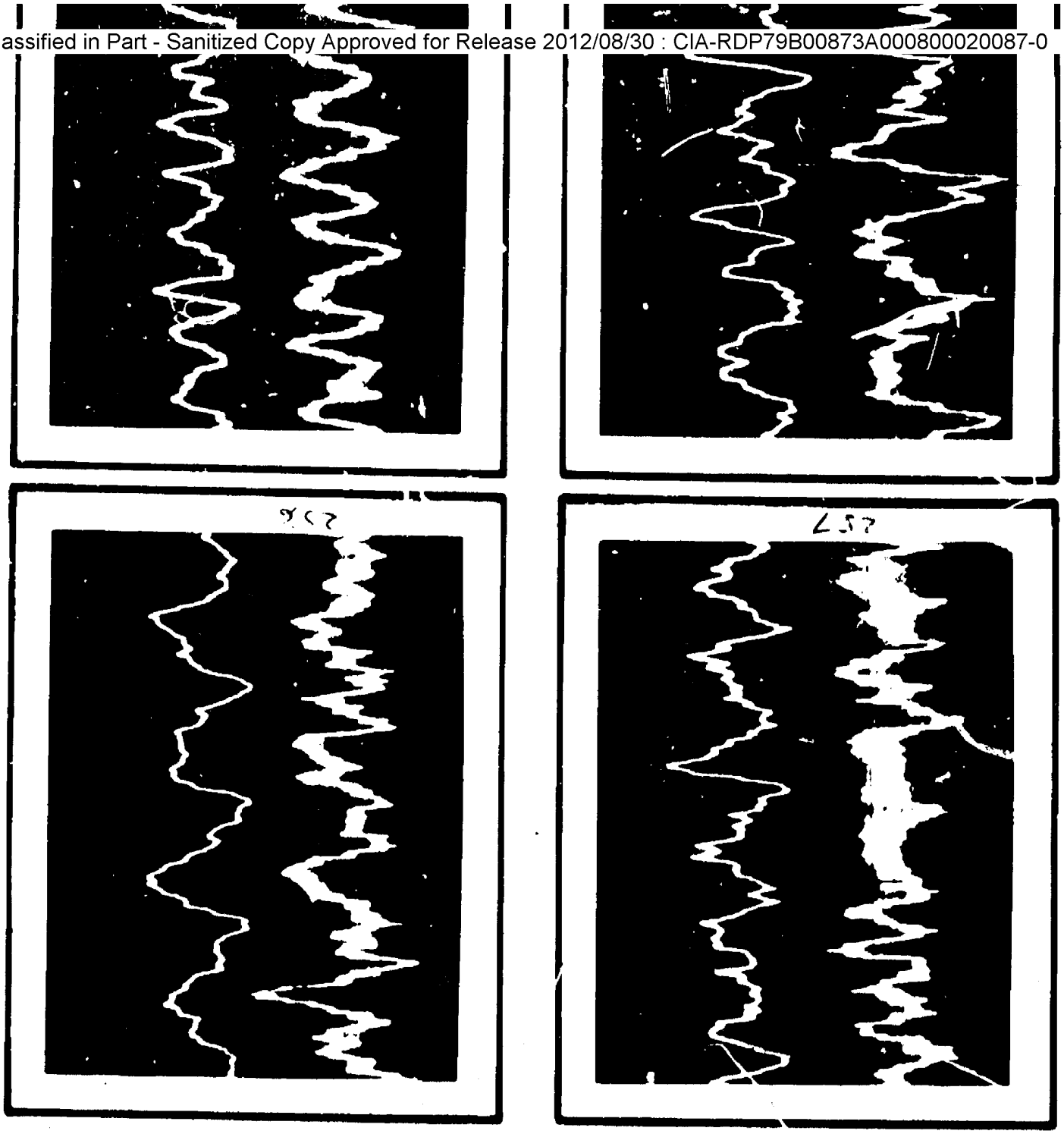








SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
250	0.001	0.0002	
251	0.001	0.0002	
252	0.001	0.0002	



SCALES			
RECORD NO.	VERTICAL (IN./SEC.)/CM.		HORIZONTAL MILLISEC. / CM.
	TOP	BOTTOM	
254	0.001	0.0002	50
255	0.001	0.0002	50
256	0.001	0.0002	50

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
1	1	.5	3.24	14	1	2.15	2.5
1	2	.72	1.15	14	2	2.15	3.0
2	1	.75	1.61	14	1	1.5	2.0
2	2	.77	1.72	14	2	1.9	2.0
3	1	.7	2.18	15	1	1.4	1.8
3	2	.65	1.96	15	2	1.6	1.5
4	1	.7	1.92	16	1	1.55	2.2
4	2	.81	2.28	16	2	1.65	1.3
5	1	.85	1.81	17	1	2.2	.7
5	2	1.0	1.0	17	2	1.4	1.3
6	1	.4	.9	17	1	.1	1.7
6	2	.89	1.8	17	2	.1	1.3
6	1	.32	.65	18	1	1.5	1.1
6	2	.45	1.5	18	2	1.5	.9
7	1	.77	1.43	16	2	1.2	1.5
7	2	.8	2.4	19	1	1.38	2.9
8	1	.79	1.78	19	2	1.4	2.2
8	2	.08	.21	20	1	1.2	4.0
9	1	.71	1.47		↑		
9	2	.4	.32				
10	1	1.9	4.9		PRECEDING PUNCHED		
10	2	2.4	3.8		ON PAPER TAPE (1/26/71)		
11	1	2.55	1.75		DATA CONTINUES ON		
11	2	2.5	.7		NEXT PAGE		
12	1	1.35	1.5				
12	2	1.4	1.2				
13	1	1.45	2.2				
13	2	1.5	2.7				

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
20	2	.13	1.95	30	2	1.2	1.05
20	2	3.2	1.6	31	1	1.2	1.0
21	1	.7	2.25	31	2	1.8	1.8
21	2	1.3	3.5	31	2	.15	1.0
22	1	.74	3.15	32	2	.56	2.8
22	2	.8	1.95	32	2	.1	1.85
22	2	.15	1.55	33	1	1.2	1.5
23	1	1	4.6	33	2	1.3	2.3
23	1	1.6	4.6	34	1	.29	.68
23	1	.30	2.0	34	2	.8	1.1
23	2	2.0	4.7	34	2	.12	.2
23	2	.1	1.15	35	1	.2	.7
24	1	.33	1.8	35	2	.4	3.03
24	2	.85	1.1	35	2	1.8	1.0
25	2	1.8	3.2	36	1	4.9	1.7
25	2	1.75	1.3	36	1	.2	.57
26	1	.7	1.2	36	2	.5	1.8
26	1	.3	1.3	37	2	4.6	.4
26	2	.32	1.2	38	1	.9	4.1
26	2	.13	.4	38	2	1.0	3.95
27	1	1.9	1.3	39	1	.88	4.0
27	2	1.5	1.1	39	2	.93	2.7
28	1	2.5	1.1	40	1	.8	2.6
28	2	.95	1.8	40	1	.25	.97
29	1	1.6	.85	40	2	1.5	.8
29	2	.85	2.8	40	2	.19	.68
29	2	.35	.75	41	1	.78	3.65
30	1	.95	.65	41	2	.49	1.95

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
41	2	.15	.2	52	2	.75	2.9
42	1	.7	2.86	52	2	.3	1.4
42	2	.6	1.55	53	1	1.05	1.55
43	1	1.0	1.6	53	2	.9	3.2
43	2	1.08	2.1	54	1	1.07	2.6
44	1	1.12	1.3	54	2	1.1	4.1
44	2	.8	1.68	55	1	1.25	4.5
45	1	.98	1.84	55	2	1.6	2.55
45	2	1.07	2.7	56	1	1.1	1.35
46	1	1.25	3.1	56	2	.65	1.7
46	2	.35	.41	57	1	1	1.3
46	2	1.35	.6	57	2	.8	.7
47	1	1.2	2.46	58	1	1	.98
47	2	.9	.4	58	2	1.05	1.2
47	2	.15	.58	59	1	.85	2.4
48	1	1	5.36	59	2	.85	2.45
48	2	1	3.6	60	1	.82	2.05
49	1	1	1.4	60	2	.9	2.2
49	1	.31	.4	61	1	.8	5.2
49	2	1.2	2.8	61	2	.8	3.3
49	2	.38	1	62	1	.85	2
50	1	1.4	1.2	62	2	.3	1.5
50	2	1.35	5.05	62	2	.35	.6
51	1	.9	2.25	63	1	1	2.1
51	1	.35	1.25	63	1	.5	1.1
51	2	1	2.05	63	2	1.75	1.7
52	1	.9	2.45	63	2	.35	1.45
52	1	.37	.9	64	1	.75	3.05

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
64	2	.55	1.1	76	1	.9	2.4
65	1	.83	3.65	76	2	.94	1.45
65	2	1.0	1.55	77	1	.95	1.8
66	1	.9	2.0	77	2	1	2.2
66	2	.85	1.2	78	1	1.05	5.3
67	1	.95	4.1	78	2	1.2	3.2
67	2	1.0	1.0	79	1	.85	1.3
68	1	1.8	1.75	79	2	1	1.55
68	2	1.9	.75	80	1	1.0	1.35
69	2	.2	.5	80	2	.95	2.55
69	1	1.7	.7	81	1	.9	1.3
69	2	1.9	.4	81	2	1.15	1.2
69	2	.17	3.3	82	1	.85	1.3
70	1	1.54	6.55	82	2	.9	2.1
70	2	1.35	4.7	83	1	1.1	1.6
71	1	6.7	.4	83	2	1.2	.8
71	2	.84	1.6	84	1	1.05	2.6
72	1	4.6	1.3	84	1	.3	.65
72	2	1.15	.7	84	2	.9	1.9
72	2	.075	.7	85	1	1	2.4
73	1	2.4	1.5	85	2	.9	3.2
73	2	11	1.25	86	1	1.1	2.3
74	1	1.1	9.65	86	2	1.1	1.65
74	2	1.4	3.45	87	1	.75	1.4
74	2	.34	1	87	2	1.3	2.45
75	1	.95	2.67	88	1	.75	1.9
75	2	1.1	1.85	88	1	.3	.75
75	2	.25	.95	88	2	1.65	1.55

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
89	1	3	1.5	102	2	.43	3.35
89	2	3.1	1.7	103	1	.45	1
90	1	.9	1.35	103	2	.41	1.25
90	2	1.1	1.4	104	1	.44	2.4
91	1	.52	1.4	104	2	.45	2.5
91	2	1.0	1.15	105	1	2.1	2.6
92	1	.8	1.45	105	1	.38	.9
92	2	.93	1.38	105	2	1	3.6
93	1	.85	1.6	105	2	1	2.9
93	2	.8	1.35	106	1	.28	1.7
94	1	.9	1.25	106	2	1.1	2.4
94	2	1.4	2.5	106	2	1.1	1.9
94	2	.2	1	107	1	2.3	2
95	1	.9	1.5	107	2	2.3	.7
95	2	.87	5.4	108	1	2	.4
96	1	1	1.9	108	2	1.55	2
96	2	.8	4.2	109	1	1.7	.8
97	1	1.1	1.2	109	2	1.8	1.35
97	2	1	2.3	110	1	1.4	.8
97	2	.38	1.5	110	2	1.8	2.05
98	1	.6	1.9	111	2	1.25	.85
98	2	.6	2.6				
99	1	.95	2.2				
99	2	.7	.9				
100	1	1	2.5				
100	2	.9	1.9				
101	1	1.3	2.7				
102	1	.4	1				

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE I

RECORD NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM	RECORD NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM
112	200	100	50				
113	50	100	50				
114	100	200	50				
115	20	100	50				
116	20	100	100				
117	20	100	100				
118	10	50	50				
119	10	20	20				
120	10	20	20				
121	20	200	50				
122	50	500	200				
123	20	50	50				

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
112	1	1.15	2.3				
112	2	2.35	1.6				
112	2	.27	1.67				
113	1	1.13	2.75				
113	2	1.2	2.3				
114	1	1.6	2.9				
114	1	.35	1.0				
114	2	1.65	1.2				
114	2	.37	1.7				
115	2	.9	1.92				
116	1	.3	1.7				
116	2	.3	1.7				
117	1	.32	2.6				
117	2	.27	1.85				
118	1	.7	2.6				
118	2	.8	1.7				
119	1	1.35	2.1				
119	1	.27	2.5				
119	2	.37	2.45				
120	1	.3	.45				
120	1	1.35	1.95				
120	2	1.9	.95				
121	1	.7	2.65				
121	2	.7	2.8				
122	1	.15	1.2				
122	2	.17	2.5				
123	1	.55	1.15				
123	2	.95	1.1				

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE I

RECORD NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM	RECORD NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM
200	2	.5	50	228	200	200	20
201	2	.5	50	229	200	200	50
202	2	.5	50				
203	10	.5	50				
204	10	.5	50				
205	10	.5	50				
206	10	.5	50				
207	10	.5	50				
208	10	.5	50				
209	10	.5	50				
210	10	1	100				
211	50	2	100				
212	2	.5	50				
213	2	.5	50				
214	5	.5	50				
215	5	.5	50				
216	5	.5	50				
217	5	1	100				
218	5	1	100				
219	5	1	100				
220	5	1	100				
221	2	.5	50				
222	2	.5	50				
223	2	20	200				
224	2	20	200				
225	2	20	200				
226	2	.5	50				
227	2	.5	50				

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO.	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
200	1	1.4	1.8	215	1	.2	3.0
200	2	.9	1.6	215	2	.35	2.45
201	1	1.4	2.2	216	1	.6	.77
201	2	1.62	1.04	216	2	.7	1.4
202	1	1.36	3.0	217	1	.9	1.52
202	2	1.8	1.5	217	2	.91	2.1
203	1	1.5	2.1	218	1	.85	1.2
203	2	1.3	1.6	218	2	.8	1.82
204	1	1.1	1.9	219	1	.92	3.2
204	2	1.2	2.0	219	2	.91	3.54
205	1	1.1	2.1	220	1	.9	1.72
205	2	1.2	1.6	220	2	.4	2.54
206	1	1.25	.55	220	1	.34	2.6
206	2	1.0	1.3	220	2	.36	1.6
207	1	1.4	.65	221	1	1.0	1.5
207	2	.8	1.37	221	2	.9	.8
208	2	1.0	1.15	222	1	.7	2.6
209	2	1.0	.8	223	1	.2	1.4
210	1	.6	1.0	223	2	.44	3.6
210	2	.65	.6	224	1	.25	1.6
211	1	.68	2.5	224	2	.4	2.7
211	2	.5	2.3	225	1	.21	1.25
212	1	.8	1.93	225	2	.42	2.15
212	2	.8	1.3	226	1	.75	1.0
213	1	.55	1.62	226	2	.65	.8
213	2	.72	1.13	227	1	2.5	1.4
214	1	.39	3.25	227	2	2.1	1.0
214	2	.5	1.9	228	1	1.4	1.6

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO. 2	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO. 2	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
228	2	1.3	2.2				
229	1	.6	1.2				
229	2	.6	.8				

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE I

RECORD NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM	RECORD NO.	TOP TRACE MV/CM	BTM TRACE MV/CM	SWEEP MS/CM
245	1.0	0.2	50				
246	1.0	0.2	50				
247	2.0	0.2	50				
248	1.0	0.2	100				
249	1.0	0.2	50				
250	1.0	0.2	50				
251	1.0	0.2	50				
252	1.0	0.2	50				
253	1.0	0.2	50				
254	1.0	0.2	50				
255	1.0	0.2	50				
256	1.0	0.2	50				
257	1.0	0.2	50				
258	1.0	0.2	50				
259	1.0	0.2	50				
260	1.0	0.2	50				

STAT

DATA INPUT FOR COMPUTER PROGRAM "VIBRED"

TABLE II

RECORD NO. 2	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM	RECORD NO. 2	1-DENOTES TOP TRACE 2-DENOTES BTM. TRACE	PERIOD CM	PEAK TO PEAK CM
245	1	.65	1.5	259	1	1.25	1.15
245	2	1.1	1.8	259	2	1.0	1.0
246	1	.65	2.2	260	1	1.0	1.9
246	2	1.0	2.15	260	2	1.05	1.15
247	1	1.2	2.2				
247	2	1.3	3.7				
248	1	.4	2.1				
248	2	.5	2.75				
249	1	.7	3.15				
249	2	.98	1.8				
250	1	.75	3.45				
250	2	1.2	2.0				
251	1	.95	2.5				
251	2	1.2	1.5				
252	1	.87	1.2				
252	2	1.0	2.1				
253	1	.9	.92				
253	2	.8	.9				
254	1	.75	.85				
254	2	.9	1.75				
255	1	1.4	2.1				
255	2	2.0	1.8				
256	1	2.1	1.6				
256	2	2.1	2.5				
257	1	1.7	1.6				
257	2	1.7	1.5				
258	1	1.9	3.2				
258	2	2.0	1.6				

STAT

COMPUTER OUTPUT

STAT

ALL VALUES ARE SINGLE AMPLITUDE

RECORD	HZ	IN.	IN/SEC	G'S
1 T	20.0	6.4E-06	8.1E-04	2.6E-04
1 B	13.9	1.3E-06	1.1E-04	2.6E-05
2 T	26.7	4.9E-06	8.0E-04	3.5E-04
2 B	26.0	5.3E-06	8.6E-04	3.6E-04
3 T	28.6	6.1E-06	1.1E-03	5.1E-04
3 B	30.8	5.1E-06	9.9E-04	4.9E-04
4 T	23.6	5.3E-06	9.6E-04	4.5E-04
4 B	24.7	7.3E-06	1.1E-03	4.6E-04
5 T	23.5	6.1E-06	9.1E-04	3.5E-04
5 B	20.0	4.0E-06	5.0E-04	1.6E-04
6 T	50.0	1.4E-06	4.5E-04	3.7E-04
6 B	22.5	6.4E-06	9.0E-04	3.3E-04
6 T	62.5	8.3E-07	3.2E-04	3.3E-04
6 B	44.4	2.7E-06	7.5E-04	5.3E-04
7 T	26.0	4.5E-06	7.4E-04	3.1E-04
7 B	25.6	7.6E-06	1.2E-03	4.9E-04
8 T	25.5	5.6E-06	8.9E-04	3.7E-04
8 B	22.2	7.4E-07	1.0E-04	3.0E-05
9 T	23.2	4.2E-06	7.4E-04	3.4E-04
9 B	50.0	5.1E-07	1.6E-04	1.3E-04
10 T	10.5	3.7E-04	2.3E-02	4.2E-03
10 B	8.3	1.3E-03	9.5E-02	1.3E-02
11 T	7.3	1.3E-04	3.7E-03	1.1E-03
11 B	8.0	3.5E-04	1.7E-02	2.3E-03
12 T	14.3	1.6E-04	1.5E-02	3.6E-03
12 B	14.3	1.3E-03	1.2E-01	2.9E-02
13 T	13.9	2.5E-04	2.2E-02	4.8E-03
13 B	13.3	3.2E-04	2.7E-02	5.9E-03
14 T	9.3	1.1E-05	6.2E-04	9.5E-05
14 B	9.3	1.3E-05	7.5E-04	1.1E-04
14 T	13.3	6.0E-06	5.0E-04	1.1E-04
14 B	10.5	7.6E-06	5.0E-04	8.6E-05
15 T	14.3	5.0E-06	4.5E-04	1.0E-04
15 B	12.5	1.9E-06	1.5E-04	3.1E-05
16 T	12.9	6.3E-06	5.5E-04	1.2E-04
16 B	12.1	1.7E-06	1.3E-04	2.6E-05
17 T	9.1	1.2E-06	7.0E-05	1.0E-05
17 B	14.3	1.5E-06	1.3E-04	3.0E-05
17 T	200.0	3.4E-07	1.7E-04	5.5E-04
17 B	200.0	1.0E-07	1.3E-04	4.2E-04
18 T	13.3	1.3E-06	1.1E-04	2.4E-05
18 B	13.3	1.1E-06	9.0E-05	2.0E-05
18 B	18.7	1.4E-06	1.5E-04	4.1E-05
19 T	14.5	8.0E-06	7.2E-04	1.7E-04
19 B	14.3	2.5E-06	2.2E-04	5.1E-05
20 T	16.7	9.5E-06	1.0E-03	2.7E-04
20 B	153.8	2.0E-07	1.9E-04	4.9E-04
20 B	6.2	4.1E-06	1.6E-04	1.6E-05

STAT

ALL VALUES ARE SINGLE AMPLITUDE

RECORD	HZ	IN.	IN/SEC	G'S
21 T	50.0	7.2E-06	2.2E-03	1.9E-03
21 B	19.4	3.6E-05	3.5E-03	3.9E-04
22 T	27.0	1.9E-05	3.1E-03	1.4E-03
22 B	25.0	1.2E-05	1.9E-03	7.9E-04
22 B	133.3	1.9E-06	1.6E-03	2.4E-03
23 T	20.0	3.7E-05	4.6E-03	1.5E-03
23 T	12.5	5.9E-05	4.6E-03	9.4E-04
23 T	52.6	6.0E-06	2.0E-03	1.7E-03
23 B	10.0	7.5E-05	4.7E-03	7.7E-04
23 B	200.0	9.2E-07	1.1E-03	2.7E-03
24 T	60.6	1.2E-05	4.6E-03	5.4E-03
24 B	23.5	1.9E-05	2.8E-03	1.1E-03
25 B	11.1	1.1E-04	8.0E-03	1.4E-03
25 B	11.4	4.5E-05	3.2E-03	6.0E-04
26 T	28.6	3.2E-06	5.9E-03	2.2E-03
26 T	66.7	1.6E-06	6.5E-03	7.1E-03
26 B	62.5	7.6E-06	3.0E-03	3.1E-03
26 B	153.3	1.9E-06	1.9E-03	2.7E-03
27 T	10.5	9.3E-05	6.5E-03	1.3E-03
27 B	13.3	3.9E-05	3.2E-03	6.9E-04
28 T	3.0	1.1E-05	2.0E-04	7.2E-05
28 B	44.4	3.2E-06	9.0E-04	6.5E-04
29 T	12.5	5.4E-06	4.2E-04	8.6E-05
29 B	23.5	9.6E-06	1.4E-03	5.4E-04
29 B	57.1	1.0E-06	3.7E-04	2.5E-03
30 T	20.1	2.9E-06	3.2E-04	1.1E-03
30 B	15.2	1.0E-06	1.0E-04	2.3E-04
31 T	10.7	5.9E-06	5.0E-04	1.4E-04
31 B	11.1	2.6E-06	1.8E-04	2.3E-05
31 B	133.3	1.2E-07	1.0E-04	2.2E-04
32 B	36.4	1.2E-06	2.8E-04	1.7E-04
32 T	28.6	2.1E-06	3.7E-04	1.7E-04
33 T	26.7	7.2E-06	7.5E-04	2.0E-04
33 B	15.4	1.2E-05	1.1E-03	2.9E-04
34 T	344.8	1.6E-07	3.5E-04	1.9E-03
34 B	125.0	3.5E-06	2.8E-03	5.6E-03
34 B	333.3	9.5E-07	5.0E-04	6.3E-03
35 T	500.0	1.1E-07	3.5E-04	2.3E-03
35 B	250.0	4.8E-06	7.6E-03	3.1E-02
35 B	55.6	7.2E-06	2.5E-03	2.3E-03
36 T	20.4	6.6E-06	8.5E-04	2.3E-04
36 T	500.0	9.1E-08	2.3E-04	2.3E-03
36 B	200.0	3.6E-06	4.5E-03	1.5E-02
37 B	21.7	7.3E-06	1.0E-03	3.5E-04
37 T	22.2	1.5E-04	2.0E-02	7.4E-03
38 B	20.0	7.0E-05	9.0E-03	3.2E-03
39 T	22.7	1.4E-04	2.0E-02	7.4E-03
39 B	21.5	5.0E-05	6.7E-03	2.4E-03

STAT

ALL VALUES ARE SINGLE AMPLITUDE

RECORD		HZ	IN	IN/SEC	G'S
40	T	25.0	8.3E-06	1.3E-03	5.3E-04
40	T	30.0	9.6E-07	1.8E-04	6.3E-04
40	B	13.3	2.4E-06	2.0E-04	4.3E-05
40	B	105.3	3.3E-07	2.2E-04	3.9E-04
41	T	25.6	1.1E-04	1.9E-02	7.6E-03
41	B	40.3	3.8E-06	9.7E-04	6.5E-04
41	B	133.3	1.2E-07	1.0E-04	2.2E-04
42	T	14.3	3.2E-04	2.9E-02	6.7E-03
42	B	16.7	1.5E-05	1.6E-03	4.3E-04
43	T	20.0	3.2E-05	4.0E-03	1.2E-03
43	B	18.5	4.5E-06	5.3E-04	1.6E-04
44	T	17.9	2.9E-05	3.3E-03	9.4E-04
44	B	25.0	2.7E-06	4.2E-04	1.7E-04
45	T	20.8	3.6E-05	4.6E-03	1.5E-03
45	B	13.7	5.7E-05	6.7E-03	2.1E-03
46	T	16.0	3.1E-04	3.1E-02	9.1E-03
46	B	57.1	1.1E-05	4.1E-03	3.3E-03
46	B	14.8	6.4E-05	6.0E-03	1.8E-03
47	T	16.7	2.3E-04	2.5E-02	6.7E-03
47	B	22.2	2.0E-05	4.0E-03	1.4E-03
47	B	133.3	6.9E-06	5.8E-03	1.3E-02
48	T	20.0	4.3E-04	5.3E-02	1.7E-02
48	B	20.0	2.0E-04	3.0E-02	1.2E-02
49	T	20.0	1.1E-05	1.5E-03	4.6E-04
49	T	64.5	9.9E-07	4.0E-04	4.2E-04
49	B	16.7	6.7E-05	7.0E-03	1.9E-03
49	B	52.6	7.6E-06	2.5E-03	2.1E-03
50	T	14.3	6.7E-05	6.0E-03	1.4E-03
50	B	14.3	5.4E-04	5.0E-02	1.2E-02
51	T	22.2	4.0E-05	5.6E-03	2.0E-03
51	T	57.1	3.7E-06	3.1E-03	2.9E-03
51	B	20.0	4.1E-06	5.1E-04	1.7E-04
52	T	22.2	4.4E-05	6.1E-03	2.2E-03
52	T	54.1	6.6E-06	2.2E-03	2.0E-03
52	B	26.7	4.3E-06	7.2E-04	3.1E-04
52	B	66.7	8.4E-07	3.5E-04	3.2E-04
53	T	19.0	1.3E-05	1.6E-03	4.9E-04
53	B	22.2	2.2E-06	3.2E-04	1.2E-04
54	T	13.7	2.2E-05	2.6E-03	7.9E-04
54	B	18.2	3.6E-06	4.1E-04	1.2E-04
55	T	16.0	4.5E-04	4.5E-02	1.2E-02
55	B	12.5	3.2E-05	2.6E-03	5.2E-04
56	T	18.2	1.2E-04	1.3E-02	4.0E-03
56	B	30.0	8.3E-06	1.7E-03	8.5E-04
57	T	20.0	1.0E-05	1.3E-03	4.2E-04
57	B	25.0	1.1E-06	1.7E-04	7.3E-05
58	T	20.0	7.8E-06	9.8E-04	3.2E-04
58	B	19.0	2.5E-06	3.0E-04	9.3E-05

STAT

ALL VALUES ARE SINGLE AMPLITUDE

RECORD		HZ	IN.	IN/SEC	G'S
59	T	23.5	1.6E-05	2.4E-03	9.2E-04
59	B	23.5	1.7E-06	2.4E-04	9.4E-05
60	T	24.4	1.3E-05	2.1E-03	8.1E-04
60	B	22.2	1.6E-06	2.2E-04	8.9E-05
61	T	25.0	3.3E-04	5.2E-02	2.1E-02
62	B	25.0	2.1E-05	3.3E-03	1.3E-03
62	T	23.5	6.9E-06	1.0E-03	3.9E-04
62	B	66.7	3.6E-07	1.5E-04	1.6E-04
62	B	57.1	1.7E-07	6.9E-05	5.6E-05
63	T	20.0	3.4E-06	1.1E-03	3.9E-04
63	T	40.0	2.2E-06	5.5E-04	3.6E-04
63	B	11.4	2.4E-06	1.7E-04	3.2E-05
63	B	57.1	4.0E-07	1.4E-04	1.3E-04
64	T	26.7	4.6E-05	7.6E-03	3.2E-03
64	B	36.4	2.4E-06	5.5E-04	3.2E-04
65	T	24.1	2.0E-05	3.1E-03	1.2E-03
65	B	25.0	2.5E-06	3.9E-04	1.6E-04
66	T	22.2	1.0E-05	2.0E-03	7.2E-04
66	B	23.5	2.0E-06	3.0E-04	1.1E-04
67	T	21.1	3.1E-05	4.1E-02	1.4E-02
67	B	20.0	2.0E-05	2.5E-03	9.1E-04
68	T	11.1	6.3E-05	4.4E-03	7.9E-04
68	B	10.5	3.6E-05	2.4E-03	4.1E-04
68	B	100.0	2.0E-06	1.2E-03	2.0E-03
69	T	11.1	2.4E-05	1.7E-03	3.0E-04
69	B	10.5	1.5E-05	1.0E-03	1.7E-04
69	B	117.6	1.1E-05	8.2E-03	1.6E-02
70	T	14.3	1.7E-04	1.6E-02	5.9E-03
70	B	14.3	1.3E-04	1.2E-02	2.9E-03
71	T	3.0	2.1E-05	4.0E-04	1.0E-04
71	B	23.3	1.1E-05	1.6E-03	6.2E-04
72	T	4.3	2.4E-05	6.5E-04	1.6E-04
72	B	17.4	3.2E-06	3.5E-04	1.3E-04
72	B	266.7	2.1E-07	3.5E-04	1.5E-03
73	T	3.3	1.4E-05	7.5E-04	1.9E-04
73	B	12.2	5.5E-06	6.2E-04	1.2E-04
74	T	13.2	4.1E-05	4.6E-03	1.4E-03
74	B	14.3	3.2E-05	3.4E-03	9.0E-04
74	B	58.8	2.7E-06	1.0E-03	9.6E-04
75	T	21.1	2.0E-05	2.7E-03	9.1E-04
75	B	13.2	1.6E-05	1.2E-03	5.5E-04
75	B	80.0	1.9E-06	9.5E-04	1.2E-03
76	T	22.2	4.3E-05	6.0E-03	2.2E-03
76	B	22.2	2.7E-06	3.6E-04	1.3E-04
77	T	21.1	3.4E-05	4.5E-03	1.5E-03
77	B	20.0	4.5E-06	5.5E-04	1.9E-04
78	T	10.0	4.4E-04	5.3E-02	1.6E-02
78	B	16.7	3.1E-05	3.2E-03	8.7E-04

STAT

ALL VALUES ARE SINGLE AMPLITUDE

RECORD		HZ	IN.	IN/SEC	G's
79	T	23.5	2.2E-05	3.3E-03	1.2E-03
79	B	20.0	3.1E-06	3.9E-04	2.3E-04
80	T	20.0	2.7E-05	3.4E-03	1.1E-03
80	B	21.1	4.3E-06	6.4E-04	2.2E-04
81	T	22.2	2.3E-05	3.3E-03	1.2E-03
81	B	17.4	2.7E-06	3.0E-04	0.5E-05
82	T	23.5	2.2E-05	3.3E-03	1.2E-03
82	B	22.2	3.9E-06	5.3E-04	1.9E-04
83	T	18.2	3.5E-04	4.9E-02	1.2E-02
83	B	16.7	1.9E-05	2.9E-03	5.4E-04
84	T	19.0	2.2E-05	2.6E-03	3.1E-04
84	T	66.7	2.0E-06	8.5E-04	9.2E-04
84	B	22.2	3.4E-06	4.7E-04	1.7E-04
85	T	20.0	1.9E-05	2.4E-03	7.3E-04
85	B	22.2	5.7E-06	8.0E-04	2.9E-04
86	T	18.2	2.0E-04	2.3E-02	6.3E-03
86	B	18.2	3.6E-05	4.1E-03	1.2E-03
87	T	26.7	2.4E-05	4.0E-03	1.7E-03
87	B	19.4	6.3E-06	6.1E-04	1.5E-04
88	T	26.7	2.8E-04	4.7E-02	2.1E-02
88	T	66.7	4.5E-05	1.9E-02	2.0E-02
88	B	12.1	1.0E-03	7.7E-02	1.5E-02
89	T	6.7	1.3E-04	7.5E-03	3.1E-04
89	B	6.5	2.1E-05	3.5E-04	8.9E-05
90	T	22.2	2.4E-05	3.4E-03	1.2E-03
90	B	13.2	3.1E-06	3.9E-04	1.3E-04
91	T	19.3	2.8E-04	3.5E-02	1.1E-02
191	B	20.0	2.2E-05	2.9E-03	1.0E-03
92	T	20.0	9.2E-06	1.4E-03	5.9E-04
92	B	21.1	2.6E-06	3.4E-04	1.2E-04
93	T	22.5	1.1E-05	1.6E-03	6.1E-04
93	B	20.0	2.1E-06	2.4E-04	1.4E-04
94	T	22.2	9.9E-06	1.2E-03	4.5E-04
94	B	14.3	7.0E-05	6.2E-03	1.5E-03
94	B	100.0	4.0E-06	2.5E-03	4.1E-03
95	T	22.2	1.1E-05	1.5E-03	5.3E-04
95	B	23.0	1.9E-04	2.7E-02	1.0E-02
96	T	20.0	1.5E-05	1.9E-03	6.2E-04
96	B	20.0	1.3E-04	2.3E-02	8.5E-03
97	T	18.2	1.1E-05	1.2E-03	3.6E-04
97	B	20.0	9.2E-05	1.1E-02	3.7E-03
97	B	50.6	2.3E-05	7.5E-03	6.3E-03
98	T	33.3	3.1E-06	1.9E-03	1.0E-03
98	B	33.3	1.2E-04	2.6E-02	1.3E-02
99	T	22.2	1.7E-05	2.2E-03	7.5E-04
99	B	28.6	1.3E-06	2.2E-04	1.0E-04
100	T	20.0	2.0E-05	2.5E-03	8.1E-04
100	B	22.2	3.4E-06	4.7E-04	1.7E-04

STAT

ALL VALUES ARE SINGLE AMPLITUDE

RECORD		HZ	IN.	IN/SEC	G'S
101	T	15.4	2.8E-04	2.7E-02	6.9E-03
102	T	25.0	1.6E-05	2.5E-03	1.0E-03
102	B	23.3	5.7E-04	8.4E-02	3.2E-02
103	T	22.2	1.3E-05	2.5E-03	9.0E-04
103	B	24.4	2.0E-04	3.1E-02	1.2E-02
104	T	22.7	4.2E-04	6.0E-02	2.2E-02
104	B	22.2	4.5E-04	6.3E-02	2.3E-02
105	T	9.5	1.1E-03	6.5E-02	1.0E-02
105	T	52.6	6.3E-05	2.2E-02	1.9E-02
105	B	20.0	1.4E-03	1.8E-01	5.9E-02
105	B	20.0	1.2E-03	1.4E-01	4.7E-02
106	T	71.4	9.5E-05	4.2E-02	4.9E-02
106	B	18.2	1.1E-03	1.2E-01	3.6E-02
106	B	18.2	8.3E-04	9.5E-02	2.8E-02
107	T	9.7	9.2E-04	5.0E-02	7.1E-03
107	B	8.7	3.2E-04	1.7E-02	2.5E-03
108	T	30.0	3.2E-06	2.0E-04	3.3E-05
108	B	12.9	2.5E-05	2.0E-03	4.2E-04
109	T	11.8	5.4E-06	4.0E-04	7.7E-05
109	B	11.1	1.9E-05	1.4E-03	2.4E-04
110	T	14.3	4.5E-06	4.0E-04	9.3E-05
110	B	11.1	4.1E-05	2.9E-03	5.2E-04
111	B	16.0	3.5E-06	3.5E-04	2.2E-04
112	T	17.5	2.1E-03	2.3E-01	6.5E-02
112	B	8.5	1.5E-03	8.0E-02	1.1E-02
112	B	69.0	1.9E-04	3.3E-02	9.4E-02
113	T	17.7	6.2E-04	6.9E-02	2.0E-02
113	B	16.7	1.1E-03	1.1E-01	3.1E-02
114	T	12.5	1.8E-03	1.4E-01	3.0E-02
114	T	57.2	1.4E-04	5.0E-02	4.7E-02
114	B	12.5	1.6E-03	1.2E-01	2.4E-02
114	B	54.3	5.0E-04	1.7E-01	1.6E-01
115	B	22.2	6.9E-04	9.6E-02	3.5E-02
116	T	33.3	8.1E-05	1.7E-02	9.2E-03
116	B	33.3	4.1E-04	8.5E-02	4.6E-02
117	T	31.3	1.3E-04	2.6E-02	1.3E-02
117	B	37.0	4.0E-04	9.2E-02	5.6E-02
118	T	29.6	7.2E-05	1.3E-02	6.9E-03
118	B	25.0	2.7E-04	4.2E-02	1.7E-02
119	T	37.0	4.5E-05	1.0E-02	6.3E-03
119	T	185.2	1.1E-05	1.2E-02	3.3E-02
119	B	135.1	2.0E-05	2.4E-02	6.4E-02
120	T	166.7	2.1E-06	2.2E-03	6.1E-03
120	T	37.0	4.2E-05	9.7E-03	5.9E-03
120	B	26.3	5.7E-05	9.5E-03	4.1E-03
121	T	23.6	1.5E-04	2.6E-02	1.2E-02
121	B	28.6	1.6E-03	2.9E-01	1.3E-01
122	T	33.3	1.4E-04	3.0E-02	1.6E-02
122	B	29.4	3.4E-03	6.3E-01	3.0E-01
123	T	36.4	5.0E-05	1.1E-02	6.2E-03
123	B	21.1	2.1E-04	2.3E-02	9.9E-03

STAT

ALL VALUES ARE SINGLE AMPLITUDE

RECORD		HZ	IN.	IN/SEC	G'S
225	T	23.9	8.4E-06	1.2E-03	4.8E-04
225	B	11.9	2.9E-04	2.1E-02	4.8E-03
226	T	26.7	6.0E-06	1.0E-03	4.3E-04
226	B	30.8	1.0E-06	2.0E-04	1.0E-04
227	T	8.0	2.8E-05	1.4E-03	1.3E-04
227	B	9.5	4.2E-06	2.5E-04	3.9E-05
228	T	35.7	7.1E-04	1.6E-01	9.3E-02
228	B	38.5	9.1E-04	2.2E-01	1.4E-01
229	T	33.3	5.7E-04	1.2E-01	6.5E-02
229	B	33.3	3.8E-04	8.0E-02	4.3E-02
245	T	30.8	3.9E-06	7.5E-04	3.8E-04
245	B	18.2	1.6E-06	1.8E-04	5.3E-05
246	T	30.8	8.3E-06	1.6E-03	8.0E-04
246	B	20.0	1.7E-06	2.1E-04	7.0E-05
247	T	16.7	2.1E-05	2.2E-03	6.0E-04
247	B	15.4	3.8E-06	3.7E-04	9.3E-05
248	T	25.0	6.7E-06	1.1E-03	4.3E-04
248	B	20.0	2.2E-06	2.7E-04	9.0E-05
249	T	28.6	8.8E-06	1.6E-03	7.3E-04
249	B	20.4	1.4E-06	1.8E-04	6.0E-05
250	T	26.7	1.0E-05	1.7E-03	7.5E-04
250	B	16.7	1.9E-06	2.0E-04	5.4E-05
251	T	21.1	9.4E-06	1.2E-03	4.3E-04
251	B	16.7	1.4E-06	1.5E-04	4.1E-05
252	T	23.0	4.2E-06	6.0E-04	2.2E-04
252	B	20.0	1.7E-06	2.1E-04	6.8E-05
253	T	22.2	3.3E-06	4.6E-04	1.7E-04
253	B	25.0	5.7E-07	9.0E-05	3.7E-05
254	T	26.7	2.5E-06	4.2E-04	1.8E-04
254	B	22.2	1.3E-06	1.7E-04	6.3E-05
255	T	14.3	1.2E-05	1.1E-03	2.4E-04
255	B	10.0	2.9E-06	1.8E-04	2.9E-05
256	T	9.5	1.3E-05	8.0E-04	1.2E-04
256	B	9.5	4.2E-06	2.5E-04	3.9E-05
257	T	11.8	1.1E-05	8.0E-04	1.5E-04
257	B	11.8	2.0E-06	1.5E-04	2.9E-05
258	T	10.5	2.4E-05	1.6E-03	2.7E-04
258	B	10.0	2.5E-06	1.6E-04	2.6E-05
259	T	16.0	5.7E-06	5.7E-04	1.5E-04
259	B	20.0	8.0E-07	1.0E-04	3.3E-05
260	T	20.0	7.6E-06	9.5E-04	3.1E-04
260	B	19.0	9.6E-07	1.1E-04	3.6E-05

STAT

DISCUSSION OF VIBRATION DATA

STAT

DISCUSSION OF VIBRATION DATA

Subsequent to discussions concerning the sources of vibration in the text of the report, the following sections summarize the results of vibration measurements of building and process equipment housed STAT STAT A detailed discussion of vibration measurements of the newest model work bench was included in the text of the report and hence, is not included herein.

Vibration Measurements of the Foundation Block, First Floor STAT

Measurements were made of the vibrations of a newly constructed equipment foundation located in the NRI Room. Records Nos. 2, 3 and 4 represent ambient vertical vibration measured at different locations atop the foundation. In these records, the top trace represents vibratory motion of the northeast corner of the foundation and the bottom trace the northwest, northeast and southeast corners for Records Nos. 2, 3 and 4, respectively. The scale is the same for both traces in each record and for all three records; therefore, direct comparisons can be made. It can be seen that the vertical vibratory motion of the top of the foundation is essentially uniform.

Records Nos. 5, 6 and 6a are comparisons of the vertical vibrations of the foundation and vertical vibrations of the floor. The top trace in Record No. 5 and the bottom traces in Records Nos. 6 and 6a correspond to vibrations of the top of the foundation. Both traces in each record are the same scale and indicate that the foundation is amplifying the motion over that observed for the floor presumably in response to the same source of vibration. Recognizing the fact that additional mass will be added to the system when the equipment is installed, it is questionable whether this added mass will reverse the tendency of amplification of motion to one which serves to isolate the equipment from the vibration source.

Record No. 7 represents horizontal motion of the foundation in the north and east directions. The bottom trace indicates that the amplitude of vibration in an easterly direction is somewhat greater than the northerly direction at essentially the same frequency.

Records Nos. 8 and 9 represent horizontal vibrations of the foundation (top trace) and the floor (bottom trace). Record No. 8 is vibratory motion in an easterly direction and Record No. 9 a northerly direction. As observed for the vertical vibration, the traces indicate that motion of the foundation in the horizontal direction is greater than that of the floor. The scale settings for the top and bottom traces are the same for both records, and therefore, the amplification of motion is readily seen.

Fastran Mass Storage Units, First Floor

Vibrations were measured in the room where the Fastran Mass Storage Units are located to compare motion of the units to that of the floor. Records Nos. 10, 11, 12 and 13 were taken at the southeast corner of the unit, which is oriented in an east-west direction immediately, adjacent to Column C-11. In these records, the top trace represents vibration of the floor and the bottom trace the top of the unit. It might be noted that a visual check of the vibration traces on the oscilloscope were made on two units stored between the unit on which the subject records were made and Column Line 12 (back wall of the room). The vibration levels of all three units are approximately the same with the unit on which the records were made being slightly higher. All three units were observed to be in phase.

Records Nos. 10 and 11 represent vibratory motion in a horizontal direction to the west, Record No. 10 being a transient vibration and Record No. 11 a typical ambient vibration. Records Nos. 12 and 13 represent horizontal vibration in a northerly direction and a vertical direction, respectively.

Note that the sensitivity of the horizontal scale of the oscilloscope for Record No. 12 is considerably greater than that of the other records.

Collectively, the traces indicate that the vibration levels of the units and the floor are essentially the same with the amplitude of motion being greater for the floor. Floor vibration is generally the same as that observed at other locations on the first floor; therefore, the units were dismissed as a significant source of vibration.

Densitometer, Room 2N420-A

Record No. 21 represents vertical vibration of the floor adjacent to the Densitometer and on top of the Densitometer glass plate. The top trace which represents floor vibration and the bottom scale which represents vibration of the glass plate are at the same scale setting and can be compared directly. With the equipment turned off, the traces indicate that the glass plate vibrations are greater than the floor. Note that in the computer output, the higher frequency was determined and not the predominant frequency which is essentially the same for the floor and the glass plate.

Record No. 22 is the same as Record No. 21 except that the equipment was turned on. The scale settings on the oscilloscope are the same for both traces. Amplification of motion is not as readily seen as when the equipment is turned off; however, when the vertical vibration of the base of the Densitometer is compared to that of the top of the glass, as seen in Record No. 23, the top trace represents the base vibration, the amplification of motion is more noticable.

Records Nos. 24 and 25 were made with the equipment off. Record No. 24 compares the vertical vibration of the base plate with that of the top of the table. The amplitudes of vibration are comparable, but the base plate is vibrating at a much higher frequency than the top of the table, 60 Hz to 24 Hz, respectively.

Record No. 25 is the same as Record No. 21. Note that the scale is not the same for the two records; however, it is the same for both traces of Record No. 25 and it can be seen that the vibration of the glass plate is considerably greater than that of the floor when the equipment is not running.

Enlarger, Second Floor near Column A-17

Vertical vibration of the floor at the base of Column A-17 (top trace) is compared with the vibration of the floor approximately 6 feet from the column (bottom trace) near the enlarger in Record No. 26. The traces cannot be compared directly as the scale settings differ. Calculated frequencies indicate that the floor near the column vibrates at approximately 28 Hz while near the enlarger, when it is running, the floor vibrates at approximately 62 Hz.

Record No. 27 compares vertical vibrations of the enlarger paper support (top trace) and the lens housing (bottom trace). The traces cannot be compared directly as the scale settings differ. The predominant frequency of the lens and paper support, 11.5 and 10.5 Hz respectively, are relatively low; however, the amplitude of vibrations is only on the order of 10^{-3} inches.

Equipment, Measuration Area-Second Floor

Record No. 24 compares the vertical vibrations of the floor (top trace) measured at the base of Column B-5 and the vertical vibrations of the main lower frame below the system magnifier (bottom trace) with all equipment on. The calculated frequencies for both traces are relatively high and reflect the high operating frequencies of the equipment in the area. The amplitude of vibrations of the floor and frame are small, 10^{-7} to 10^{-8} inches.

The top traces of Records Nos. 35 and 36 are the same as Record No. 34, while the bottom trace of Record No. 35 is a measure of the horizontal vibration of the main lower frame in a northerly direction and Record No. 36 is horizontal vibration in an easterly direction for the same location. As observed in Record No. 34, the frequencies are high and the amplitudes are low when the equipment is on.

Record No. 37 is the same as Record No. 34 with the equipment turned off. The settings, while different for the traces of each record, are the same for Records Nos. 34 through 36. The vertical vibration of the frame (top trace of Record No. 37), with the equipment off, generally agrees with floor vibrations observed in other areas in Building 213.

Barry Isolation Mounts, Fourth Floor

Vibration measurements were taken on top of the slab (rock) of the optical benches and the isolation base or floor to evaluate the effectiveness of the Barry Isolation Mounts in Rooms 4N805-B and 4N806-C. Records Nos. 58 through 73 were taken in Room 4N806-B. Records Nos. 74 and 75 were taken in Room 4N806-C.

Records Nos. 68 and 69 are direct comparisons (scale setting the same for top and bottom traces) of the vertical vibrations of the isolation base (bottom trace) and the top of rock (top trace) with the mounts on. These traces illustrate the effectiveness of the mounts in removing the high frequencies. Record No. 69, taken at the same location with the air mounts off, indicates that vertical vibrations of the base of the mount and top of rock slab are essentially the same.

Record No. 71 compares the vertical vibration of the top of rock (top trace) with that of the floor(bottom trace) with the air mounts on, while Records Nos. 73 and 74 compare horizontal vibrations in a westerly and northerly direction, respectively, at the same locations. Collectively, the records indicate that the Barry Isolation Mounts are effective in significantly reducing the higher frequency vibrations; however, at some frequencies (see Records Nos. 71 and 72), the motion of the floor is somewhat amplified.

Records Nos. 74 and 75 compare the vertical vibrations of the upper (top trace) and lower (bottom trace) slabs with the air mounts on. Again, the mounts effectively reduce the higher frequency vibrations but the low frequency amplitude is essentially the same.

Heating Unit Bearing Housing, Fifth Floor

Vibration of the heating unit located in Room 4S475-C was measured while the fan was in operation. The top trace of Record No. 87 represents vertical vibration of the base of the heating unit and the bottom trace is a measure of horizontal vibration of the side of the light gauge metal housing of the unit. The base vibrates at a frequency of 26.7 Hz and an amplitude of 2.4×10^{-5} inches in a vertical direction. The side of the unit vibrates horizontally at a frequency of 15.4 Hz with a 6.3×10^{-6} inches amplitude.

Record No. 88 was taken at the heating unit bearing housing. The top trace is a measure of the vertical vibration and the bottom trace horizontal vibration. As expected, the bearing housing vibrates vertically at the same frequency as the base but at a greater amplitude, 2.8×10^{-4} inches as compared to that of the base of 2.4×10^{-5} inches.

Vibration of the bearing housing in the horizontal direction was found to be considerably greater than that of the side of the unit, 1×10^{-3} inches as compared to 6.3×10^{-6} respectively.

Additional Measurements with the Air System On and Off, Fourth Floor

Vibration measurements were taken at various locations on the fourth floor to compare those with the air system on to those at the same location with the air system off. For ease of comparison, these data are summarized in the table that follows:

COMPARISON OF VIBRATION MEASUREMENTS WITH AIR SYSTEM ON AND OFF

Location	AIR SYSTEM ON				AIR SYSTEM OFF			
	Record No.	Frequency (Hz)	Amplitude (Inches)	Velocity (In/Sec)	Record No.	Frequency (Hz)	Amplitude (Inches)	Velocity (In/Sec)
III	245	*V 30.8 H 18.2	3.9×10^{-6} 1.6×10^{-6}	7.5×10^{-4} 1.8×10^{-4}	256	V 9.5 H 9.5	1.3×10^{-5} 4.2×10^{-6}	8.0×10^{-4} 2.5×10^{-4}
IV	246	V 30.8 H 20.0	8.3×10^{-6} 1.7×10^{-6}	1.6×10^{-3} 2.1×10^{-4}	257	V 11.8 H 11.8	1.1×10^{-5} 2.0×10^{-6}	8.0×10^{-4} 1.5×10^{-4}
V	247	V 16.7 H 15.4	2.1×10^{-6} 3.8×10^{-6}	2.2×10^{-3} 3.7×10^{-4}	258 **259	V 10.5 H 10.0 V 16.0 H 20.0	2.4×10^{-5} 2.5×10^{-6} 5.7×10^{-6} 8.0×10^{-7}	1.6×10^{-3} 1.6×10^{-4} 5.7×10^{-4} 1.0×10^{-4}
VI	248	V 25.0 H 20.0	6.7×10^{-6} 2.2×10^{-6}	1.1×10^{-3} 2.7×10^{-4}	252 ***253	V 23.0 H 20.0 V 22.0 H 25.0	4.2×10^{-6} 1.7×10^{-6} 3.3×10^{-6} 5.7×10^{-7}	6.0×10^{-4} 2.1×10^{-4} 4.6×10^{-4} 9.0×10^{-5}
VII	249 250	V 28.6 H 20.4 V 26.7 H 16.7	8.8×10^{-6} 1.4×10^{-6} 1.0×10^{-6} 1.9×10^{-6}	1.6×10^{-3} 1.8×10^{-4} 1.7×10^{-3} 2.0×10^{-4}	254 255	V 26.7 H 22.2 V 14.3 H 10.0	2.5×10^{-6} 1.3×10^{-6} 1.2×10^{-5} 2.9×10^{-6}	4.2×10^{-4} 1.7×10^{-4} 1.1×10^{-3} 1.8×10^{-4}
VIII	251	V 21.1 H 16.7	9.4×10^{-6} 1.4×10^{-6}	1.2×10^{-3} 1.5×10^{-4}	**260	V 20.0 H 19.0	7.6×10^{-6} 9.6×10^{-7}	9.5×10^{-4} 1.1×10^{-4}

* Denotes Direction: V = Vertical, H = Horizontal

** For Records Nos. 259 and 260, the USGS Air System and 4SE Supply Fan were turned off.

*** All Horizontal Vibrations to the North, Except Record No. 253 which is to the West.

By comparing the velocities in the preceding table, it can be seen that only a slight decrease occurs when the air system is turned off. Direct comparison of velocities for different loadings of a given system is meaningful in that both displacement and frequency are taken into account. Comparison based on displacement is valid only when displacements are compared at the same frequency. It can be concluded then that from an economical standpoint, attempts to reduce the vibration levels of the air system would be unjustified as the reduction would be almost negligible.

APPENDIX B
ADDITIONAL COMPUTER RUNS
EFFECT OF INPUT
AT RESONANT FLOOR FREQUENCIES

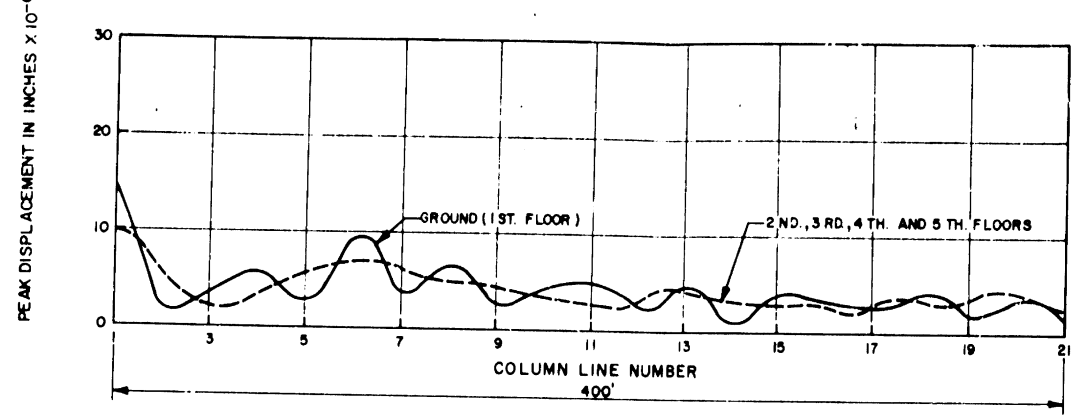
GROUND MOTION INPUT AT RESONANT FLOOR FREQUENCIES

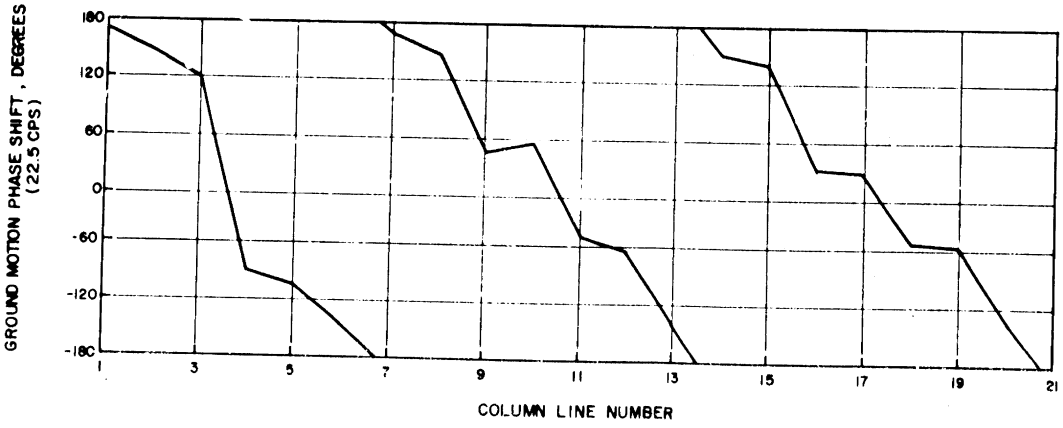
An additional computer analysis has been performed to supplement the research explained in the main body of the report. The purpose of this investigation was to ascertain the response of the building as the excitation frequency passed through a natural frequency of the floor systems. Since the second, third, fourth and fifth floors all have one of their natural frequencies at approximately 22.5 Hz, frequencies in the vicinity of 22.5 Hz were used as input for the analysis.

The results of the analysis are summarized on Fig B-1. Figure B-1 shows the vertical response of the building due to a 22.5 Hz excitation at the subway tunnels. As can be seen from the figure, the responses of the second, third, fourth and fifth floors are identical and are not amplified as normally would be expected when a body is vibrated at a frequency very close to its natural frequency. The magnitude of the floor responses is similar to the amplitude of the ground at the corresponding column line number.

Figure B-1 also shows the variation in phase angle of the excitation vibration as a function of the column line number. The variation in the phase of the driving force offers a plausible explanation for the seemingly anomolous behavior of the floor systems at their natural frequency. The results indicate that the driving force coming from the columns on each end of a floor slab are out of phase and subtract rather than add and create a resonant condition in the floors.

The additional analysis performed in this phase of the investigation indicates that the floor systems in the building do not have resonant behavior from ground transmitted vibrations due to the independent manner in which the building columns act. The displacements experienced at each floor are very similar in magnitude to the corresponding ground displacement.





U.S. GOVERNMENT
WASHINGTON, D.C.

STAT

FIGURE B-1