



# Clocks and Watches of the Qing Dynasty

From the Collection in the Forbidden City

清宫钟表集萃

—北京故宫珍藏

FOREIGN LANGUAGES PRESS

外 文 出 版 社



Clocks and Watches of the Qing Dynasty  
--From the Collection in the Forbidden City

# 清宫钟表集萃

——北京故宫珍藏



江苏工业学院图书馆  
藏书章



ESS

士

## 图书在版编目 (CIP) 数据

清宫钟表集萃: 北京故宫珍藏 / 廖频编; 郎秀华, 秦小培撰;  
胡锺, 刘志岗, 赵山摄. —北京: 外文出版社, 2002.8

ISBN 7-119-03050-7

I. 清… II. ①廖… ②郎… ③秦… ④胡… ⑤刘… ⑥赵…  
III. 钟表—考古—中国—清代 IV. K875.2

中国版本图书馆 CIP 数据核字 (2002) 第 023441 号

编 辑: 廖 频  
撰 文: 郎秀华 秦小培  
图 片: 故宫博物院提供  
摄 影: 胡 锺 刘志岗 赵 山 赵小权  
冯 辉 夏 静 邹一伟 余志勇等  
翻 译: 黄友义 丛国玲 郝光峰  
英文改稿: 保罗·怀特  
设 计: 兰佩瑾 元 青  
责任编辑: 兰佩瑾

## 清宫钟表集萃

© 外文出版社

外文出版社出版

(中国北京百万庄大街 24 号)

邮政编码: 100037

外文出版社网页: <http://www.flp.com.cn>

外文出版社电子邮件地址: [info@flp.com.cn](mailto:info@flp.com.cn)

[sales@flp.com.cn](mailto:sales@flp.com.cn)

利丰雅高印刷 (深圳) 有限公司印刷

中国国际图书贸易总公司发行

(中国北京车公庄西路 35 号)

北京邮政信箱第 399 号 邮政编码 100044

2002 年 (大 32 开) 第一版

2002 年第一版第一次印刷

(英汉)

ISBN 7-119-03050-7/J·1585 (外)

009600 (平)

85-E-528P

# Contents

## *1. Clocks Made in China*

### **Clocks Made in the Forbidden City Workshop, Qing Dynasty**

1. Sandalwood Pavilion Chiming Clock	• • •	30
2. Sandalwood, Double-eaved Tower Striking Clock	• • •	31
3. Black Lacquer and Painted Tower Clock Decorated with Eight Immortals Presenting Birthday Gifts	• • •	32
4. Black Lacquer, Gilded Tower Clock	• • •	34
5. Double-eaved Tower Clock Decorated with Revolving Eight Immortals	• • •	35
6. Clock on Chest Held by Two Boys	• • •	36
7. Gilded Copper Hand-rest Clock	• • •	37
8. Gilded Copper Hat-rack Clock	• • •	38
9. Gilded Tower Clock	• • •	39
10. Alarm Clock	• • •	40
11. Gilded Clock Decorated with Revolving Eight Immortals, Fountain and Flowers	• • •	41
12. Wood-and-Plaster Bird Cage Clock	• • •	42
13. Double-sided Mahogany Clock	• • •	43
14. Blossoming Flower Clock	• • •	44
15. Revolving Wooden Pagoda Clock	• • •	46
16. Copper Flower-inlaid Tower Clock	• • •	47
17. Sandalwood Screen Clock	• • •	48
18. Fanning Figure Clock	• • •	49
19. Yuan Dynasty Water Clock	• • •	50
20. Sandalwood Tower Chiming Clock	• • •	51
21. Copper Water Clock in the Hall of Celestial and Terrestrial Union	• • •	52
22. Sundial in Front of the Hall of Supreme Harmony	• • •	54

### **Clocks Made in Guangzhou**

23. Gilded Copper and Enamel-inlaid Clock Decorated with Tree and Fairy	• • •	55
24. Four-sided Gilded Copper and Yellow Enamel Clock	• • •	56
25. Gilded Copper Pavilion Clock Decorated with Swimming Ducks and Revolving Figures	• • •	57
26. Gilded Copper Pavilion Figure Striking Clock	• • •	58
27. Gilded Copper Tower Clock with Birthday Celebration Decorations	• • •	59
28. Gilded Copper Enamel-inlaid Clock with Birthday Celebration Decorations	• • •	60
29. Gilded Copper Enamel Gourd Clock	• • •	61
30. Gilded Copper Clock with Gourd-shaped Top	• • •	62
31. Gilded Copper Enamel Vase Clock Decorated with a Fisherman, Woodcutter, Farmer and Scholar	• • •	63
32. Enamel Pavilion Chiming Clock Decorated with Three Apes Offering Gifts	• • •	64
33. Gilded Copper Mirror Clock	• • •	65
34. Gilded Copper Clock with Immortal Apes Presenting Birthday Peaches	• • •	66
35. Gilded Copper and Enamel-inlaid Clock Supported by a Deer	• • •	68
36. Gilded Copper and Enamel-inlaid Fountain Clock	• • •	69
37. Gilded Copper and Enamel Umbrella Clock	• • •	70

38. Gilded Copper Automatic Door Clock Decorated with Five Boys Competing for a Lotus	. . .	71
39. Gilded Copper and Enamel Potted Flower Clock	. . .	72
40. Gilded Copper Elephant Clock	. . .	73
41. Birthday Celebration Screen Clock	. . .	74
42. Sandalwood Clock Decorated with Mother-of-pearl Inlay and Longevity Wishes	. . .	75
43. Gilded Copper Movable Pagoda Clock	. . .	76
44. Gilded Copper and Enamel Gourd-shaped Clock	. . .	78
45. Gilded Copper Stone-inlaid Mirror Clock	. . .	79
46. Gilded Copper and Inlaid Enamel Longevity Clock	. . .	80
47. Gilded Copper and Inlaid Enamel Longevity Wishes Clock	. . .	81

### **Clocks Made in Suzhou**

48. Gilded Copper Bird Pavilion Clock	. . .	82
49. Gilded Copper Magic Clock with Automatic Door	. . .	83
50. Sandalwood Clock with Polaris Constellation and Lunar Terms	. . .	84

## *II. European Clocks and Watches*

### **British Clocks and Watches**

51. Gilded Copper Clock Decorated with Lions Supporting a Flower Pot	. . .	85
52. Gilded Copper Chiming Clock with Four Lions Supporting a Fountain	. . .	86
53. Gilded Copper Rectangular Clock Decorated with a Cow	. . .	87
54. Gilded Copper Square Bird Cage Clock	. . .	88
55. Gilded Copper Clock with Rhinoceroses Supporting Cosmetic Box and Mirror	. . .	90
56. Gilded Copper Clock Decorated with Agate and Revolving Flowers	. . .	91
57. Gilded Copper Clock on Square Agate Stand with Two Boys	. . .	92
58. Wooden Tower Whistling Clock Decorated with Flower Patterns	. . .	93
59. Mahogany Calendar Double Dial Clock	. . .	94
60. Gilded Copper Rockery Clock with Swimming Swans	. . .	95
61. Gilded Copper Flower Pot Clock	. . .	96
62. Triangular Wooden Tower Music Clock Supported by Lions	. . .	98
63. Gilded Copper Chiming Clock with Moving Figures and Pillars	. . .	99
64. Gilded Copper Clock with Writing Figure	. . .	100
65. Gilded Copper Grapevine Clock	. . .	102
66. Gilded Copper Clock Decorated with Revolving Flowers, Phoenix and Fountain	. . .	104
67. Gilded Copper Tower Clock Decorated with Peacock Fanning Its Tail	. . .	106
68. Gilded Copper Clock Supported by a Sheep	. . .	107
69. Gilded Copper and Enamel Pocket Watch	. . .	108
70. Gilded Copper Tower Clock on Horseback	. . .	109
71. Gilded Copper Tower Chiming Clock with Dancing Figures	. . .	110
72. Clock with Gilded Copper Elephant and Lion Tamer	. . .	112
73. Gilded Copper Chiming Clock Set in a Mirror	. . .	113
74. Gilded Copper Clock Supported by Four Goats and Two Angels	. . .	114
75. Gilded Copper Chiming Pocket Watch with Openwork Enamel Decoration	. . .	116
76. Calendar Clock with Hawksbill Turtle Shell Inlaid with Copper Patterns	. . .	117
77. Gilded Copper Mirror Clock	. . .	118

78. Gilded Copper Tower Clock Supported by Goats	• • •	119
79. Gilded Copper Fountain Chiming Clock Supported by an Elephant	• • •	120
80. Gilded Copper Fountain Chiming Clock with Revolving Flowers	• • •	122
81. Gilded Copper and Enamel Vase Clock	• • •	123
82. Hawksbill Turtle Shell Tower Clock with Sailing Boat and Movable Figures	• • •	124
83. Black Lacquer Wooden Tower Table Clock with Copper Decorations	• • •	125
84. Gilded Copper Pavilion Globe Clock with Gemstone Decorations	• • •	126
85. Gilded Copper Pocket Watch with Gemstones Inlaid Around the Dial	• • •	127
86. Gilded Copper Clock with Boy and Sheep	• • •	128
87. Wooden Tower Clock with Copper Decorations, Sailing Boat and Fountain	• • •	129
88. Gilded Copper Tower Four-sided Clock	• • •	130
89. Gilded Copper Pearl-inlaid Pocket Watch	• • •	131
90. Gilded Copper Chariot Chiming Clock Pulled by an Elephant	• • •	132
91. Gilded Copper Clock Supported by an Elephant	• • •	134
92. Gilded Copper Orchestra and Mirror Clock	• • •	136
93. Gilded Copper Movable Pagoda Clock	• • •	138
94. Gilded Copper Umbrella Clock with Revolving Flowers	• • •	140
95. Gilded Copper Fountain Clock	• • •	142
96. Gilded Copper Clock Decorated with Revolving Flowers in a Vase	• • •	143
97. Gilded Copper Flower Revolving Clock	• • •	144
98. Gilded Copper Rising and Falling Pavilion Clock Inlaid with Gemstones	• • •	145
99. Gilded Copper Clock Decorated with Three Children Striking the Hours	• • •	146
100. Gilded Copper Partridge Clock	• • •	147
101. Gilded Copper Pavilion Clock with Rolling Balls, Swimming Ducks and a Fountain	• • •	148
102. Gilded Copper Clock Supported by a Camel and Decorated with Revolving Figures	• • •	150
103. Gilded Copper Clock Supported by Horses and Decorated with Revolving Figures, Flowers and Fountain	• • •	152
104. Gilded Copper Figure Striking Bell Clock	• • •	154
105. Wood-Framed Iron Mechanical Clock	• • •	155
106. Gilded Copper, Agate-inlaid Telescope Clock	• • •	156
107. Silver Organ Clock with Openwork Sculpture	• • •	157
108. Gilded Copper Framed Clock	• • •	158
109. Gilded Copper Clock Inlaid with Enamel Strips	• • •	159
110. Mahogany Tower Clock Inlaid with Copper Strips	• • •	160
111. Gilded Copper Clock Supported by Winged Animals with Flowers and a Fountain	• • •	161
112. Gilded Copper Clock with Automatic Doors	• • •	162
113. Hawksbill Turtle Shell Chiming Clock Inlaid with Copper Decorations	• • •	164
114. Gilded Copper Pocket Watch Inlaid with Diamonds	• • •	165
115. Gilded Copper Clock with Strikers on Three Sides	• • •	166
116. Gilded Copper Pocket Watch Decorated with Ladies Listening to Flute Playing	• • •	168
117. Gilded Copper Pocket Watch Inlaid with Pearls	• • •	169
118. Gilded Copper Pocket Watch with Copper Colored Dial Plate	• • •	170
119. Watch Inlaid on a Gilded Copper Good Wishes Object Decorated with Gemstones	• • •	171

120. Gilded Copper Saddle Watch Inlaid with Decorative Stones	• • •	172
---	-------	-----

### French Clocks and Watches

121. Gilded Copper Pavilion Clock	• • •	173
122. Gilded Copper Enamel Clock	• • •	174
123. Clock with Goddess Holding a Ball	• • •	175
124. Gilded Copper Pavilion Clock Inlaid with Enamel Decorations	• • •	176
125. Copper Boat Clock	• • •	177
126. Copper Locomotive Clock	• • •	178
127. Copper Furnace Clock	• • •	179
128. Parrot Clock	• • •	180
129. Chiming Clock Decorated with Enamel Thread	• • •	181
130. Gilded Copper Clock with Rolling Ball Mechanism	• • •	182
131. Gilded Copper Singing Bird Clock	• • •	184
132. Gilded Copper Clock with Blue Enamel Flower Vase	• • •	185
133. Gilded Copper Rolling Ball Clock	• • •	186
134. Gilded Copper Hand-held Mirror Clock	• • •	187
135. Air Balloon Clock	• • •	188
136. Gilded Copper Painted Clock with Blue Ceramic Vase	• • •	189

### Swiss Clocks and Watches

137. Cicada-shaped Pin Watch Inlaid with Diamonds	• • •	190
138. Black Lacquer and Gold Painted Tower Clock	• • •	191
139. Gilded Copper Pocket Watch with Enamel Flower Decorations	• • •	192
140. Gilded Copper Six-pillar Pavilion Clock	• • •	193
141. Gilded Copper Marble Pavilion Clock	• • •	194
142. Pocket Watch Inlaid with Pearls	• • •	195
143. Pearl-inlaid Pocket Watch	• • •	196
144. Pearl-rimmed Pocket Watch	• • •	197
145. Pomegranate-shaped Pin Watch with Diamonds	• • •	198
146. Lock-shaped Watch Decorated with Enamel Thread	• • •	199
147. Watch Inlaid in Gilded Copper Vase	• • •	200

### Clocks and Watches from Other Countries

148. Copper Windmill Clock	• • •	201
149. Small Gold Watch	• • •	202
150. Gilded Copper Singing Bird Clock	• • •	203
151. Glass-cased Gilded Copper Clock	• • •	204
152. Gilded Copper Clock Inlaid with Artificial Diamonds	• • •	205
153. Gilded Copper Clock on Horseback	• • •	206
154. Gilded Copper Twin-dog Clock	• • •	207

# 目 录

## 一、中国钟表

### 清宫造办处制造

1. 紫檀木亭式时刻更钟	•••••	30
2. 紫檀重檐楼阁式更钟	•••••	31
3. 黑漆彩绘楼阁式群仙祝寿钟	•••••	32
4. 黑漆描金楼式钟	•••••	34
5. 重檐楼阁式转八仙钟	•••••	35
6. 双童托柜表	•••••	36
7. 铜镀金迎手钟	•••••	37
8. 铜镀金冠架钟	•••••	38
9. 金漆楼阁式钟	•••••	39
10. 时辰醒钟	•••••	40
11. 铜镀金八仙水法转花钟	•••••	41
12. 木制泥金鸟笼式表	•••••	42
13. 红木座双面钟	•••••	43
14. 自开花献桃荷花缸钟	•••••	44
15. 木质塔式转八仙乐钟	•••••	46
16. 木楼嵌铜花钟	•••••	47
17. 紫檀插屏钟	•••••	48
18. 掬扇机器人钟	•••••	49
19. 元延祐三年漏壶	•••••	50
20. 紫檀木雕楼式自鸣钟	•••••	51
21. 交泰殿铜壶滴漏	•••••	52
22. 太和殿日晷	•••••	54

### 广州制造

23. 铜镀金嵌珐琅开花仙人钟	•••••	55
24. 铜镀金嵌黄珐琅四面钟	•••••	56
25. 铜镀金亭式跑鸭转人钟	•••••	57
26. 铜镀金亭式人打钟	•••••	58
27. 铜镀金楼式献寿钟	•••••	59
28. 铜镀金嵌珐琅三人献寿钟	•••••	60
29. 铜镀金嵌珐琅葫芦式钟	•••••	61
30. 铜镀金葫芦顶楼式钟	•••••	62
31. 铜镀金珐琅楼渔樵耕读钟	•••••	63
32. 珐琅亭式三猿献宝乐钟	•••••	64
33. 铜镀金容镜钟	•••••	65
34. 铜镀金仙猿献桃乐钟	•••••	66
35. 铜镀金嵌珐琅鹿驮钟	•••••	68



36. 铜镀金嵌珐琅龙吐水法钟	.....	69
37. 铜镀金珐琅翻伞座钟	.....	70
38. 铜镀金自开门五子夺莲钟	.....	71
39. 铜镀金珐琅花盆式钟	.....	72
40. 铜镀金转水法太平有象钟	.....	73
41. 群仙祝寿插屏钟	.....	74
42. 紫檀嵌螺钿群仙祝寿钟	.....	75
43. 铜镀金珐琅升降塔式钟	.....	76
44. 铜镀金珐琅葫芦式钟	.....	78
45. 铜镀金嵌料石花镜嵌表	.....	79
46. 铜镀金嵌珐琅楼式万寿无疆钟	.....	80
47. 铜镀金嵌珐琅飞人献福寿钟	.....	81

### 苏州制造

48. 铜镀金鸟音亭式钟	.....	82
49. 铜镀金自开门变戏法钟	.....	83
50. 紫檀木北极恒星图时辰节气钟	.....	84

## 二、欧洲钟表

### 英国钟表

51. 铜镀金狮驮嵌螺钿方花盆表	.....	85
52. 铜镀金四狮驮水法乐钟	.....	86
53. 铜镀金立牛长方座钟	.....	87
54. 铜镀金四方形鸟笼表	.....	88
55. 铜镀金犀牛驮容镜规矩箱表	.....	90
56. 铜镀金嵌玛瑙转花表	.....	91
57. 铜镀金镶玛瑙双童方座表	.....	92
58. 木楼嵌铜花木哨乐钟	.....	93
59. 红木楼式带日历两套钟	.....	94
60. 铜镀金假山跑鸭水法钟	.....	95
61. 铜镀金花盆式嵌料石花表	.....	96
62. 狮驮木楼三角形音乐钟	.....	98
63. 铜镀金自开门转人转柱乐钟	.....	99
64. 铜镀金写字人钟	.....	100
65. 铜镀金葡萄架铜人举表	.....	102
66. 铜镀金嵌珐琅转花鸟音水法钟	.....	104
67. 铜镀金牌楼式孔雀开屏钟	.....	106
68. 铜镀金羊驮钟	.....	107
69. 铜镀金嵌珐琅画怀表	.....	108
70. 铜镀金四马驮亭式平放钟盘钟	.....	109
71. 铜镀金牌楼式舞者音乐钟	.....	110
72. 铜镀金人戏狮象驮钟	.....	112
73. 铜镀金玻璃柱音乐镜表	.....	113
74. 铜镀金四羊驮两人举表	.....	114

75. 铜镀金镂空花珐琅套音乐怀表	•••••	116
76. 玳瑁楼嵌铜饰日历钟	•••••	117
77. 铜镀金反光镜滚球钟	•••••	118
78. 铜镀金四羊驮塔式转花钟	•••••	119
79. 铜镀金象驮水法塔乐钟	•••••	120
80. 铜镀金转花水法乐钟	•••••	122
81. 铜镀金珐琅壁瓶式表	•••••	123
82. 玳瑁楼式跑船跑人时乐钟	•••••	124
83. 黑漆木楼嵌铜饰大座钟	•••••	125
84. 铜镀金亭式料石地球钟	•••••	126
85. 铜镀金镶料石圈口明机芯怀表	•••••	127
86. 铜镀金少年牵羊钟	•••••	128
87. 木楼嵌铜饰跑船水法钟	•••••	129
88. 铜镀金楼式规矩箱四面钟	•••••	130
89. 铜镀金镶珠石杯式表	•••••	131
90. 铜镀金象拉战车乐钟	•••••	132
91. 铜镀金象驮琵琶摆钟	•••••	134
92. 铜镀金人奏乐容镜钟	•••••	136
93. 铜镀金转人升降塔钟	•••••	138
94. 铜镀金转花翻伞钟	•••••	140
95. 铜镀金水法连机动大座钟	•••••	142
96. 铜镀金花瓶式顶转花钟	•••••	143
97. 铜镀金转花钟	•••••	144
98. 铜镀金嵌料石升降塔钟	•••••	145
99. 铜镀金三人打乐钟	•••••	146
100. 铜镀金乐箱鹁鸽钟	•••••	147
101. 铜镀金亭式滚球转鸭水法钟	•••••	148
102. 铜镀金水法转人骆驼驮钟	•••••	150
103. 铜镀金四马驮转花转人水法钟	•••••	152
104. 铜镀金转花人打钟	•••••	154
105. 木壳铁板机器钟	•••••	155
106. 铜镀金饰玛瑙望远镜表	•••••	156
107. 银镂空花弄跑人风琴钟	•••••	157
108. 铜镀金架挂钟	•••••	158
109. 铜镀金嵌珐琅片钟	•••••	159
110. 红木楼式嵌铜饰三套钟	•••••	160
111. 铜镀金变花水法翼兽驮钟	•••••	161
112. 铜镀金自开门人打钟	•••••	162
113. 玳瑁楼嵌铜饰乐钟	•••••	164
114. 铜镀金珐琅镶钻石壳怀表(正、反面)	•••••	165
115. 铜镀金转水法三面人打钟	•••••	166
116. 铜镀金珐琅听萧图壳怀表(正、反面)	•••••	168
117. 铜镀金嵌珐琅画镶珠怀表(正、反面)	•••••	169

118. 铜镀金铜色表盘怀表	.....	170
119. 铜镀金镶料石花如意嵌表	.....	171
120. 铜镀金镶料石口马鞍表	.....	172

#### 法国钟表

121. 铜镀金亭式钟	.....	173
122. 铜镀金珐琅座钟	.....	174
123. 铜镀金女神举球钟	.....	175
124. 铜镀金嵌珐琅圆亭式座钟	.....	176
125. 铜轮船式表	.....	177
126. 铜火车头式表	.....	178
127. 铜锅炉式表	.....	179
128. 鸚鵡钟	.....	180
129. 掐丝珐琅八音表	.....	181
130. 铜镀金滚球压力钟	.....	182
131. 铜镀金鸟音座钟	.....	184
132. 铜镀金蓝瓷花瓶式钟	.....	185
133. 铜镀金滚钟	.....	186
134. 铜镀金镶料石花把镜表	.....	187
135. 气球载人钟	.....	188
136. 铜镀金饰彩绘蓝瓷瓶钟	.....	189

#### 瑞士钟表

137. 金嵌钻石蝉形别针表	.....	190
138. 黑漆描金楼式钟	.....	191
139. 铜镀金镶珠口边珐琅花卉怀表	.....	192
140. 铜镀金珐琅六柱亭式钟	.....	193
141. 铜镀金石座亭式水法表	.....	194
142. 金珐琅镶珠怀表	.....	195
143. 珐琅镶珠蕃莲花怀表	.....	196
144. 铜镀金珐琅珠口怀表	.....	197
145. 金珐琅镶钻石石榴形别针表	.....	198
146. 铜镀金掐丝珐琅镶珠锁形表	.....	199
147. 铜镀金座珐琅双耳瓶嵌表	.....	200

#### 其它国家的钟表

148. 铜风车钟(亨德利)	.....	201
149. 小金表(亨德利)	.....	202
150. 铜镀金鸟音座钟(亨德利)	.....	203
151. 铜镀金四明钟(美国)	.....	204
152. 铜镀金嵌假钻石表(美国)	.....	205
153. 铜镀金转水法人物马驮钟(意大利)	.....	206
154. 铜镀金双狗座钟(日本)	.....	207

**Clocks and Watches of the Qing Dynasty**  
--From the Collection in the Forbidden City

# 清宫钟表集萃

——北京故宫珍藏



ESS

社

**Compiled by:** Liao Pin  
**Text by:** Lang Xiuhua, Qin Xiaopei  
**Photos by:** Hu Chui, Liu Zhigang, Zhao Shan, Zhao Xiaoquan,  
Feng Hui, Xia Jing, Zou Yiwei, Yu Zhiyong  
**Translator:** Huang Youyi, Cong Guoling, Hao Guangfeng  
**English reviser:** Paul White  
**Designer:** Lan Peijin, Yuan Qing  
**Editor:** Lan Peijin

First Edition 2002

## **Clocks and Watches of the Qing Dynasty**

--From the Collection in the Forbidden City

ISBN 7-119-03050-7

© Foreign Languages Press  
Published by Foreign Languages Press  
24 Baiwanzhuang Road, Beijing 100037, China  
Home Page: <http://www.flp.com.cn>  
E-mail Addresses: [info@flp.com.cn](mailto:info@flp.com.cn)  
[sales@flp.com.cn](mailto:sales@flp.com.cn)

Distributed by China International Book Trading Corporation  
35 Chegongzhuang Xilu, Beijing 100044, China  
P.O.Box 399, Beijing, China  
*Printed in the People's Republic of China*

# **Foreword**

The Palace Museum in Beijing, the largest museum in China, has in its collection some of the finest clocks and watches produced worldwide during the 18th and 19th centuries. They are not only timekeeping instruments, but also examples of superb craftsmanship, testifying to the outstanding skill of clock and watch makers in both China and other countries.

China boasts a long history of the development and production of timepieces. During the 10th and 14th centuries, China invented different kinds of astronomical devices which combined the functions of astronomical measurement with the mechanical recording of time. The earliest time-measuring devices first appeared in China more than 3,000 years ago.

## **Ancient Chinese Chronometers**

The sundial is the earliest and most primitive form of timepiece known to man. In China, the first sundials appeared during the Western Zhou period, some 3,000 years ago. The device consisted simply of an erect pole, and people tried to calculate the occurrence of the summer and winter solstices by observing the movement and length of the shadows of the pole cast by the sun. On the day of the winter solstice, the shadow was the longest, while at the summer solstice it was at its shortest. An improvement on this crude device was the gnomon, which consisted of a vertical pole fixed to a horizontal ruler marked at regular intervals. The shadows cast by the pole could be more accurately measured by using the gnomon.

A further improvement was a sundial which told the time throughout the day (The 24 hours were divided into 12 units, while each of these units was again divided into eight sub-units, equivalent to quarters of an hour) as the position of the sun shifted. It consisted of an obelisk standing on a huge stone disc engraved with the eight sub-units in each of the twelve units representing the passage of the day. This type of timepiece appeared before the Han Dynasty (206-220 BC). One made of white marble can be seen on the open terrace in front of the Hall of Supreme Harmony in the Forbidden City in Beijing. Its very location symbolizes that the emperor had under his control the unified time-telling system for the whole empire.

As the sundial relied on the sun to tell the time, it was useless on cloudy days and during the night. To solve this problem, the water clock, or clepsydra, was invented. This instrument enabled the passage of time to be observed as the level of water, the speed and amount of feed of which had been preset, rose. Water clocks varied in structure according to the times in which they were produced, but mainly they consisted of a tank from which water dripped and a container which received the water. They also ranged from mono-container to multi-container types. The water clocks of the Han

Dynasty all had a single, round water container with a movable arrow marking the change in water level. Such containers were not large enough to contain enough water for a whole 24-unit cycle and had to be refilled to keep on working. The volume on astronomy in *The History of the Song Dynasty* records details of a water clock made by Shen Kuo (1031-1095). This clepsydra consisted of three containers for relaying the water, called the *qiu hu* (initial container), the *fu hu* (second container) and the *fei hu* (last container), respectively, in addition to one for collecting water called the *jian hu*. When the containers for relaying water were filled in succession, the water flowed evenly into the one for collecting water, in which an arrow would rise along with the water level, indicating the passage of time. In the Hall of Celestial and Terrestrial Union in the Forbidden City is a large copper clepsydra 588.8 cm high, built in 1744.

### **Ancient Mechanical Time-telling Devices**

The first mechanical timepiece in China appeared during the Han Dynasty. In the early years of the 2nd century, Zhang Heng, an imperial astronomer of the Eastern Han Dynasty, built an armillary sphere powered by water. Motivated by cog wheels pushed by dripping water, his armillary sphere turned one circuit each week in a regular fashion. Fixed to it was a mechanism indicating the number of days in the month. This consisted of an axle which turned one circuit each day. The axle, making use of the gear and cam systems, indicated the number of days in a given month in imitation of the blossoming of a legendary flower which was believed to blossom from the first to the 15th day of the month and each day bear a fruit. From the 16th day onward, it was said, a fruit would drop from it every day. At a time when there was no time-telling equipment, people observed the blossoming and withering of the flower to learn which given day of the month it was. The armillary sphere had an iron axle in the center, which revolved in the direction of the turning of the earth. The axle joined the sphere in line with the north and south poles. As it turned, it could accurately demonstrate astronomical changes.

Scientists in later times also made armillary spheres which mostly used water power. Of course, there were improvements and new creations. In 725, Zhang Suihe, a monk, and Liang Lingzan built a water-powered astroscope which had an automatic time-telling mechanical structure. Two wooden figures were fixed to a horizontal beam. One figure's job was to beat a drum for telling the time at the point of arrival of each of the eight sub-units, while the other did the same at the point of arrival of each of the 12 units in a day.

The water-driven astronomical clock tower built in 1086 by Su Song and Han Gonglian was an instrument combining an armillary sphere with a celestial globe and a mechanical timepiece. The top level is an armillary sphere, the middle part is a celestial globe, and the lower part is a five-story wooden pavilion type of structure with a door on each level. In all, more than 100 small wooden figures are fixed to the five-story pavilion. At the right time, one figure comes out of each of the doors indicating the time written on a wooden tablet held in its hand. The whole device is made up of over 150 parts. Behind the wooden pavilion is a mechanical system powered by water, which is very close to the escape device in clocks and watches of modern times. It is thus of great significance in the history of clock and watch making. In fact, it was this that prompted the British

scientist Joseph Needham to conclude that it was highly possible that the tradition of Chinese astronomical clocks was the direct forerunner of European astronomical clocks of the Middle Ages.

In 1276, a time-telling device fixed to a lamp, produced by astronomers of the Yuan Dynasty, was no longer a part of astronomical apparatus, but purely a timepiece. At the turn of the Yuan and Ming dynasties (late 14th century), Zhan Xiyuan invented a five-wheel device using dripping sand, bringing clock making to the stage of telling the time with a dial plate and needles. It was an independent mechanical timepiece, similar to the chime clocks of modern times. If more efforts had been made in this direction, replacing the power produced by constant water or sand flow with that created by hammers and spiral power springs, clock making in China would have been quickly knocking at the door of modern clock and watch making and have given the technology of timepiece making a great leap forward. Since the long-lasting feudal society in China maintained a social structure of a self-sufficient natural economy and patriarchal rule marked by highly centralized power, productivity was held in check, while science and technology, which are really the primary productive forces, were given insufficient attention. In fact, technology was regarded by the rulers as a set of heretical and sinister skills, and efforts were made to suppress it. An astronomical device carved out a piece of crystal presented to the first emperor of the Ming Dynasty by an official in charge of celestial observation was smashed to pieces, as the emperor regarded it as something totally useless. Many similar inventions and discoveries made by Chinese scientists were thrown by the wayside, as they could not circulate or be made use of.

### **Westerners Who Introduced Clocks to China, and Clock Making in China in Recent Times**

Contemporary mechanical clocks were introduced to China toward the end of the Ming Dynasty (1368-1644), when Western traders and colonizers made their way east, and large numbers of missionaries arrived in China, including the two Italians Michele Ruggieri and Matteo Ricci (1552-1610). It was Ricci who introduced clocks from the West to China.

Matteo Ricci was fluent in Chinese, and well-versed in mathematics and astronomy. He was also able to make sundials and clocks. He landed in Guangzhou in 1581, and lived in China for more than twenty years. In 1598, he went to Beijing, and three years later entered the Forbidden City, when he presented Emperor Wanli (1573-1620) with two chime clocks and a triangular prism. One of the clocks was said to have been placed in the Imperial Garden in the Forbidden City, and the other was kept in the palace halls for the use of the emperor. Since no one at the court understood the technique of clock striking, Ricci was made to stay. These two clocks had quite an impact on mechanical clock making in China. According to contemporary documents, timepieces made with hammers and spiral springs repeatedly appeared in China in the middle and later parts of the 17th century.

After Emperor Kangxi (1661-1722) of the Qing Dynasty decided to lift the ban on maritime trade with foreign countries in 1685, British, French, Italian and Portuguese merchants began to flock to China to engage in trade. The customs of Guangdong often



bought Western goods for the imperial palace. After chime clocks were introduced into the Forbidden City, time there was kept accordingly. Emperor Kangxi, who was very interested in Western studies, showed a great interest in chime clocks, often taking them apart to study their structure. He even wrote a poem about how he enjoyed studying chime clocks. According to records of tributes the imperial court received, the number of clocks brought in by Western merchants increased quickly after 1759. The Guangdong customs administration alone sent 40 to 50 clocks to the court each year. The total number of such clocks was 1,025, and most of them were made in Britain.

The Office of Manufacturing at the Hall of Mental Cultivation, a place in the Forbidden City for producing things required by the emperors also made chiming clocks. The workshop that produced chiming clocks during the reign of Emperor Yongzheng (1723-1735) was called the Clock Workshop, which employed foreigners to teach the workmen their skills. The first of these foreign experts was a Swiss named Stadlin, and many others were Western missionaries. The clocks favored by the Qing court were quite ornate, with musical functions, movable figures, sailing boats, blooming flowers, etc.

At the same time, clock making also made headway in Guangzhou and in cities along the Yangtze River such as Suzhou, Nanjing and Yangzhou.

In the period from 1736 to 1795, when Emperor Qianlong was on the throne, clocks were ubiquitous in the halls of the Forbidden City and other royal palaces. Huge numbers of clocks were kept in the Xuanyuan Hall of the Yuanmingyuan Palace and at the imperial summer retreat in Rehe, a town north of Beijing. However, many valuable clocks were stolen by marauding foreign soldiers in the 19th century. A record from 1861 says, "From the Yuanmingyuan Palace, 93 large clocks, 13 small ones, 20 big watches and 182 small ones were lost." In 1900, eight allied foreign armies invaded Beijing. Such places as the Summer Palace and the Forbidden City were looted, resulting in uncountable losses. What is preserved in the Palace Museum today is only a fraction of the clocks and watches of the period of Emperor Qianlong. Those from the period immediately before and after him are even fewer. The chiming clocks presented by Matteo Ricci have disappeared without a trace.

## China's Clock and Watch Manufacturing

China's contemporary mechanical clock and watch making industry began in the mid-17th century, under the impetus of the introduction of clocks and watches from the West.

After the Italian missionary Matteo Ricci presented the Ming Dynasty Emperor Wanli with two chiming clocks, Western clocks and watches came to China as gifts in a steady stream, stimulating the founding of the clock and watch making industry in the major trading cities of Guangzhou, Suzhou and Nanjing.

Emperor Kangxi had a strong interest in astronomy and the calendars, and clocks and watches from the West had a great appeal for him, more for their technical intricacies than the ornamental uses which delighted other emperors. He set up his own workshop for making clocks and watches, employing foreign technical personnel as supervisors.

**Clocks and Watches Made by the Office of Manufacturing at the Hall of Mental Cultivation** This office was in charge of making utensils and was known as the "Work-