

# **Лабораторная работа № 1**

## **Тема: Измерение линейных размеров штангенинструментом**

**Цель работы:** Изучение конструкции, устройства и назначения штангенинструмента.

### **Задания и порядок выполнения**

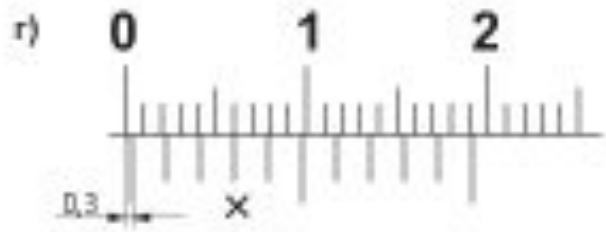
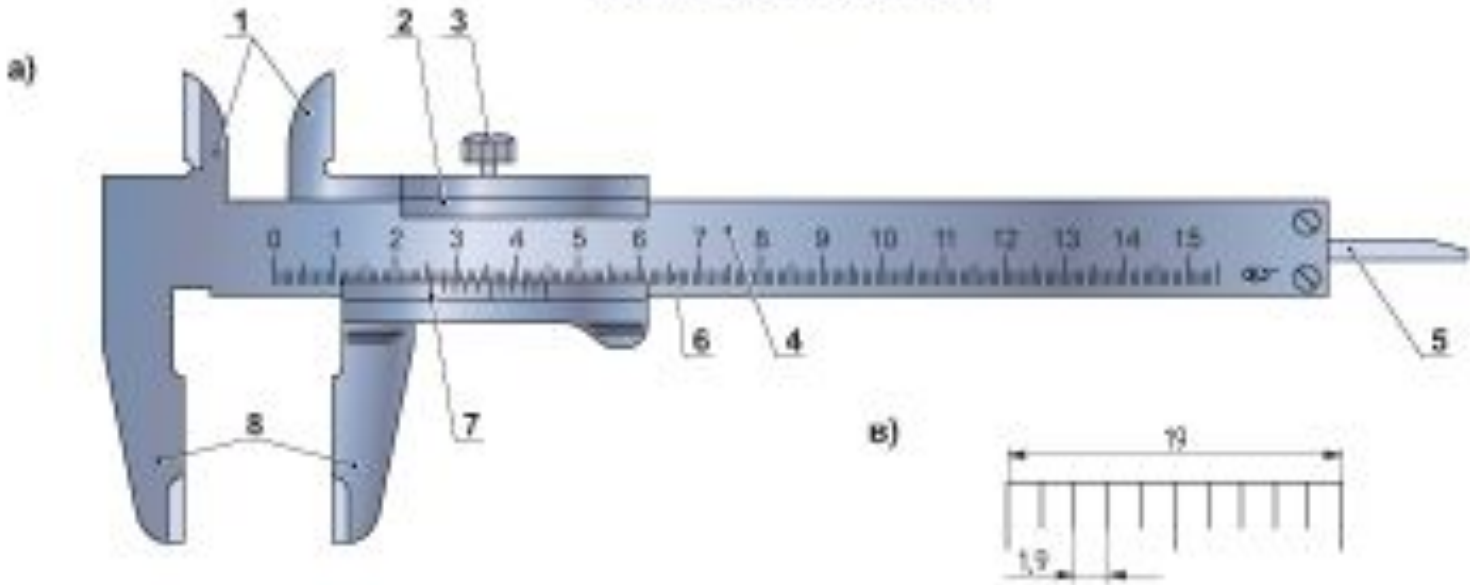
- 1) Изучить конструкцию, регулировку и настройку штангенинструмента
- 2) Изучить механизмы отсчетного устройства
- 3) Произвести измерения основных размеров деталей с точностью до 0,1 мм, до 0,05 мм.
- 4) Выполнить эскиз измеряемой детали с нанесением основных чертежных и полученных действительных размеров
- 5) Записать в табл. 2 метрологическую характеристику применяемого в лабораторной работе инструмента
- 6) Записать в табл. 3 результаты измерений детали и составить отчет о работе

# Материальное обеспечение

- 1. Штангенциркуль ШЦ-1 ГОСТ 166-80 -12-15 шт
- 2. Штангенциркуль ШЦ-2 ГОСТ 166-80 -12-15 шт
- 3. Штангенциркуль ШЦ-3 ГОСТ 166-80 -12-15 шт
- 4. Измеряемые детали: стальные валы диаметром  $D_{\min}=10-20$  мм,  $D_{\max}=30-40$  мм и длиной от 40 до 50 мм - 15 шт
- 5. Штангенглубиномер ШГ ГОСТ 162-80 1-5 шт

**Штангенприборы** предназначены для абсолютных измерений линейных размеров. **Штангенциркуль** предназначен для измерения наружных и внутренних размеров

ШТАНГЕНЦИРКУЛЬ ШЦ-I



- а) штангенциркуль ШЦ-I предназначен для наружных и внутренних измерений, для измерения глубины:
- 1 – губки для внутренних измерений;
  - 2 – рама;
  - 3 – сколы рамок;
  - 4 – шпатель;
  - 5 – линейка глубиномера;
  - 6 – шкала штанги;

- Т – нониус;  
В – губки для наружных измерений;
- б) целое число миллиметров у штангенциркуля отсчитывается по шкале штанги слева направо, нулевым штрихом нониуса;
- в) нониус с валичковой точкой 0,1 мм;
- г) определение доли миллиметра с валичковой точкой 0,1 мм (проставки указки 3-й штрих нониуса)

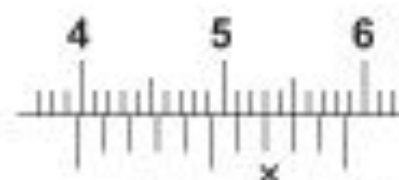
0. Средства для измерения линейных размеров

Допуски и технические измерения



# ШТАНГЕНЦИРКУЛЬ ШЦ-1

а)



Пример отсчета:  $39 \text{ мм} + 0,1 \text{ мм} \times 7 = 39,7 \text{ мм}$

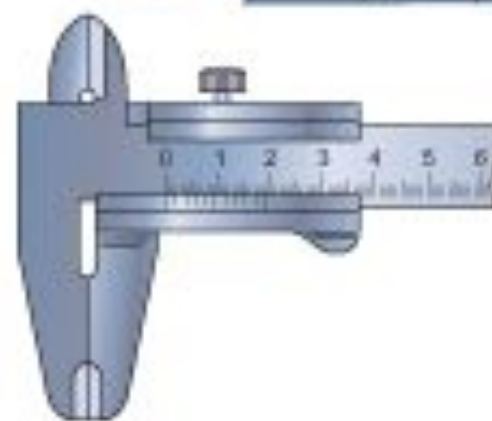
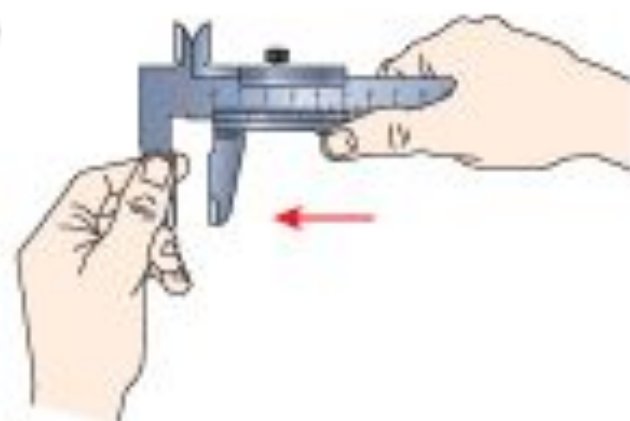


Пример отсчета:  $61 \text{ мм} + 0,1 \text{ мм} \times 4 = 61,4 \text{ мм}$

б)



в)



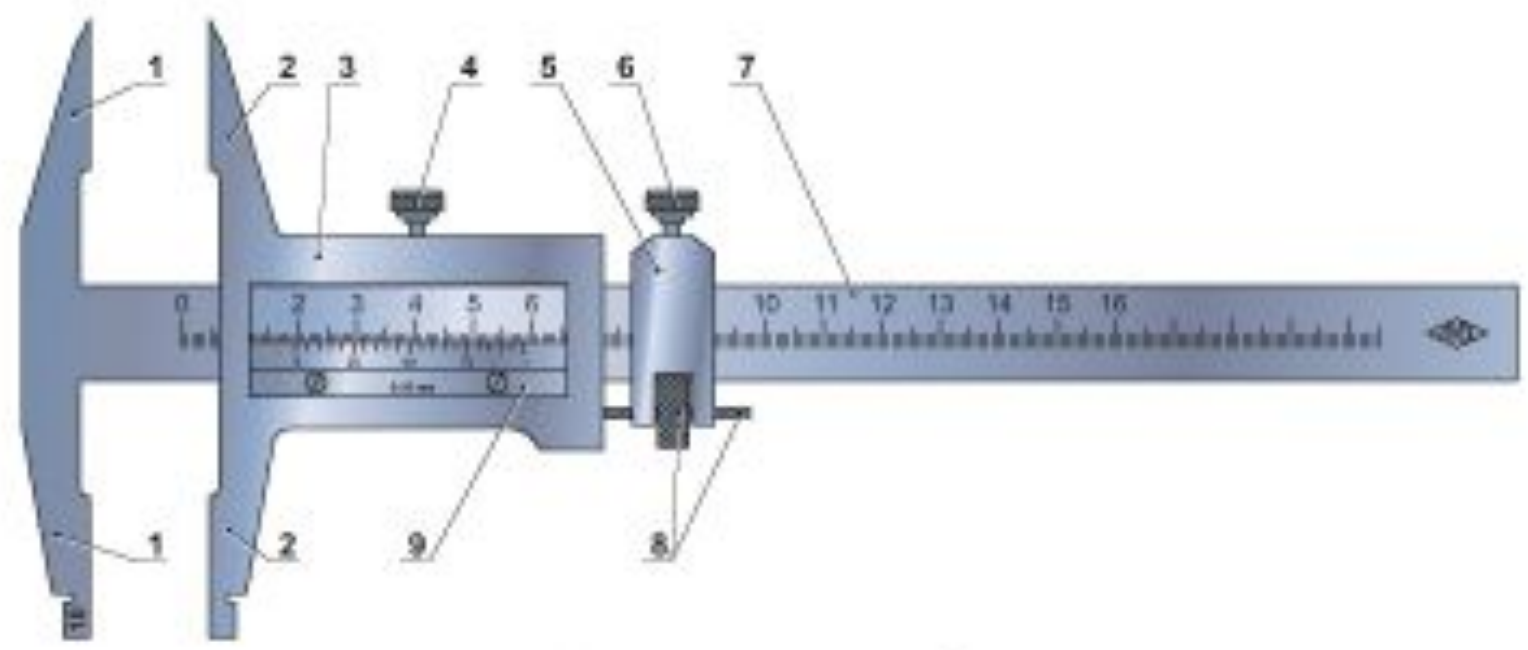
- а) чтение показаний на штангенциркуле с величиной отсчета 0,1 мм;
- б) проверка нулевого положения штангенциркуля;
- в) перемещение рамки штангенциркуля





# ШТАНГЕНЦИРКУЛЬ ШЦ-1

Предназначен для наружных и внутренних измерений.



- 1 – неподвижные измерительные губки;
- 2 – подвижные измерительные губки;
- 3 – рама;
- 4 – замок рамы;
- 5 – рама микрометрической подгонки;
- 6 – замок рамы микрометрической подгонки;
- 7 – шпатель;
- 8 – гайка и винт микрометрической подгонки рамы;
- 9 – конус.

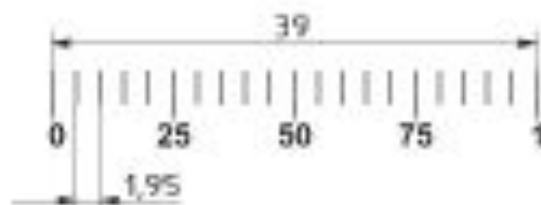


## ШТАНГЕНЦИРКУЛЬ ШЦ-1

Нониус, длина которого равна 39 мм, разделен на 20 частей.

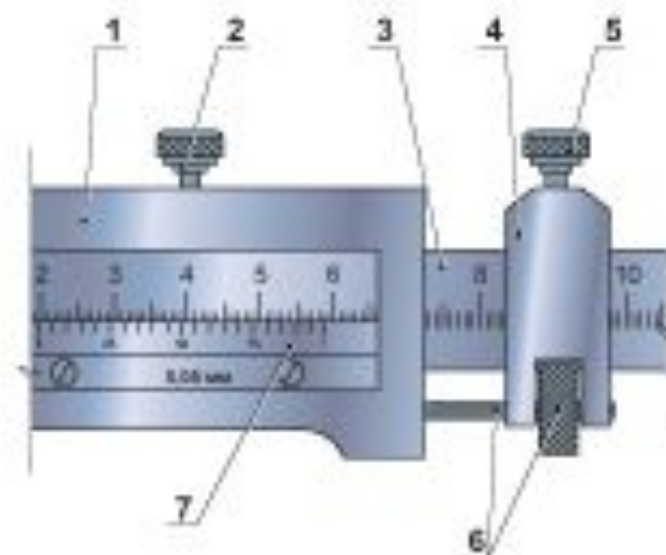
Одно деление нониуса составляет

$\frac{39}{20} = 1,95$  мм, на 0,05 мм меньше целого числа миллиметров.



Шкала нониуса с делением отсчета 0,05 мм

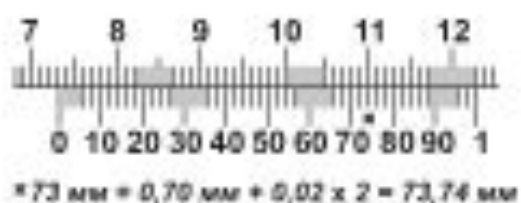
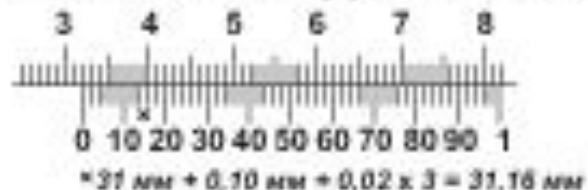
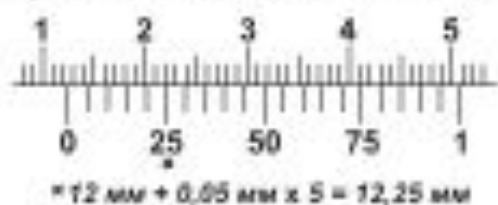
Микрометрическую подачу применяют для точной установки рамки относительно штанги.



- 1 – рамка;
- 2 – зажим рамки;
- 3 – штанга;
- 4 – рамка микрометрической подачи;
- 5 – зажим рамки микрометрической подачи;
- 6 – винт и винт микрометрической подачи;
- 7 – нониус.

## ШТАНГЕНЦИРКУЛЬ ШЦ-И

Примеры чтения показаний на штангенциркулях с величиной счета по нониусу 0,05 мм и 0,02 мм



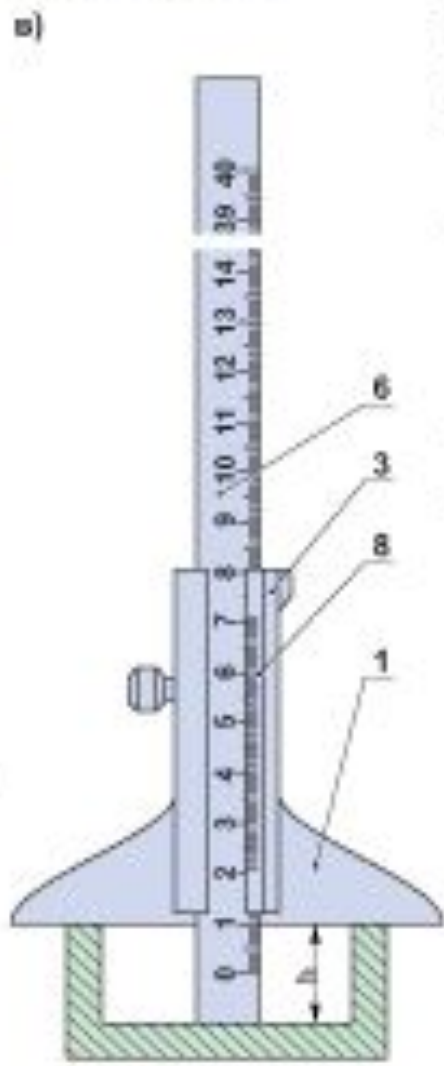
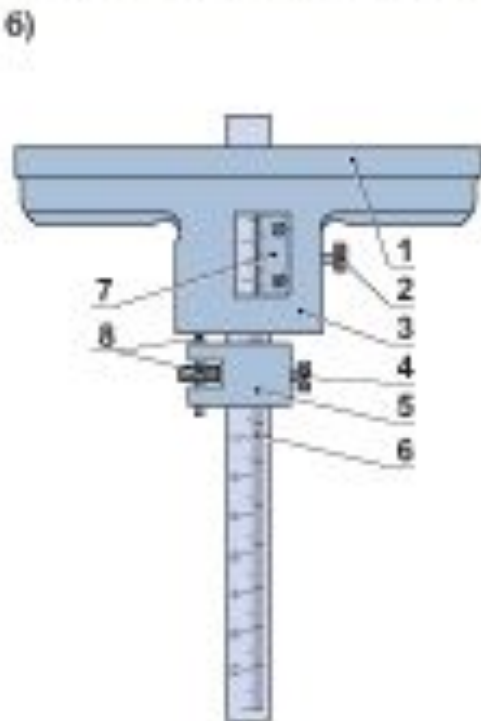
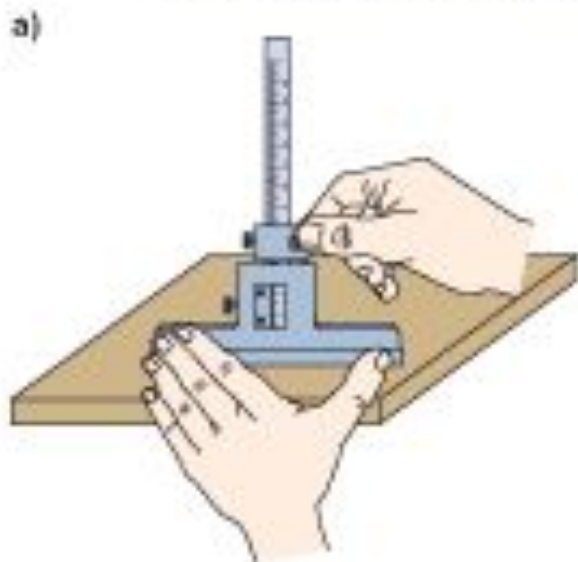
Чтение показаний при внутренних измерениях





**Штангенглубиномеры** принципиально не отличаются от штангенциркулей и предназначены для измерения глубины отверстий, пазов и расстояний между пазами.

ШТАНГЕНГЛУБИНОМЕР С ВЕЛИЧИНОЙ ОТСЧЕТА ПО НОНИУСУ 0,05 мм

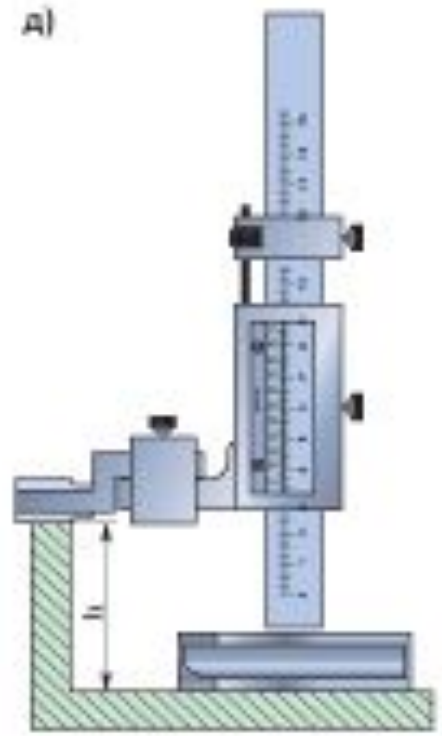
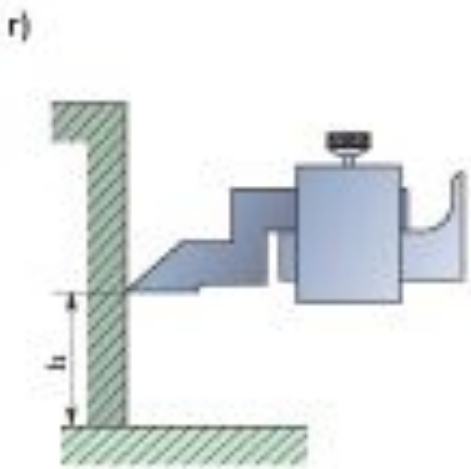
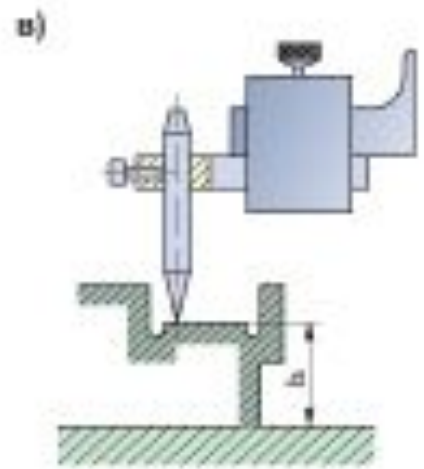
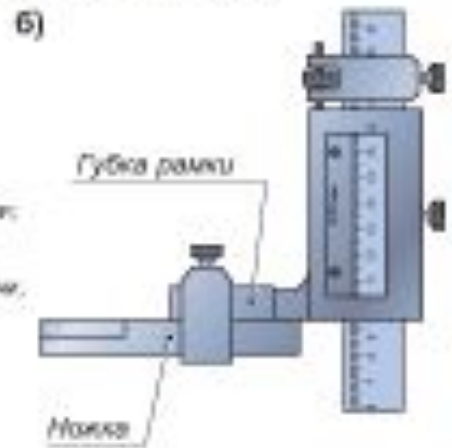
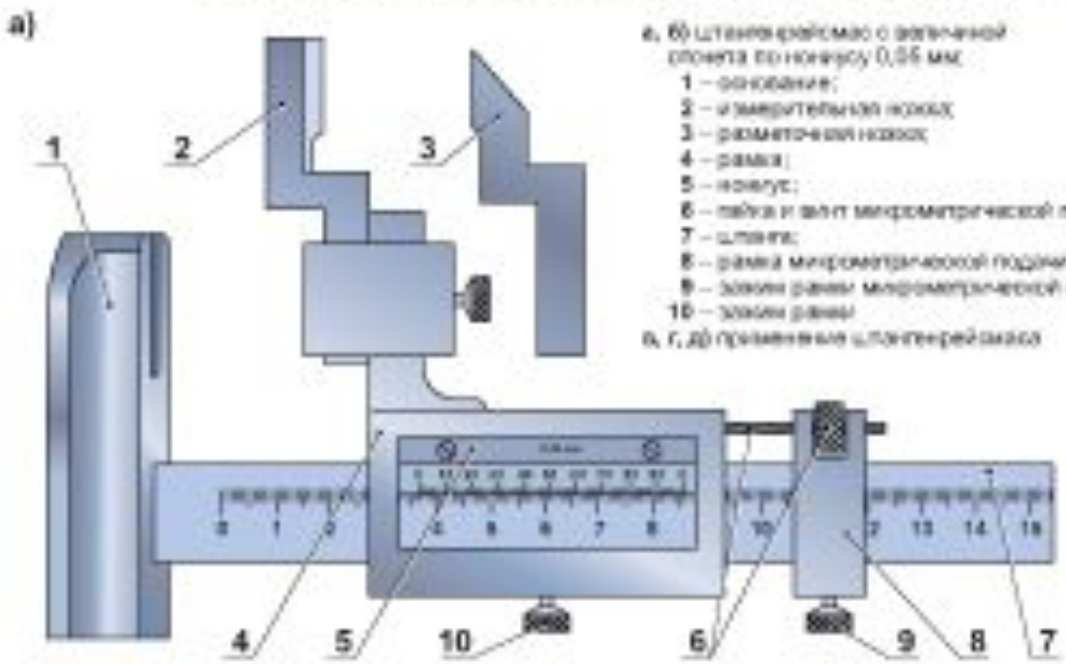


- Штангенглубиномер с величиной отсчета по нониусу 0,05 мм применяется для измерения глубины в отверстия и пазах небольших размеров:
- а) проверка нулевого положения штангенглубиномера;
  - б) штангенглубиномер с величиной отсчета по нониусу 0,05 мм;
  - в) применение штангенглубиномера:
- 1 – траверса;
  - 2 – зажим рамки;
  - 3 – рамка;
  - 4 – зажим рамки микрометрической подачи;
  - 5 – рамка микрометрической подачи;
  - 6 – штанга;
  - 7 – гайка и винт микрометрической подачи;
  - 8 – нониус.

И. Средства для измерения линейных размеров

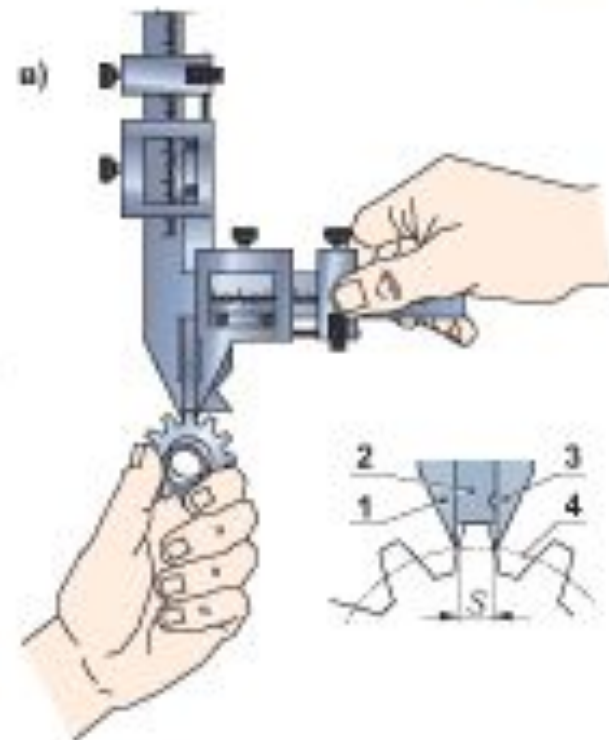
**Штангирейсмасы** являются основными приборами для разметки и измерения высоты деталей

ШТАНГЕНРЕЙСМАС С ВЕЛИЧИНОЙ ОТСЧЕТА ПО НОНИУСУ 0,05 мм



И. Средства для измерения линейных размеров

MTA studies were a mixture of CPT, EPT, and TPT up to 1.8 hours. The on/off times [20, 27, 28, 29] and frequency [30, 31, 32, 33] and frequency [34, 35] and frequency [36, 37] and frequency [38, 39] and frequency [40, 41] and frequency [42, 43] and frequency [44, 45] and frequency [46, 47] and frequency [48, 49] and frequency [50, 51] and frequency [52, 53] and frequency [54, 55] and frequency [56, 57] and frequency [58, 59] and frequency [60, 61] and frequency [62, 63] and frequency [64, 65] and frequency [66, 67] and frequency [68, 69] and frequency [70, 71] and frequency [72, 73] and frequency [74, 75] and frequency [76, 77] and frequency [78, 79] and frequency [80, 81] and frequency [82, 83] and frequency [84, 85] and frequency [86, 87] and frequency [88, 89] and frequency [90, 91] and frequency [92, 93] and frequency [94, 95] and frequency [96, 97] and frequency [98, 99] and frequency [100, 101] and frequency [102, 103] and frequency [104, 105] and frequency [106, 107] and frequency [108, 109] and frequency [110, 111] and frequency [112, 113] 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Допуски и технические измерения



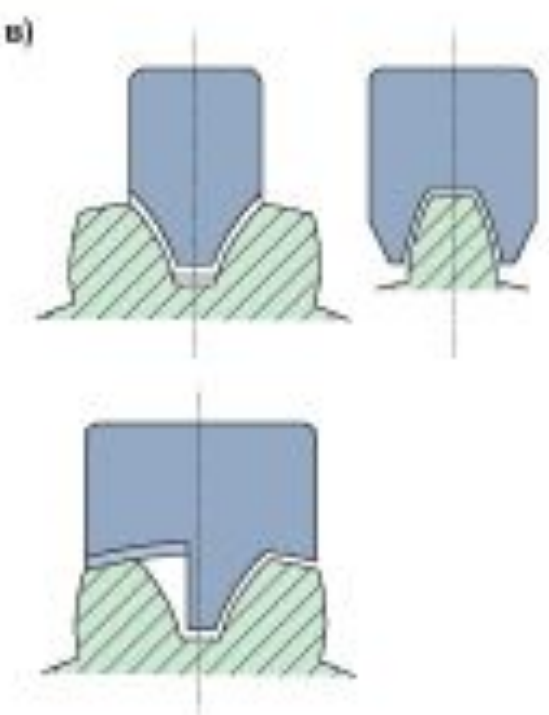
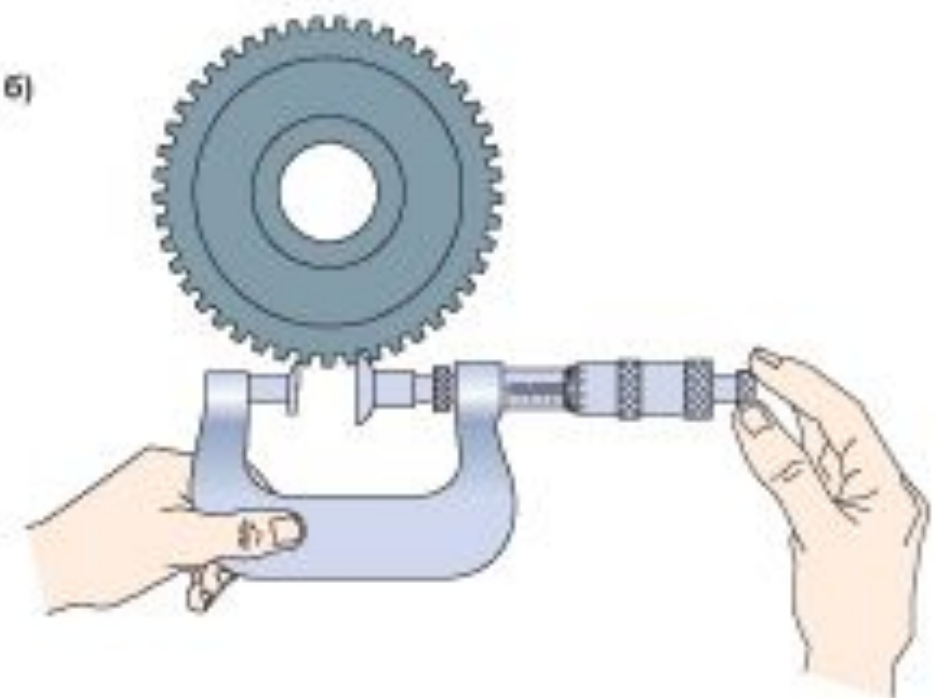
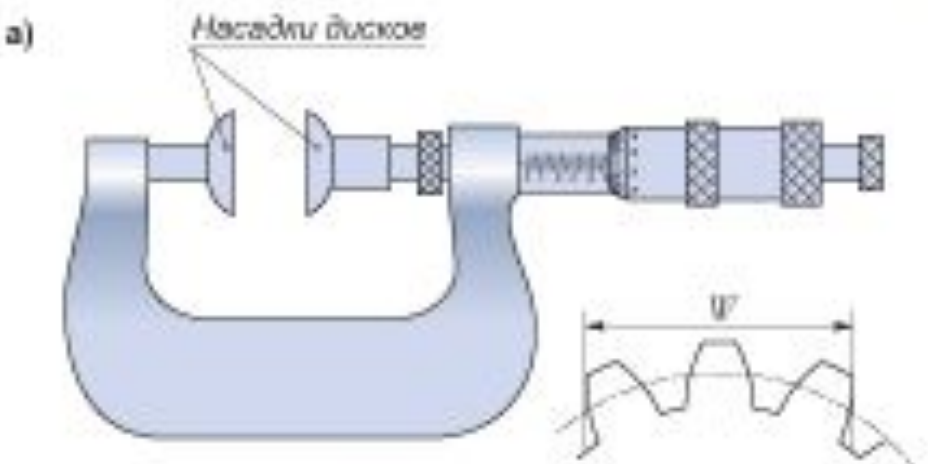
# ТАНГЕНЦИАЛЬНЫЙ ЗУБОМЕР



а) закрепление верньера;  
б) измерение тангенциальным зубомером;

в) отсложение +0,13 мм на тиски;  
г) зубомер установлен на размер

# ЗУБОМЕРНЫЕ МИКРОМЕТРЫ И ИХ ПРИМЕНЕНИЕ



- а) зубомерный микрометр;  
 б) применение зубомерного микрометра;  
 в) шаблоны для контроля профиля зуба