

[54] **PERCUSSION APPARATUS FOR BLOOD SAMPLING**

[75] Inventors: **Manuel C. Sanz**, Grand Lancy, Geneva; **Georges Revillet**, Onex, Geneva, both of Switzerland

[73] Assignee: **Micromedia Systems, Inc.**, Philadelphia, Pa.

[22] Filed: **Sept. 3, 1971**

[21] Appl. No.: **181,423**

2,399,011	4/1946	Erikson	128/275
3,134,380	5/1964	Armad	128/253 X
2,639,709	5/1953	Volgenau	128/276
2,699,784	1/1955	Krayl	128/333
3,604,424	9/1971	Windom	128/295

FOREIGN PATENTS OR APPLICATIONS

1,938,871	2/1970	Germany	128/DIG. 5
771,890	8/1934	France	128/DIG. 5

Primary Examiner—Kyle L. Howell

Attorney—Gerry J. Elman, Carl A. Castellan et al.

[30] **Foreign Application Priority Data**

Sept. 4, 1970 Switzerland..... 13352/70

[52] U.S. Cl. **128/2 F**, 128/DIG. 5, 128/275, 128/314

[51] Int. Cl. **A61b 5/14**

[58] Field of Search 128/2 F, 2 R, 2 G, 128/2 B, DIG. 5, 275, 276, 314, 316, 253, 295

[56] **References Cited**

UNITED STATES PATENTS

3,623,475	11/1971	Sanz et al.....	128/2 R
3,626,929	12/1971	Sanz et al.....	128/2 R
3,635,213	1/1972	LaHay.....	128/2 R

[57]

ABSTRACT

An apparatus for taking blood samples which involves strapping a blood collector tube to the part of the body from which the sample is to be taken. The blood collector tube has a resilient collapsible funnel which, when compressed, allows a lancet to puncture the dermis and epidermis. A striker member is placed on the end of the tube and a piston, normally held in a spring compressing position by a latch is released thus allowing the spring to impact on the base of the tube, compressing the funnel member and allowing the lancet to puncture the skin.

8 Claims, 8 Drawing Figures

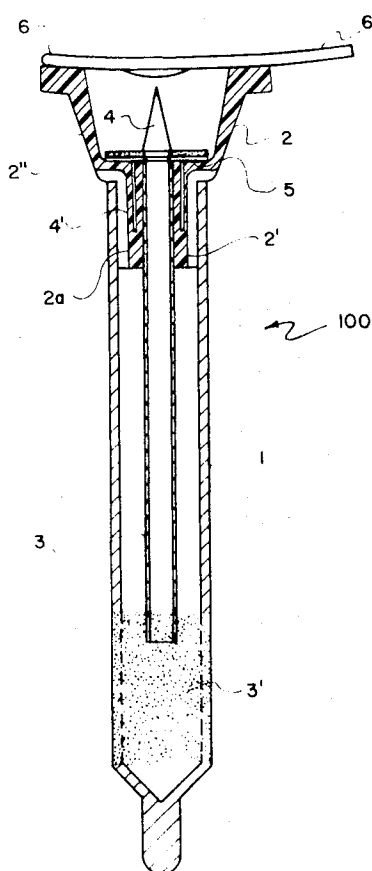


FIG. 1

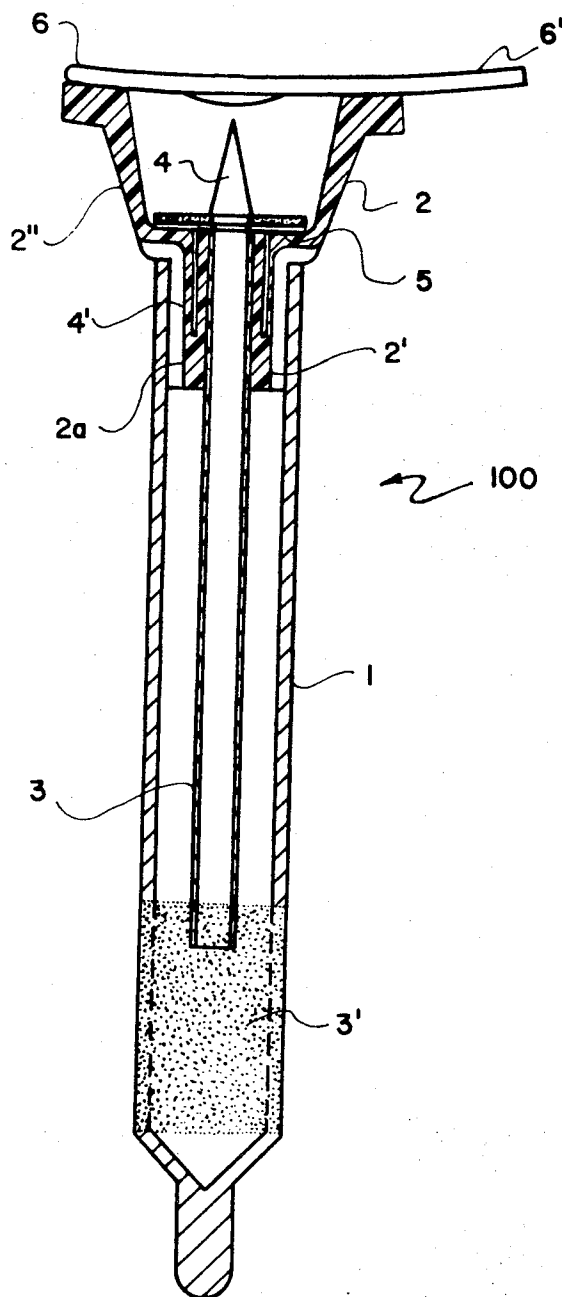


FIG. 2a

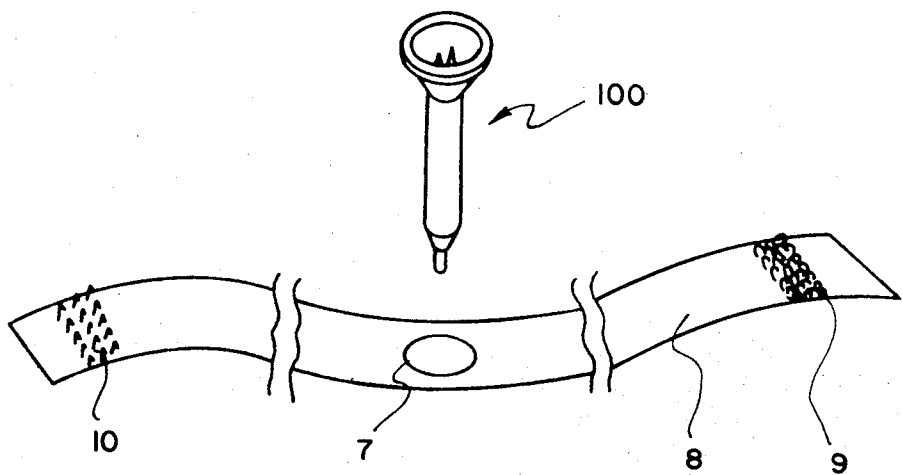
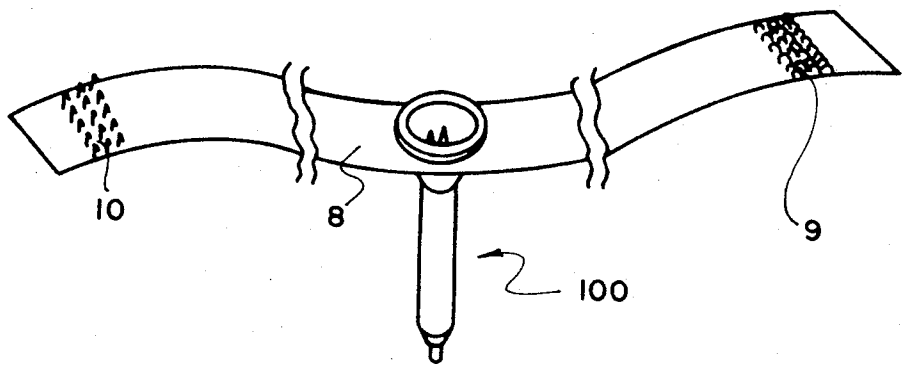


FIG. 2b



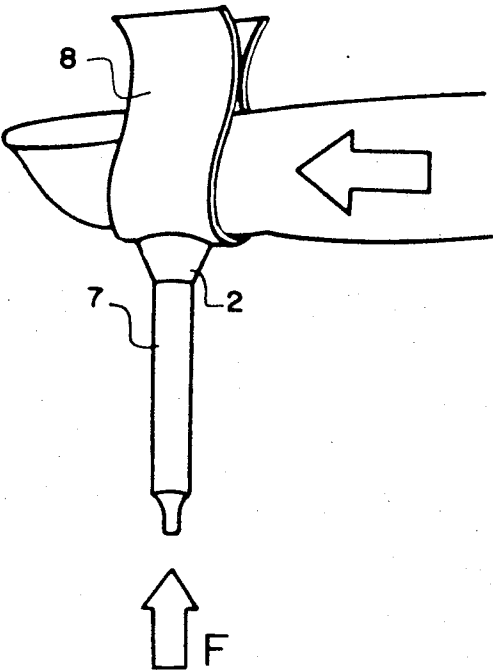


FIG. 3

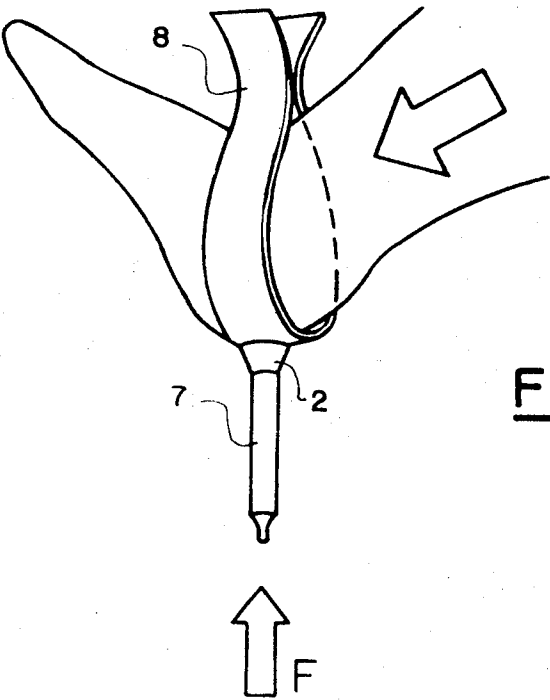


FIG. 4

FIG. 5a

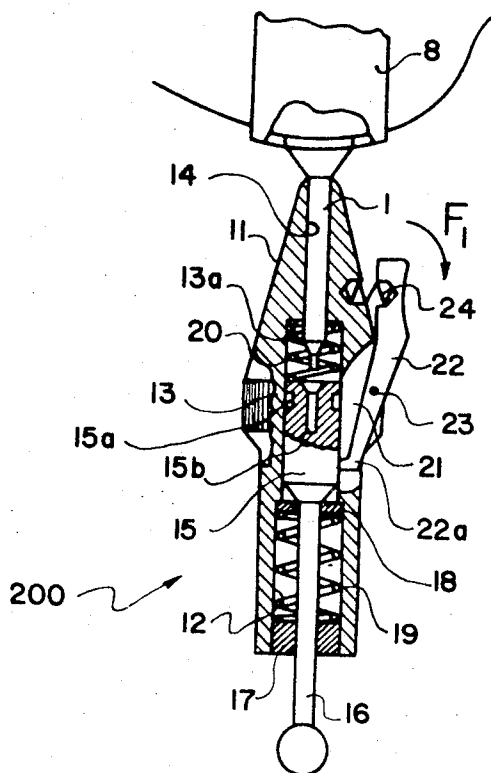


FIG. 5b

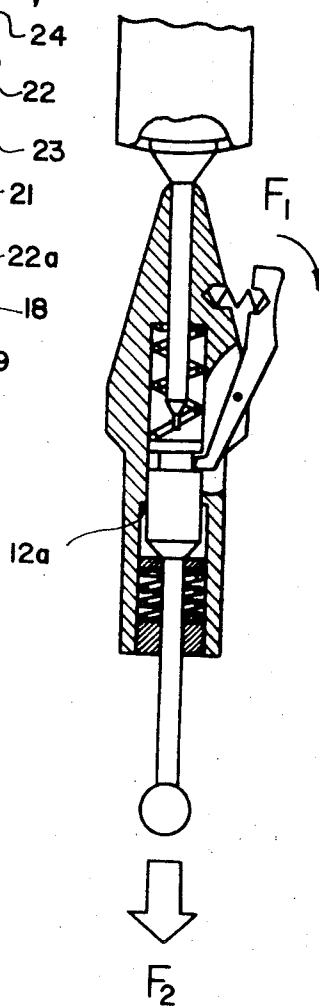
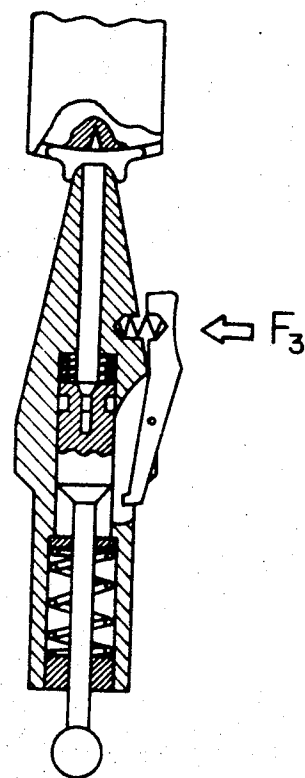


FIG.5c



PERCUSSION APPARATUS FOR BLOOD SAMPLING

Priority is hereby claimed on the basis of Swiss application, Ser. No. 13,352/70, filed Sept. 4, 1970.

This application relates to an apparatus and method for taking blood samples from the limbs of a patient. Copending U.S. Pat. Application Ser. Nos. 843,096 and 843,016 now U.S. Pat. Nos. 3,623,475 and 3,626,929, respectively both filed on 18 July 1969 and entitled "Blood collector device" and "Apparatus for obtaining a percutaneous and digital blood sample", respectively describe, firstly a device for collecting a percutaneous digital blood sample, comprising a tubular body or receptacle in the mouth of which is mounted a funnel member of resilient material which communicates at the bottom thereof with the receptacle and inside which are provided a pair of lancets for incising the dermis, and secondly, a stationary apparatus for automatically taking a blood sample which also uses the tubes just described.

Experience has shown that these two devices could only properly be used for taking blood samples from fingers of a certain size and that it was practically impossible to use this apparatus on the fingers of young children, in particular new-born babies. Due to the structural design of the stationary device, only digital blood-sample-taking operations can be performed.

Furthermore, it has been found that it could at times be useful to be able to take a blood sample with a tube similar to that described in the specification of copending U.S. Pat. No. 3,623,475 without having to resort to the apparatus described in the specification of copending U.S. Pat. No. 3,626,929.

The instant invention lies in the provision of an apparatus which enables this last requirement to be performed and which at the same time enables the above enumerated drawbacks to be overcome. The instant apparatus is intended to perform exclusively with a device of the kind described in the specification of copending U.S. Pat. No. 3,623,475. It imparts an axial striking action of sufficient force to drive the lancets of the collector tube into both the epidermis and dermis of the part of the body from which blood is to be taken, thereby making the necessary incisions for a sample of the blood to issue. It is to be noted, however, that the instant apparatus, as opposed to the apparatus described in the specification of U.S. Pat. No. 3,626,929, does not massage the part of the body where the incisions are made to cause the blood to flow towards the incisions. Such a massaging has to be performed by the operator, by hand or in any other suitable way.

The instant apparatus includes a blood collector tube of the type described in copending U.S. Pat. No. 3,623,475 and further includes a strap by which said blood collector tube is attached to, e.g., the foot of an infant, and an impacting mechanism which receives the end of said tube and employs a spring loaded piston to thrust the blood collector tube against the skin of the user, thereby causing the flexible funnel member of the tube to collapse and allowing the tube lancets to puncture the skin.

Accordingly, it is an object of this invention to provide an improved blood sampling apparatus and method for taking blood samples.

It is a further object of this invention to provide an improved blood sampling apparatus which may be strapped to a patient for the sampling operation.

Still further, it is an object of this invention to provide an apparatus comprising a blood collector tube with lancets which is strapped to a patient and an impacting device which receives the tube and imparts a force to it to puncture the patient's skin.

These and other objects of this invention will become apparent when reference is had to the accompanying specification and drawings in which:

FIG. 1 is a vertical section through a blood collector device of the kind described in the specification of our U.S. Pat. No. 3,623,475;

FIGS. 2A and 2B show the blood collector tube of FIG. 1 and its relationship to the securing strap;

FIG. 3 shows the blood collector tube strapped to a finger;

FIG. 4 shows the blood collector tube strapped to the heel of a foot;

FIGS. 5A, 5B, and 5C are vertical sections of the blood collector tube and the impacting member in various stages of its operation on a human foot.

Referring now to FIG. 1, the tube is designated generally as 100 and comprises a tubular receptacle 1 at the top end of which is secured a funnel member 2 of resilient material, e.g. plastic or rubber. The member 2 has a lower, plug-like portion 2' with a passage 2A in which is inserted a conduit 3 extending into the tubular receptacle 1 and communicating with the cup-like portion 2'' of the funnel member 2 at its top end. At the base of the cup are an upstanding lancet 4, although more than one lancet can be employed, and a pad 5 of absorbent material. The lancet is adapted to perform a puncture of the dermis and of the epidermis of the person from which a blood sample is to be taken and the pad serves to absorb the liquid that issues from the tissues when first being cut. A removable cover 6 serves to seal off the device and can be removed simply by pulling on tab portion 6'. The tube may have information pertaining to the patient magnetically encoded on a magnetizable band 3' on the circumference of tube 1. Vent passages such as 4' are provided around the periphery of portion 2' to allow entrapped air to escape as the tube is being filled.

To take a blood sample with the device of FIG. 1, the latter is inserted into the opening 7 of a strap 8 (FIGS. 2A and 2B) which has one end portion lined with bent over bristles 9 that are closely set and resistant, and its other end portion provided with a plurality of small hook-like elements 10. The bristles 9 and elements 10 are similar to Velcro fasteners.

When the strap 8 is folded over around a finger as in FIG. 3, or even a foot as, e.g., the foot of a young child as in FIG. 4, the hooks 10 engage with the bristles 9 and hold the strap sufficiently tightly on the finger or the foot for the mouth of the funnel-like member 2 to be pressed against the finger or the foot.

Referring now to FIGS. 5A, 5B, and 5C, a striker member 200 is adapted to receive the lower portion of the described blood collector device and impart a force thereto in the direction of arrow F (FIGS. 3 and 4) to cause an incision by lancet 4 of the epidermis and of the dermis of the body portion against which the device is being applied.

The striker apparatus 200 comprises a generally tubular casing 11 having an internal passage which is subdivided into three passages, 12, 13 and 14 of decreasing diameter, starting with passage 12.

Slidably mounted in passages 12 and 13 is a piston 15 having a downwardly extending rod 16 which projects out of the casing through a plug 17 closing off portion 12. The striking end of piston 15 is formed with a circumferential groove 15A and an axial recess 15B.

In passage 12 there is mounted a centrally apertured disc 18 which surrounds the piston rod 16, and a coil spring 19 compressed between the plug 17 and the disc 18.

A coil spring 20 is housed in passage 13 and engages, at one end, the piston 15 and, at its other end, a shoulder 13A that is formed between the portions 13 and 14. The spring 20 is so designed that it exerts a much smaller axial force than that of spring 19, but is sufficient to keep piston 15 in the position shown in FIG. 5A.

The casing 11 is formed also with a radial and axially extending slot 21 which communicates with the passage 13 and in which is pivotally mounted a lever 22 on a pivot pin 23 that is subject to the action of a coil spring 24 tending to urge the lever 22 in the direction of arrow F_1 (FIGS. 5A and 5B).

The lever 22 acts as the control member of the apparatus to institute the impacting action.

The method of operation commences with securing the blood collector tube to the selected part of the body by means of its strap 8 whereby its funnel member is pressed against the surface of this part. The striker apparatus 200 is put into place as shown in FIG. 5A by slipping the casing 11 over the tubular receptacle 1, the latter occupying the passage portion 14 in the casing 11.

The rod 16 is then pulled outwards in the direction of arrow F_2 (FIG. 5B) against the action of the spring 19 until the circumferential groove 15A of piston 15 comes to lie opposite a nose 22A on the end of lever 22. The lever 22 then moves in the direction of arrow F_1 under the action of the spring 24 and the nose clicks into the groove 15A to lock the piston 15 and the compressed spring 19 in a cocked position (FIG. 5B).

Pressure is then exerted on the top end of the lever 22 in the direction of arrow F_3 to cause the latter to rock in a direction opposite to F_1 and hence to cause the nose 22A to withdraw from the groove 15A of piston 15 thereby releasing the latter which is then violently propelled upwards (FIG. 5C).

As is apparent from FIGS. 5A to 5C, the energy of the spring 19 is transmitted to the piston 15 via the apertured disc 18 but the action of this spring on the piston ceases when the disc 18 comes to bear on the shoulder 12A between the passages 12 and 13.

After the disc 18 impacts on shoulder 12A the piston 15 and its associated rod 16 continue to move upwards by inertia and initially compress the weaker spring 20 and then strike the tip of the tubular receptacle 1 of the blood collector device. Upon being struck, the tubular receptacle 1 is propelled axially towards the patient's body, the cup-like portion of the funnel member 2 yields and collapses and the lancet 4 (FIG. 1) is driven into the epidermis and dermis thereby performing the desired incision for taking a blood sample.

When the piston 15 has carried out its striking action and upon all of its kinetic energy having passed to the tubular body 1 and to the spring 20, the latter, through having been compressed, then forces the piston 15 and its rod 15 back downwards until the piston comes into

engagement with the apertured disc 18 as shown in FIG. 5A.

Thus, the only force left acting on the collector device is that due to the resilient cup-like portion of its funnel member 2 which then can return from its collapsed position to its normal rest position, thereby extracting the lancet 4 from the patient's skin.

Once the striker apparatus 200 has performed its striking action it is removed from the collector device by slipping its casing 11 axially along the tubular receptacle 1.

To gather blood in the tubular receptacle 1 of the collector device, it suffices to massage the incised portion of the body either manually for instance, with a roller by successive motions directed towards the incision thereby causing blood to flow towards the latter and to issue therefrom into the funnel member 2 of the device, whence it passes into the tubular receptacle 1 through the conduit 3 (FIG. 1).

While only embodiment of the invention has been shown and described, it will be apparent to those skilled in the art that many obvious changes and modifications can be made without departing from the scope of the appended claims.

We claim:

1. A device for collecting a percutaneous digital blood sample from infants and the like comprising the combination of a tubular body closed at one end and open at the other end and adapted to collect the blood, a funnel member having a resilient funnel portion and a discharge end and engaged at said discharge end in the open end of said body and a mass of absorbent material located within said funnel portion, and at least one incisor lancet in said funnel portion projecting through and beyond said mass and located wholly within said funnel member, said funnel member providing an open passage from said funnel portion to the interior of said tubular body to allow for blood flow, flexible strap means connected to said tubular body below said funnel member for securing the funnel portion to a human body, and elongated striker means receiving the closed end of said tubular body and coaxial therewith, said striker means including a biased striker member and a means to release said member to allow it to impart a longitudinal force to the closed end of said tubular body to obtain a blood sample.

2. A device according to claim 1, and including a capillary tube forming an extension of said funnel member and said passage and extending to a location adjacent to the closed end of the tubular body.

3. A device according to claim 2, wherein one end of the capillary tube is located within the discharge end of the funnel member, and is integral with said lancet.

4. A device according to claim 1 and including a base plate supported in a lower part of said funnel portion, said lancet being integral with said base plate.

5. A device according to claim 1, including means for allowing entrapped air to vent from said tubular body comprising a passage located in the discharge end of said funnel.

6. A device according to claim 1 where said striker means includes a tubular aperture receiving the closed end of said tubular body, said striker member comprising a striker piston rod, spring means normally biasing said striker piston in a predetermined position, latch means for maintaining said piston in a second position which compresses at least a portion of said spring

5

6

means, said latch means adapted to be released by a user to allow said compressed spring means to impart a velocity to said piston to effect an impact with the closed end of said tubular body to collapse said funnel portion and allow said lancet to penetrate into a human body.

7. A device according to claim 6 wherein said spring means comprises two opposed compression springs, said springs acting to maintain said piston in said prede-

termined position, one spring being weaker than the other which is compressed when said striker piston is withdrawn to allow the velocity imparted by said compressed spring to said piston to overcome said weaker spring thus allowing said piston to impact the closed end of said tubular body.

8. A device as in claim 1 wherein said tubular body has a magnetizable layer on the body surface thereof.

* * * * *

10

15

20

25

30

35

40

45

50

55

60

65